A GENEALOGICAL EXAMINATION AND GROUNDED THEORY OF THE ROLE OF HUMAN ENHANCEMENT TECHNOLOGY IN AMERICAN POLITICAL CULTURE

by

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ABSTRACT

The purpose of this dissertation is to develop a grounded theory and, in fact, anticipatory knowledge about the role of human enhancement technology in American political culture. A review of the technology assessments of human enhancement technology revealed a startling lack of critical history in scholars' attempts to predict future outcomes of technological development and societal uptake on the basis of historical knowledge. The absence of such critical history—defined as the ability to examine the minute linkages and relationships between historical artifacts operating under the theory that all such relationships are rightly subject to criticism and cannot be assumed to lend themselves to a linear historical progress—has led to a body of literature that succumbs to what is referred to in this dissertation as the "linear fallacy." The "linear fallacy" is a flawed syllogism whereby the naive and uncritical comparison of a present technology to a similar technology in the past is used to develop predictive knowledge. This dissertation proceeds by establishing a method of critical history based on Nietzsche's genealogy, applying it to a case study of the development of IQ and mental testing, mapping the current sociotechnical context of cognitive enhancement, supporting that map through public opinion data, and, finally, developing the concept of the "linear fallacy." It is demonstrated through the case studies and supporting empirical evidence that the literature on human enhancement does indeed succumb to the "linear fallacy"; that a critical historical method is well suited to technological assessment; that general theories of intelligence are central to the sociotechnical context of cognitive enhancement; and, that critical historical case studies should be added as a preliminary stage of Real-time Technology Assessment.

To my beautiful wife Jenny without whose support I would never have completed any degree at all, let alone this one. To my daughter, Phoenix, an inspiration and source of constant joy. Finally, to Old Joe, who constantly reminded me "Time is short, yet art is long". Thank you, one and all.

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Overview

Imagine for a moment that you have become a packet of data—a very complex packet of data but data nonetheless—and you are streaming through space. You pass within the outer reaches of the gravity well of a black hole of modest size. Its modesty does not prevent it from exerting sufficient gravitational force to pull you from your track through space and send you spiraling inward. You cannot see what you are approaching because at the event horizon—the point at which the gravitational pull of the singularity at the black hole's core becomes so strong that even mass-less data like light can no longer escape—has blacked out all activity beyond it. You know the black hole only by its influence on you as you are sucked toward a black veil beyond which it is impossible to know what is taking place.

Now, imagine that you pass the event horizon. Stephen Hawking—the eminent British astrophysicist—initially predicted that, contrary to the predictions of classical physics, beyond the event horizon matter and data would actually be warped and destroyed. He has since recanted and been forced to pay up on a bet with American physicist John Preskill. He satisfied the terms of the bet by giving Preskill an encyclopedia of baseball. Hawking had bet Preskill that his prediction that matter within a black hole would be destroyed and that information about it could not be recovered. Hawking has since revised his predictions to conclude that matter will not be destroyed in a black hole and thus in theory information could be recovered about what happens to it. This is not to say that actually recovering that data will ever become possible.

We are left, for the moment, with the understanding that matter and data are preserved within a black hole but remain unknowable to those of us lucky enough to have avoided being sucked in. You are now in the black hole, and you have been preserved, but you cannot escape, and no knowledge of you can ever escape. Just as important, you cannot know anything of the world outside the black hole after the moment you entered. You are no more able to see out than you were to see in. The point is that singularities—the point of immensely dense matter created when a massive star collapses in on itself catastrophically—create spaces within which data is isolated and unknowable from without and within.

Ray Kurzweil—prolific inventor and author—has used the metaphor of the singularity to describe what he believes will be the future outcome of the supposed exponential increase in technological and evolutionary progress. I have returned to this metaphor many times in recent years because there is an inherent problem—actually there are many but only one which has consistently fueled my interest—in thinking in these terms if what you are engaged in is technological prediction. Kurzweil has used his theoretical musings and mathematical modeling to make predictions about what the next decades leading up to the singularity—he sees it happening sometime in the middle of this century—and, astonishingly, beyond will look like for humanity.

The problem I have returned to time and again in my own thinking about human enhancement and technological change is that if there is a singularity in our future it will create an event horizon which should make it impossible for us to know—and silly for us to speculate—what it looks like, of what it consists, and what the world will look like

beyond it. Language becomes difficult here precisely because of the problematic nature of the metaphor. Technically, there should be no world beyond the singularity. Such is the nature of black holes; the star and its environs cease to exist in any form that would be meaningful to our current understanding of physics. It would seem that this part of the metaphor should be applied to any speculation about this catastrophic technological event, but Kurzweil never goes so far. The world does continue and with humans in it; it is just radically altered. Kurzweil thinks he knows what those alterations may look like and what some of their implications may be. I think that if such an event does lie in our future, then the only logical course of action would be to embrace a radical fatalism about our world because a singularity at its center would, by its very nature, so radically alter everything we know that it would be impossible to call it the same world with a straight face.

Kurzweil's language often approaches this type of transformative language, but he presses on with prediction and normative speculation nonetheless. The question that has driven much of my own research and fueled the initial curiosity that led to this dissertation is how could such an obviously intelligent man write himself into a metaphorical corner from which his own musings cannot possibly hope to escape intact? Belief in the singularity—and it does constitute belief rather than grounded theoretical knowledge as I will demonstrate in this dissertation—should sound the death knell for technological prediction. It should also simplify policy prescription, because we merely have to cope with the intervening decades beyond which the best laid plans will be of no avail.

Singularities do not signal the beginning of something; rather, they signal the end of known space and time within a certain region of the universe. We can only detect them by their effects on surrounding objects and processes; they cannot be observed. Just as in the hypothetical "you" could not see the approaching event horizon and only knew it by the way it pulled you inexorably off course. I am a stickler for carrying metaphors out to their complete and logical conclusion. I think metaphors partially used are sloppy writing indicative of sloppy thinking. Gazing forward into the future, we could only detect a singularity in our future by its effects on surrounding history. It would begin to draw all of the various historical relations in the human world toward itself, and if we accept Kurzweil's theory, it would then draw all of history toward itself because this exponential growth applies equally to all systems that increase in complexity over time. It would warp nearby history in ways we could not predict, and it would be by our inability to accurately foresee what was to come based on what had come before that we would identify the singularity causing so much mischief. Kurzweil does not get to the singularity this way.

According to Kurzweil the progress of complexity is predictable and linear, though its course experiences a bend at the knee of the curve due to exponential doubling after which it is still linear but has assumed a vertical trajectory, driven upward at massive and ever-increasing speeds. Kurzweil plots the progress of history on exponential growth curves including up to and beyond the singularity. It is not that Kurzweil's thinking is inherently defective; his work elsewhere would belie this claim in any respect. Rather, he has succumbed to a rather common human logical error, the

category mistake. He has transposed the predictable velocity and trajectory of growth in computer processor speeds onto all of the history of life. Inherent in such a mistake is the radical reduction of the complex developmental webs that are productive of all of our various sociotechnical antecedent states to a simple series of linear and progressive transactions.

In this dissertation I aim to analyze what I refer to as the ""linear fallacy"" in scholarship about human enhancement and to begin to develop grounded theory about the role of human enhancement technology in American political culture. I will demonstrate what I believe to be a more accurate and useful way to approach a critical history of technology and society through an engagement with the works of Stephen Gould and John Carson on the development of intelligence and mental testing in America and France over the past two centuries. The goal of this engagement is to demonstrate how we should go about using sophisticated historical review to develop a better understanding of sociotechnical context in order to assess developing technologies in something closer to real-time. I define sociotechnical context as the combination of technology and human institutions in a web of relationships that is productive of changes in both technology and human society. The goal of such contextual mapping is to develop a better understanding of what value society hopes to derive from such technologies. The understanding of what the public values in technology and how technology is perceived within society is essential to crafting evaluative instruments like public-opinion surveys and procedures for expert engagement. Real-time technology assessment (RTTA) must necessarily begin with contextual mapping and the development

of a better understanding of the complex web of desire, institutional arrangements, and technological development it aims to evaluate.

I will demonstrate how current scholarship on human enhancement swings wide of the mark on evaluating accurately the sociotechnical context of human enhancement technology. It does so because it typically proceeds through the same sort of historical reduction I discussed with reference to Ray Kurzweil's work above. This is true of both camps in the normative and practical debate about human enhancement. Through the work of Ray Kurzweil and Francis Fukuyama, I will demonstrate how both camps employ the unfortunate fallacy that technological progress is linear and easily knowable to support divergent normative claims and political prescriptions. It is also the case that a profound misunderstanding of the nature of political culture colors the scholarship in this arena. I will try to develop a theoretical understanding of political culture as it relates to advanced technology. I will preliminarily test the understanding I develop through grounded theory against early public-opinion data on human enhancement technology. The relationship between the role of intelligence in shaping the context within which cognitive enhancement technologies are being developed and deployed will be made clearer through the combination of theory, history, and basic public-opinion research. Subsequent research attempting to evaluate cognitive enhancement technologies should proceed in part from the groundwork I am doing here.

Hobbes and Political Culture

Thomas Hobbes was not an advocate of representative government in the traditional sense. Mark Brown demonstrates that while he did not hold with democracy

or representations strictly speaking he did have a theory of representation, one that was in conflict with the developing liberal democratic concepts of political representation. While John Locke was crafting a theory of representation that posited an individual, Aristotelian contract between representative and represented, Hobbes was arguing a more Platonic theory of representation that involved a more abstract level of representation as groups of individuals aggregated to form a civil society and collectively authorize a representative—the infamous leviathan—to rule in their collective name. The framers of our constitution were allied with Hobbes in their desire to create a system of representation focused not on the individual but, instead, to represent "the people" as a consenting unit that authorized a body of elites to select ever finer and representatives that are more powerful. Needless to say, both Hobbes and the framers lost the battle for control of America's constitution, and a peaceful democratic revolution added amendments and fostered judicial rulings that devolved power into the hands of individuals as far as our form of representative democracy now closely resembles Locke's theory of a one-to-one contract for representation. However, Hobbes won out in another and, perhaps, more significant way.

Hobbes' theory of politics carried the day in terms of how we organize and perceive our political space. Hobbes argued that politics—not democracy, an important distinction that is often lost—forms the framework within which all other social activities take place. Essentially, politics for Hobbes takes on its most broad and basic form becoming merely a way to describe the subtext to all of our social interactions. Political culture is much the underlying elements of computer software. It is the binary code—the

most basic machine language consisting of strings of ones and zeros—underlying all of our higher-level programming—where we write computer programs in something close to natural language—and those programs are shaped at a meta-level by the structure of that underlying code framework and tend to take on its character to some extent. The world becomes a series of social structures built on a basic understanding of how to resolve conflicts of interest and in some cases even to collaborate for mutual gain, and this basic understanding, this subtext, is politics.

The significance of Hobbes for Brown is to lend some theoretical credence to the truism that "everything is political." Specifically, Brown is arguing that science is already an intensely political activity. Hobbes provides a theoretical way to understand how this could be so given the prevailing popular perception of science as still corresponding to the seventeenth-century gentleman scientist model where science is isolated, unrepresentative, and above all elite. Hobbes also helps to dispel the conflation of politics—or the political if you are so inclined—with democratic or representative forms of governance. If Hobbes is arguing that everything is political—or that everything we do takes place within a political space and is shaped by that fact—it should be obvious to all that he is not saying that everything is democratic or representative in the classical liberal sense. It may be political for Hobbes but it is only representative in his unique way of understanding representation; where representation is not a one-to-one contract between representative and represented but collective agreement between a body of people joined as a civil society and a sovereign chosen to represent them. Conversely, Hobbes leaves the door open for more classically liberal representative activities and

institutions within science by defining politics and its influence so broadly. Hobbes may believe that abstracted representation through a single sovereign is the form of government best suited to providing security and, perhaps above all, stability, but he does acknowledge that other forms of representation and governance exist and that they, too, are political.

One of my principle goals in this dissertation is to begin to develop a method of historical inquiry that will be useful as a preliminary stage of technology assessment through its capacity to produce more accurate and useful understandings of sociotechnical context. The object of inquiry in terms of analyzing sociotechnical context is the technology in question, the culture within which it is embedded, and so it is necessary to establish a good definition of political culture in general, and the specific political culture being analyzed.

In attempting to define American political culture, I have an extensive body of literature to rely on. Robert Putnam has made a notable scholarly career doing just this, and—according to a thoroughly unscientific Google book search—at least 40,000 others have contributed to the topic. However, I am lucky in this respect in that the scholarship on human enhancement tends to bear directly and intentionally on the subject of political culture, largely. It is possible for me to anchor my inquiry in this body of literature with some supporting roles for traditional philosophical inquiries into political culture and still adequately capture the dynamics at play. I can map the field of engagement and still focus on the core object of inquiry, human enhancement, without having to get bogged down in one of the most extensively reviewed topics in social science. Further, I am not

so much interested in mapping the entire depth and breadth of American political culture as I am in identifying key characteristics of its relationship with a particular technology and the mechanisms of exchange between science and the broader political culture in reference to human enhancement.

I have identified as one of the failings of scholarship on human enhancement in this respect is that it tends to adopt a rather naïve understanding of historical development. It does so in order to more easily construct linear models of technological progress and to use those models to substantiate normative claims, political positions, and policy recommendations about human enhancement. This is the case without regard for the scholar's position on human enhancement; both Ray Kurzweil and Francis Fukuyama—my two principal interlocutors in a subsequent chapter—succumb to what I have come to call the ""linear fallacy"." Each brandishes an intentionally unsophisticated historical model of man's relationship with technology and technology's "march of progress" in order to establish either utopian or dystopian claims, respectively, as fait accompli.

In order to respond effectively to scholarship predicated upon impoverished historical research I believe you must begin with a more complete historical approach. It would be interesting to conduct a critical history of all of technology, but it has been done and to no avail. The scope is far too broad to serve as a useful contextual map in any attempt to produce a technological assessment of a specific technology. Thomas Kuhn conducted such a review in order to create a theory of scientific and technological development that remains immensely influential today. On the other hand, Kuhn's

history was less than optimally critical, and thus many have argued that his theoretical model of the scientific enterprise is flawed, a self-serving hagiography of science rather than an honest assessment of the state of affairs and a theory of what is possible in terms of shaping science within American political culture.

I will take a different approach. Rather than attempt to theorize the entire scientific enterprise and entire American political culture, I will approach the problem through the lens of a single scientific field of inquiry. I will further narrow my approach by selecting a single variable that I believe is having a profound impact on that field of inquiry by virtue of its power within American political culture. I will then subject that variable—the theory of general intelligence—to critical historical analysis by engaging with the work of Stephen Jay Gould and John Carson, two scholars who themselves have conducted extensive historical reviews of the subject. Developing a deep understanding of how general intelligence was constructed by both society and science will provide insights into its impact on the present sociotechnical context, which is how I will refer to the broad set of social and technological facts and institutions that shape both how technology responds to society and how society is shaped by its technology. In that phrasing alone, it should be obvious that I patently reject the validity of linear historical models of technological progress.

My historical method is developed based on Nietzsche's genealogy, which I will describe in detail in the next section. My analysis of intelligence has led me to develop a grounded theoretical model of the sociotechnical context in which cognitive enhancement—a relevant subset of human enhancement—is developing. I believe that

theories of general intelligence are central to the way in which we think about cognitive enhancement and thus will have a profound impact on how we respond to their development. Their centrality is a function of their centrality to American political culture. The lion's share of our political culture is profoundly competitive in nature. This competition is among individuals and groups that tend to form and reform around an ever-changing array of identities. The two most potent identities in American political culture arise as a function of our heterogeneity and our subsequently contentious history as a nation. Race and class are still the most intensely felt identifiers in American political culture despite both having been subjected to rigorous campaigns intended to sublimate them in both the public's discourse and its consciousness. My review of the development of intelligence will substantiate this claim in exposing the incredibly powerful and broadly applied social dynamics at play in shaping—and being shaped by—intelligence.

My theoretical model of the sociotechnical context of cognitive enhancements indicates that theories of general intelligence are central to its formation. Further, as both Gould and Carson demonstrate, the actual state of the scientific research into cognitive enhancements—as opposed to the social scientific scholarship about cognitive enhancement—when it is overtly informed by theory at all, is being driven by theories of multiple intelligences. Theories of general intelligence—which will be described in greater detail in chapter II—hold that intelligence is a single, quantifiable, measurable, largely heritable, thing in the head which is fungible for all cognitive tasks, central to our identity and competitive ability, and highly resistant to improvement by environmental

factors. Theories of multiple intelligence hold that cognitive tasks are handled by discrete centers in the brain and that it makes little sense to speak of a single cognitive ability such as an IQ. Rather, humans have emotional intelligence or spatial intelligence—just to name two—and that, yes, genetic inheritance does play a role in developing these abilities but environment is a powerful factor and humans can work to reshape their cognitive ability in a given area, though by virtue of scarce resources and time this means neglecting the development of another areas. Theories of multiple intelligence argue that the way in which these various stores of mental abilities combine to act on a given problem is incredibly complex, as is the web of biological and environmental factors that shapes the type and amount of the various intelligence possessed by any one individual.

Two things became immediately obvious as I compared these two theories of intelligence to my theoretically informed understanding of American political culture. First, in an environment that is intensely competitive and riven by intense and deeply ingrained social divisions along racial and economic lines a theory of general intelligence would be incredibly useful for establishing the rank ordering of both individuals and groups. This is, in fact, the very way in which such theories have been, and continue to be, used. The desire to rank order individuals and groups was influential in inspiring some of the early researchers who developed these theories, and they did their jobs all too well as our culture continues to hold to a belief in a very real thing called intelligence, which can be passed on from parent to child, used to order groups in terms of their innate ability to compete, and—for many lay people and scholars—enhanced. The centrality of

general intelligence to American political culture is also a driving factor in rendering cognitive enhancement a tremendously controversial subject.

Multiple intelligences, on the other hand, despite being less influential than general intelligence in a broad sense, is the theory underlying the actual research being conducted into cognitive-enhancing drugs and devices. Drugs like Adderall are designed to affect a specific aspect of cognition like concentration, not to raise your IQ in general. In terms of actual devices, the work has focused on the creation of devices that can aid in specific tasks like speech and language processing, motor control, memory, and some aspects of executive function. It also surfaces in popular culture on occasion, particularly the idea of emotional intelligence; however, it is decidedly second fiddle to general intelligences powerful string section in terms of shaping American political culture. I theorize that if this were not the case, if multiple intelligences were the dominant force in shaping American political culture, it would change the debate about and the reality of cognitive enhancement profoundly. It would do this principally through changing the way we perceive ourselves and construct our shared understandings of human nature. The entire politics of competition underlying American culture would have to change as we became less readily able to meaningfully compare individuals and groups to each other and instead were limited to much more tightly confined and specific areas of cognitive competition. The malleability inherent in theories of multiple intelligences would also have a profound impact on the American debate about the utility of collective attempts to improve cognition in individuals and groups just as general intelligence has influenced that dialogue in attempt to limit such attempts. In short, a shift in the

prevailing theory of intelligence would change everything.

I substantiate the claims just made in part on the basis of public-opinion data gathered during the 2008 National Nanotechnology Survey. While we did not measure public perceptions of intelligence with the depth or directness, we did gather a great deal of indirect evidence to indicate that Americans are forming their opinions of enhancement technologies, in large part, on the basis of a competitive political culture formed on a theory of general intelligence. It also lends preliminary support to my argument that changing the theory of intelligence would work to shift public opinion—and the expectations of science that opinion indicates—to fall more realistically in line with the present state of enhancement R & D. It would also work to prepare us to debate more fruitfully how to respond to such technologies over time.

The remainder of this introduction will be devoted to establishing the historical method I intend to employ. I will also provide a more precise outline of the structure of the rest of the dissertation. I will close here by restating the four principal goals of this dissertation: first, to establish a new method of historical review capable of deeper and more critical analysis of the very complicated histories of humanity and its technology; second, to establish the existence of a problem within the scholarship on human enhancement—the problem is the prevalence of the "linear fallacy", or the tendency to predicate theory on naïve histories of technological development; third, to apply theory and method to the concept of intelligence in order to gain anticipatory knowledge of the sociotechnical context in which cognitive enhancement technologies are being developed; and fourth, to substantiate both theory and knowledge on the basis of public-opinion data about

American attitudes toward and beliefs about enhancement technology in general and cognitive enhancement in particular.

Finally, before laying out the organization of the dissertation to follow, I will attempt to establish a working definition of human enhancement technology in order to make clear the nature of the connections between such technologies and social competition. Human enhancement technology is any physiologically incorporated device, pharmaceutical product, or medical procedure that improves an individual's physical or cognitive abilities beyond the uppermost boundary for the species in terms of either the number or the strength of those abilities. This article will first unpack the lexical and logical difficulties inherent in the definition offered above. What is a technology, a relevant trait for enhancement, or the appropriate boundary for the line between therapy and enhancement are far from settled issues and will require some discussion. It will include a brief discussion throughout of the theoretical and historical underpinnings of human enhancement by way of explanation of the choices made in forming the definition above.

Technology's roots are in action rather than artifacts. The Greek *Technè* means art or skill and *technologia* refers to the study of an art or skill. The etymology of the word makes no mention of the material or social artifacts of *technologia*, but today that is perhaps the most common understanding. Technology is no longer conceived of as something you do or you study in order to do, but rather as something you hold, possess, and use to your advantage. Thus, defining human enhancement technology only in terms of devices or procedures represents something of a departure from historical definitions

but it does conform to contemporary convention. It serves a further analytical purpose in distancing human enhancement technology from social technologies and learned skills—as already noted these definitions seem obscure to most—and confining it to devices and medical procedures.

Social technologies—the modern state system for example—have certainly served to enhance human capacities but such a statement is uncontroversial and seems to belie the energy with which many oppose what has come to be known as human enhancement technology. The same can be said of learned skills and arts; it is not unusual to describe these things as enhancing our natural abilities. Further, it is likewise uncontroversial to argue that mundane—and perhaps even cutting edge—commercial material technologies enhance our natural abilities. The personal digital assistant serves to augment memory and the motor vehicle enhances our personal mobility. Glasses perfect our eyesight and clothing adds to the protective properties of our skin and hair. The very mendacity of such technologies marks them out from human enhancement technologies proper.

If analytically and epistemologically human enhancement technology is a distinct category then of what does it consist? Bio-mechanical prosthetics that possess greater strength than a normal human limb—even though they are deficient in many other ways—are human enhancement technologies despite the fact that they are intended as therapy. The recent ruling by the International Olympic Committee established prosthetics as a potential enhancement by excluding sprinter Oscar Pistorius of South Africa—a decision that was recently overturned by the Court of Arbitration for Sport—arguing that Pistorius' carbon-fiber legs extended his stride beyond what he would

naturally be capable of. Likewise, certain classes of psycho-pharmaceuticals constitute enhancements when used by the healthy to increase their ability to concentrate, remember, and remain unaffected by sleeplessness. Finally, genetic or nanotechnological alterations constitute enhancements in a way which is far more obvious to the casual observer in that that they confer properties or advantages which are not analogous to past technologies. Pharmaceuticals can be compared to caffeine or illegal stimulants and prosthetics can be seen as similar to technologically advanced equipment like the specialized suits and shoes employed by elite level sprinters, but the alterations offered by genetics and nanotechnology appear to be of a different quality rather than just quantity.

To review, the technology in human enhancement technology refers to physiologically incorporated devices, pharmaceuticals, and medical procedures. Limiting human enhancement technology to physical or cognitive capacities can be seen as problematic as it appears to exclude emotion. This exclusion is not, however, arbitrary. Emotional enhancement—one of the most prominent kinds at present through the use of Selective Serotonin Re-uptake Inhibitors like Prozac—is certainly controversial in its own right and a separate ethical conversation should continue with regard to such drugs but in terms of human enhancement technology such drugs appear to only be important in their capacity to enhance cognition through the regulation of mood. Thus, it is useful to focus on cognitive capacities for analytical reasons. Further, it is conceptually less difficult to envision an upper boundary for cognitive and physical capacities than it is for emotion. It is also worth noting that in referring to physical capacities this includes

sensory capabilities that are a function of both physiology and cognition. If nothing else is clear by this point it should be unmistakable that definitional boundaries in human enhancement are weak and motile.

Finally, in terms of definition at least, discussions about where to place the boundary between therapy and enhancement have been many and often rancorous. Ethicists working in the area of disability studies have been particularly active and vigorous in challenging the rather pat boundaries others have sought to establish. It has been argued that any increase over an individual's given abilities—either restoring them to a level greater than they would have been at prior to some deficit or an increase absent any prior deficit—constitutes human enhancement. In a literal sense, this is true, as an individual human has been enhanced by technology. However, this definition fails to include the systematic and species-wide nature of many enhancements. It is, in effect, far too narrow. A broader definition might refer to any technological enhancement beyond what would be normal for the species. Analytically this enables the examination of much broader trends in technological enhancement and it acknowledges some of the ethical issues that arise from enhancing a creature that is embedded within a socially and culturally complex context sometimes referred to as human nature. The use of a species norm is problematic and ultimately dooms this definition. It is far too easy to challenge the construction of such norms and thus undermine an argument predicated on such a definition. The diversity of ability both among individuals and groups within the human species confounds any attempt to convincingly establish analytically useful norms.

Establishing an upper boundary to human abilities for the purposes of analyzing

potential human enhancement technologies is far less problematic than establishing what is normal. While there are humans that can run considerably faster than the average time it would take a healthy adult human to sprint 100 meters, there are none that can naturally match the speed of, say, a horse. We can point to the track time of the current world record holder in the 100-meter dash as a more or less firm upper boundary for human running abilities. It is true that it is almost inevitable that at some point in the future another human will fractionally exceed this time without the use of what would be considered enhancement technology under out definition. However, the very fact of their having done so without the use of many of the technologies that are today controversially considered enhancements works to firm up the boundary. Thus, tents which simulate sleeping and training at altitude—i.e. an oxygen depleted environment—would not constitute human enhancement technology because they are not internalized and do not exceed an upper limit that has already been met by many Nepalese, but gene doping to produce substantially higher levels of Erythropoietin (EPO) would as it is both internal and a condition which cannot be achieved without advanced technology and thus cannot naturally be reproduced elsewhere within the species. The line between injecting synthetic EPO and somatic genetic modifications to cause the body to metabolize higher levels is a bit more problematic, but not insurmountably so.

Organization

This dissertation is organized as four interleaved papers in four separate chapters. The papers have much in common and they each act on a central narrative but they have been written as distinct manuscripts for eventual article publication. The papers are

incorporated here as chapters. Chapter I describes the historical and theoretical lacunae I find in the scholarship on human enhancement technology through an engagement with Mark Brown and Sheila Jasanoff. I also build on the introductory attempt to define and explain Nietzsche's historical method known as genealogy. I explain how this method can be productively brought to bear on the deep analysis of human enhancement technologies and why such reviews are necessary. This chapter is designed to explain the understanding of political culture that I will employ in the subsequent three chapters and lays the groundwork for a more sophisticated historical analysis of the technology of intelligence. Further, this chapter is a preliminary attempt to reinvigorate a method of historical review originally developed by Nietzsche that is more theoretically and critically deep in order to avoid the pitfalls of the monumental history most often employed in human enhancement scholarship.

In Chapter II, I engage with the work of John Carson and Stephen Jay Gould in an attempt to deploy my new method in an examination of the technologies of intelligence and mental testing. These two technologies are instrumental in shaping the sociotechnical context in which cognitive enhancements are being developed. They work to disjoin the popular perceptions of cognitive enhancement and the social science scholarship on the subject from the actual research being conducted to develop new cognitive enhancements. The aid in the naive understanding of current and future enhancements as being unproblematically embedded in a linear history of technological progress that is both reductionist and deterministic in its outlook and outcomes. I do not attempt to answer the question of what intelligence actually is; rather, I try to demonstrate

that what we presently believe it to be does not correspond to any objective reality and the belief that it does has a negative impact on the sociotechnical context and our ability to think critically about how to respond to these technologies.

In Chapter III I describe a set of public opinion results gathered during the 2008 National Nanotechnology Survey. In this survey, we conducted the first ever measurement of public knowledge of and opinion about human enhancement technology in general and cognitive enhancement in particular. We discovered that knowledge was shallow but sharpened considerably in response to the questions asked over the course of each survey. Further, support levels varied sharply based on knowledge and the specific application of the technology in question, i.e. medical devices enjoyed much stronger support than generic brain implants or implants for communications. I use this data, interpreted through the lens of my new historical method, to test a series of hypotheses developed in Chapter II's review of the development of intelligence and mental testing. The data support the contention that the present sociotechnical context is constructed around misleading theories of general intelligence and that a more nuanced public understanding of intelligence would have a dramatic and beneficial impact on the contextual relationships between enhancement technology and American political culture.

Finally, in Chapter IV I describe an error in logic that I find to be pervasive in human enhancement scholarship. I call this logical error the "linear fallacy" and define it as: a flawed syllogism that contends that a similarity between a historical technology and a contemporary technology can be generalized to provide useful knowledge about the future of both the present technology and technology in general. This type of category

mistake is shown to be pervasive in human thought by Stephen Gould and it is central to the development of the theories of general intelligence that are exerting such a negative influence on the sociotechnical context of cognitive enhancement. I engage with the work of Raymond Kurzweil and Francis Fukuyama to demonstrate that the "linear fallacy" is common to both proponents and detractors of human enhancement technology. I then show how my new method can help eliminate this logical error in future scholarship and in public discourse.

I conclude with a discussion of the role of historical analysis in establishing a robust program of Real-time Technology Assessment (RTTA) as established by the work of David Guston and Daniel Sarewitz. Critical historical analysis of the kind employed in this dissertation will be useful in each of the four stages of RTTA: analogical studies of transformational innovations, contextual mapping, monitoring changing public and expert knowledge, and identifying and assessing societal values relative to technologies. I finish by outlining future research necessary to further develop both the method established here and RTTA. Future research would include additional iterations of the survey conducted in 2008 in order to correct some of the defects attendant on any first-time measurement of the public's opinion on a subject. Further iterations of the survey would also establish a useful longitudinal baseline for measuring changing knowledge and attitudes on human enhancement over time, one of the goals of RTTA. Also needed are additional applications of my new historical method to the other technologies underlying the current sociotechnical context of cognitive enhancement and a more extensive tracing of the Law of Accelerating returns and monumental and antiquarian history through the

human enhancement literature beyond my two principle interlocutors.

Chapter I: Mark Brown, Sheila Jasanoff, Friedrich Nietzsche, Thomas Hobbes, and Political Culture

Introduction

The value of introducing canonical political theory into a contemporary social or political study very often is that it helps to trace both the structural and the historical context of a subject. The use of contemporary democratic theory in human enhancement scholarship is, in many ways, hamstrung by the failure to examine the deeper offerings in the theoretical canon. Mark Brown's recent work Science in Democracy: Expertise, Institutions, and Representation attempts to introduce the insights that can be gained from the canonical political theorists with regard to the specific question of the democratization of science. Brown offers a genealogical examination of the co-development of the dichotomous pairs *common sense and empirical science* alongside *participatory democracy and representative democracy*. The utility of his analysis to this dissertation is in his ability to provide a useful and accurate definition of political culture derived through the work of Thomas Hobbes.

Sheila Jasanoff offers an understanding of both political culture and the development of scientific, and then public, knowledge that is similar in many ways to both Brown and Hobbes, though Jasanoff does not acknowledge the theoretical underpinnings of the definitions she employs. Like Brown and Hobbes, Jasanoff understand political culture to be a powerful framework within which social interactions take place. It is the *a priori* agreement to mediate social conflicts through political institutions to be negotiated on an ongoing basis. Hobbes understood science to be just

one of the social groups or activities operating within the framework of political culture and, as such, was subject to the same sorts of pressures and political controls as any other group, civic associations or political parties for example. Scientific knowledge was, for Hobbes, a human creation that carried the inevitable marks of its politically constrained and enabled production, and it could not be assumed to accord with the actual reality of the world around us or with benign human goals. Jasanoff and Brown each adopt this understanding of political culture, and, as it both accords with the analysis of American political culture undertaken in this dissertation and a critical historical method, I will as well.

In this chapter, I will engage with Brown and Jasanoff in an attempt to develop a working definition of political culture that accords well with both the understanding of American political culture developed later in the dissertation as well as a critical historical method. I accomplish primarily though identifying the Hobbesian aspects of their work and tying together what I believe are the most relevant aspects of each of their attempts to develop the concept of political culture in a useful way. The second purpose of the chapter is to develop and begin to operationalize both Nietzsche's ethic and his method of historical analysis. In engaging with Nietzsche's *Uses and Disadvantages of History for Life* I hope to make clear not only what I believe is the most useful historical method for conducting case studies in the context of technological analysis, but also to lay the groundwork for a later critique of the historical analysis of two of the most prominent scholars of human enhancement, Ray Kurzweil and Francis Fukuyama.

Mark Brown and Thomas Hobbes on Political Culture

Brown argues that Hobbes' work destabilizes the presumed boundaries between politics and science "Hobbes thus challenges those trying to locate an essential boundary between science and politics, as well as those all too happy to collapse them together" (132). Hobbes does this, in part, through his conceiving of politics and political culture as being separate, though obviously interrelated. No, science is not an entirely political enterprise as some of the scholarship in the social constructivist tradition would have it, nor can scientifically produced knowledge be understood as wholly politically constructed as some analysts have accused Hobbes of theorizing, the work of Bruno Latour is a good example of both of the aforementioned perspectives. On the other hand, arguments for the exceptional and apolitical nature of science ignore its place within a powerful construct like political culture at the expense of any real understanding of the social impacts and relationships scientific research and its outputs produce. The decontextualized nature of such analyses, while appealing to some, is less than useful in the pursuit of strategies for anticipatory governance, which is a program for analysis of technologies in real-time and the construction of robust mechanisms for governing emerging technologies in a timely, and thus more effective, way. Anticipatory governance and Real-Time Technology Assessment (RTTA) will be discussed in detail in the conclusion of this dissertation.

Asserting the socially and politically contingent nature of much of scientific practice and the knowledge it produces seems intuitive from the perspective of critical and non-linear histories of technological development but demonstrating proves difficult.

This dissertation attempts to qualitatively and quantitatively explore one portion of political culture, and this is done in support of the Hobbesian model of knowledge production that has been so thoroughly reproduced by Brown and Jasanoff.

Brown describes Hobbes' perspective on who bears ultimate responsibility for the actions taken by scientists in this way "Although today's critics of the social and environmental impacts of science tend to blame either individual scientists or modern science itself, Hobbes suggests that citizens hold ultimate responsibility for the public consequences of scientific knowledge" (133). Hobbes was interested in including science among the activities authorized by the sovereign that were, ultimately, the moral and practical responsibility of the citizens themselves. He does this through establishing a chain of responsibility where citizens—who have already established the basic framework of political culture when they agreed to enter into civil society and mediate their disputes politically through the authorization of a sovereign individual or body to govern them—authorize every action of the sovereign *a priori*, and who in turn authorizes scientific practice and knowledge production. In combination with Jasanoff's more nuanced depiction of the coproduction of epistemic communities based on public knowledge, Hobbes' political culture forms a potent response to critics who would divorce the public from responsibility for scientific practice and scientifically produced knowledge.

In terms of how specific political cultures forms Brown includes Hobbes' perspective with Machiavelli's when he writes "For Hobbes, as for Machiavelli, there is no plausible pre-political basis for political order, and so order must be created through

politics" (120). Hobbes is, as is Machiavelli, trying to establish that there is no natural political order, just as there is no natural structure to political institutions, we can see this when he makes a comparison to certain social non-human creatures, Brown recreates Hobbes' position when he writes "Bees, ants, and certain other creatures may be said to live in naturally constituted societies, writes Hobbes, but humans can live together peacefully 'by covenant only, which is artificiall'" (120). The artificial covenant is the *a priori* agreement to negotiate social differences through political mechanisms, rather than other means such as violence, and this is the framework, which is then filled with specific political forms, like democracy, over time. While I find something analytically useful the way in which Hobbes conceives of political culture as the framework that derives from the foundational moment of civil society, and the way he makes clear the distinction between politics and political culture, he is less than clear on how we might go about finding evidence of the contours of political culture or its origins, Brown portrays the problem this way "Hobbes conceives politics as something that cannot fully be reduced to or explained by historical, material, ethical, legal, religious, or social factors" (120). For Hobbes these factors, alone or in combination, fail to capture political culture itself and can only provide information about specific institutions embedded within political culture. Information about political culture must be inferred from the linkages between these institutions and the outputs of their relationships. Jasanoff makes clear some of the analytical difficulties that can arise from such a model of political culture, not least of which is the difficulty in operationalizing meaningful variables when one of the principal elements of your model, the prior consent of the civil society to political mediation,

approaches ineffability, but, as Brown writes "[Hobbes'] view of politics as providing a framework for other social activities remains instructive [for the reasons already noted]" (120).

Brown explains the relevance of Hobbes' political culture to science studies, here applied specifically to human enhancement scholarship, in explaining Hobbes' nominalist theory of language. Hobbes argues that science's inherent weakness—both in politics and in the production of knowledge—is its reliance on language, which, as Brown puts it "exceeds its ability to stabilize [social and linguistic conventions]" (116). Science's connection to political culture, dependence upon it, is embedded in the linguistic nature of scientific explanation and understanding. It is by this fact intrinsically political, and already constrained by its dependence on other social objects embedded in the framework supplied by politics. Science must act in conjunction with other social entities and processes to stabilize linguistic conventions if it is to function at all. This constraint is before any of the material constraints supplied by embedding science within a specific political regime that determines its funding and regulatory environment. The nominalism of Hobbes is essential for understanding the development and role of theories of general intelligence in American political culture. It is the underlying mechanism, or the missing link, in the analysis of intelligence's formation in America. In order to further stabilize and explicate a definition of political culture I turn now to Sheila Jasanoff.

Sheila Jasanoff and Political Culture

Explanations based on national structure as an unproblematic variable fell out of favor with the rise of post-structuralist thought in the U.S. academy. Sheila Jasanoff

explains exactly how post-structuralism impacted comparative analyses when she writes "The theoretical dilemmas reflect most importantly the rise of post-structuralist thought and the attendant difficulty of taking entities such as 'science,' 'state,' or 'society' for granted as stable units of analysis. All these concepts have to be seen instead as historically situated, contingent, dynamic constructs whose form and fixity are as much in need of explanation as they are available for explaining other developments" (19). Post-structuralism was pointing out a problematic assumption in comparative analyses similar to what Nietzsche discovered in monumental history. The effects of history, society, and chance were being mistaken for causes. Destabilizing this assumption was crucial to understanding the impact of culture and history on present decision-making.

Jasanoff explains how such destabilized comparative analysis becomes useful in understanding the development of biotechnology—a focus of this dissertation though its engagement with Francis Fukuyama—when she writes "Although it [biotechnology] has called forth roughly similar cycles of regulatory attention in Europe and the United States, biotechnology has given rise to quite different national discourses of risk and safety, naturalness and artificiality, innovation and ownership, constitutional rights, and bioethics. To account for these divergences, we must ask how policy problems were construed in different political cultures" (21). Jasanoff's analysis thus becomes useful in two ways: first, it offers an example of how preliminary thinking on the development of biotechnology has already proceeded and in my engagement with John Carson I offer a deeper look at such comparison on an international level, though my focus then returns to level of comparison between contexts and technology specific to the American political

culture; second, she points directly to the use of political culture as the crucial independent variable in technology assessment of this kind. I will take this a step further and argue in the conclusion to this dissertation that based on such logic accurate and deep maps of sociotechnical context beginning with political culture are a necessary precursor to even formulating such questions properly.

A particular point of interest for my dissertation in relation to the prominence of intelligence in the sociotechnical context developing around cognitive enhancement technology is the coproductive nature of the relationship between public knowledge and political culture. Jasanoff begins to explain how public knowledge is integrated into political culture when she writes, "Political culture in contemporary knowledge societies includes the tacit, but nonetheless powerful, routines by which collective knowledge is produced and validated" (21). Theories of general intelligence and the technology of mental testing are forms of public knowledge with particular relevance to for any assessment of the role of cognitive enhancement in competition within American political culture, a view Jasanoff seems to support when she says "political authority in the management of science and technology derives not only from the formal and informal rules of political practice [the politics within political culture, which extends well beyond mere political forms], but also from the less explicit cultural commitments to forms of legitimation that fill out the routines of what we think of as normal politics" (21-22). In American political culture that would include not only the impetus toward racially defined competition and hierarchy, but also the associated desire to discover scientific evidence to bolster such competitive and classificatory schemes in the absence of

longstanding social and political support that have been damaged through political action on other fronts.

What Jasanoff is doing is establishing the utility of a very different way of understanding the social variables involved in knowledge production and political interaction. She is attempting to define a system operating on two levels. The lower level is that of political culture, which she defines in the broad Hobbsian terms I developed from Mark Brown's work in this chapter. Hobbes understood political culture to be the basic contractual framework within which all other social activities took place. In its most basic form political culture is the prior agreement on the part of the members of a civil society to negotiate conflicts between social forms, needs, desires, and ways of living through political forms to be specified at a later time. It is the antediluvian moment at which a group of people agrees to forsake other forms of conflict management, like violence, and instead submit themselves to ostensibly neutral systems of arbitration and individual arbiters within those systems. The upper level of operation in Jasanoff's understanding is the social objects that populate that broad political and cultural framework, and they include voluntary associations of all sorts, races, socio-economic classes, political organizations and institutions, the very political forms which were negotiated after the initial contract to form a political culture, and, yes, science is included among the many social objects within political culture, this list is, of course, not exhaustive.

Returning to Jasanoff, she tends to describe her understanding of political culture in relation to its role in the production of public knowledge as when she says, "Scientific

knowledge, it is now widely accepted, does not simply accumulate, nor does technology invariably advance benign human interests. Changes in both happen within social parameters that have already been laid down, often long in advance" (13). Jasanoff is advancing three points here. First, she is adopting a constructivist understanding of scientific knowledge and process that accords with Hobbes' assertion of the same as we saw with Brown. Second, she is beginning to offer an initial image of how public knowledge is produced with reference to the underlying political culture. Finally, she is arguing that political culture is a set of social parameters that have been established well in advance of any particular scientific advance and that these social parameters already play a role in constraining and directing the development of scientific knowledge. Thus, the role of post-structuralist thought in science and technology studies has been to establish that "state structures must be regarded as both dependent and independent variables; similar conclusions hold with regard to science, technology, and society [the other significant social objects within political culture]" (19).

In engaging with the work of Mark Brown and Sheila Jasanoff, I have attempted to develop a working definition of political culture to serve as the backdrop to a more specific examination of the sociotechnical context of cognitive enhancement technology. Brown relies of Hobbes' very broad definition of political culture as the framework of mediation within which all other social activity takes place. Brown then grapples with trying to populate this framework and explain the relationship between its initial contours and the specific political and social forms that it has produced and that have acted back on it in significant ways. I am attempting to add to Brown's endeavor in this dissertation,

particularly with my case study of the nature of the relationship between general theories of intelligence and competition in American political culture. Jasanoff carries Hobbes' framework a little further as she defines *political* as that which concerns the production and distribution of social benefits and risks, and *culture* as the social meanings, identities, and forms of life that operate within the space of the political. Thus, for the purposes of this dissertation, at least, political culture is defined as the framework within which the production and distribution of social risks and benefits takes place through the mediation of social meanings, identities, and forms of life. This is a definition of political culture that will work well with a non-linear and relational understanding of history such as the one I have begun to develop through Nietzsche's genealogy.

The problem for such a definition of political culture is the inherent looseness of the various elements of the individual units it contains within itself. In part, this is an intentional softening designed to accommodate a non-linear and relational historical method. On the other hand, it is a function of the looseness of the objects themselves. They cannot be defined as precisely and unproblematically as many determinist philosophers and analysts would have it because they are, in their very natures, imprecise and interrelated. Jasanoff explains well the problems arising from a constructivist definition of political culture and public knowledge when she writes "Particularly troubling for analysis is the recognition that systems of knowledge and belief about the natural world are not built independent of the social worlds within which they are embedded. Evidence from many quarters points to the subtle and multidimensional process of coproduction, in which problems of society and problems about nature are

simultaneously addressed and resolved" (22). If society, scientific knowledge, political culture, and politics are not distinct in fact, they cannot be conceptualized as distinct for the purposes of social scientific measurement and technology assessment. One of the goals of this dissertation is to begin to operationalize a method for developing case studies of technologies and their contexts that could be useful in establishing methods for blending qualitative and empirical examinations of technologies in service to robust technology assessment. I will now engage with Nietzsche's genealogy in an attempt to begin developing his historical method in a way that is useful for technology assessment.

An Ethics and Method of History: Operationalizing Nietzsche's Genealogy

In this dissertation, I want to begin the process of operationalizing Nietzsche's ethics and method of historical analysis in service to technological analysis. Nietzsche argued that history had degraded into what he referred to as the historical sense, which he described as a kind of "sleeplessness," and "rumination," which characterizes the tendency to embed all of life in a persistent historical narrative that was harmful to life in the present (65). Nietzsche was not anti-historical, he believed we needed history but that we needed it for reasons which were different from the ways in which it was used in his time, and I believe it is still often employed that way today. Nietzsche wrote that we "need it [history], that is to say, for the sake of life and action, not so as to turn comfortably away from life and action, let alone for the purpose of extenuating the self-seeking life and the base and cowardly action" (59). He believed that history was often used to stifle life and action by working to glorify and preserve the past at the expense of the living. His hyperbole aside, I believe this is an apt description of the way in which

history is used in the literature on human enhancement technology. The technological and historical determinism inherent in the scholarship of authors like Ray Kurzweil and Francis Fukuyama, which then wends its way into the work of what some might consider more serious scholars, is designed to perpetuate what these writers see as an inexorable historical march toward a specific technological future or to struggle against that future by preserving a human nature supported by a specific reading of history. What Kurzweil and others are doing, according to Nietzsche, is living historically, which is to assert an embeddedness in a persistent and inexorable historical narrative that portrays all of life as continuously unfolding before the eyes. To see this world this way, Nietzsche argues, is to lose the self and to act against life in the present by bolstering the dominance of the past.

Nietzsche determined that the best way to thwart the historical sense is to establish a method of historical analysis and ethics of history that focused on establishing horizons, he wrote "And this is a universal law: a living thing can be healthy, strong, and fruitful only when bounded by a horizon; if it is incapable of drawing a horizon around itself, and at the same time too self-centred to enclose its view within that of another, it will pine away slowly or hasten to its untimely end" (63). Nietzsche intends horizons to represent the ability to see both the present and a given body of historical information as semi-discreet entities. The two have some degree of intercourse but one does not define the other in any sense that would be limiting. Nietzsche seeks guidance from historical objects and relationships but wants, at the same time, to preserve the vitality of the present as a distinct aggregate of objects and relationships capable of innovating new

ways of living and acting.

The option to flout historical precedent must be preserved and the historical sense does not allow for the dynamism Nietzsche believes is essential to a strong and active life. In the case of human enhancement scholarship, that portion of it characterized by an attempt to preserve human nature against the perceived assault of enhancement technology—Francis Fukuyama is representative of this type of scholarship—is in danger of pining away and failing to act and live boldly because it is anchored by the chains of a deterministic version of human history that writes the universal character of humanity in stone. In contrast, pro-enhancement scholarship—or scholarship which is ostensibly neutral and concerned only with the efficacy of the technology in question, ethics be damned—runs the very real risk, according to Nietzsche, of hastening to its untimely end in large part because it cannot see past the determinism in its own historical narrative, which claims that technology develops in according to natural or mathematical laws not subject to human intervention. Both of these are ways of using history that derive from an ethical perspective that places life in service to history. Nietzsche sought to offer a third option stemming from the ethical perspective that always placed history in service to life.

I am not going to attempt to reconcile Nietzsche's ethical perspective with the present work. It would be possible to conceive of a relationship between the belief that history should serve life, that histories should be conducted with an eye toward supporting bold action and the project I am engaged in, which is the reformulation of the way history is used in support of anticipatory governance. However, it is not necessary

for the success of this dissertation and instead I will focus on the method of history Nietzsche offered in response to the historical sense. Nietzsche's historical method, sometimes referred to as genealogy, is not a scientific method in the strictest sense and he was less than forthcoming in terms of specific ways in which one could operationalize his genealogy.

Nietzsche would celebrate the unscientific and often obscure nature of his method given that one of the ways in which he felt history was being abused by his contemporaries was that it was being turned into a science, in which histories were taken to be objective records and analyses, "History become pure, sovereign science would be for mankind a sort of conclusion to life and a settling of accounts with it" (67). He believed that scientific history was creating generations of humans born "gray-haired," humans who believed they were at the end of life's history and could only study what had come before with no thought for what they would do next. In this way Nietzsche links scientific history with religion, and it should be obvious why attempting to operationalize his *ethic* of history in service to technology assessment would be difficult and probably fruitless.

Rather than offer a formal method of historical analysis Nietzsche described three types of history: monumental, antiquarian, and critical. He claimed that each had its place and its uses but that if any one of them should dominate the other two or if any of them were used outside of their rightful context or by the wrong sorts of people they would be harmful. Together, or when properly used alone, his three types of history would produce historical analyses and narrative that were properly enslaved by the living

and designed to promote action and new life. Nietzsche describes the relationship between what he calls the "living man"—the man of action, the future-oriented man—when he writes "History pertains to the living man in three respects: it pertains to him as a being who acts and strives, as a being who preserves and reveres, as a being who suffers and seeks deliverance. This threefold relationship corresponds to three species of history—insofar as it is permissible to distinguish between a *monumental*, an *antiquarian*, and a *critical* species of history" (67). Monumental history serves the man who acts, antiquarian history serves the man who preserves and reveres, and critical history serves the being that suffers and seeks deliverance. Nietzsche's argument is proceeding along two tracks where on one track he is arguing for the correct composition of history and on the other he is arguing for the correct composition of humans. The two are intimately related for Nietzsche, and this is the jeopardy he finds in the misuse of history. Humans, according to Nietzsche, should need and deploy all three types of history both within the species and within each individual. Nietzsche fears the degradation of individuals and cultures if they focus on only one type of history.

Nietzsche's most concise definition of monumental history reads as follows "That the great moments in the struggle of the human individual constitute a chain, that this chain unties mankind across the millennia like a range of human mountain peaks, that the summit of such a long-ago moment shall be for me still living, bright and great—that is the fundamental idea of the faith in humanity which finds expression in the demand for a *monumental* history" (68). Monumental history in this sense focuses on the most significant individuals and events in a body of historical data to construct a single,

glorious narrative. It is a history designed to instruct based on past, interrelated glories and it is built upon a faith in the positive and progressive nature of human development. The underlying theme of such histories is that history is a single narrative tale that moves ever forward toward glory. In order to determine your next step, you men of action, you need only glance back at the most significant moments and men of the past to understand what they did and how it advanced the species. For Nietzsche, the faith in humanity, or the hope for humanity that is embedded in monumental history is that "...one thing will live...a work, an act, a piece of rare enlightenment, a creation...it is the belief in the solidarity and continuity of the greatness of all ages and a protest against...the transitoriness of things" (69).

Nietzsche finds a value to such histories when properly employed by living humans but he is critical of such histories on two fronts. First, Nietzsche describes the eliding of "sharp corners and hard edges" in the construction of such histories (69). He characterizes these as acts of violence against the past, although occasionally necessary acts of violence. Monumental history necessarily deals in "approximations and generalities, in making what is dissimilar appear similar" (70). He goes on to describe the outputs of monumental history as being causally underdetermined "since it as far as possible ignores causes, one might with only slight exaggeration call it a collection of effects in themselves, of events which will produce an effect on all future ages" (70). History and its chain of effects are transubstantiated into a *cause* by the monumental historian through the elision of causes and relationships below the level of the most significant effects. When monumental history dominates, the past is mutilated as its most

significant elements are amputated in service to a narrative of greatness. Nietzsche sees a very specific value in such histories for inspiring action, but they are harmful to a more complete understanding of the past and its implications for the present. Monumental history can actually tell us very little about how the present condition came to be and thus can tell us nothing about the likely future beyond its ability to inspire.

In analyzing the work of Ray Kurzweil, specifically his Law of Accelerating returns and the metaphor of the singularity, I will make clear the connection between his work and monumental history of the type described above. Kurzweil deals in abstractions in an effort to construct a narrative of inexorable progress toward a glorious technological end to present humanity. It is never made explicit, but underlying his historical analysis is the hope to inspire action along a specific technological trajectory and to forestall any attempts to intervene in technological development. The focus on monuments in Kurzweil's work softens the hard edges of history and obscures the relational and contingent nature of historical objects in order to make his analysis of relatively well understood and stable bodies of historical data—like the history of processor development from the last forty years—appear to be seamlessly applicable to less stable bodies of historical data like the history of all life on Earth. His claim that every system of increasing order and complexity will increase exponentially over time depends on monumental history in order to seem plausible. One potential way to respond to Kurzweil's monumental history is to construct a counter-history that focuses on explaining and preserving the stability of human nature through time, an antiquarian history.

The antiquarian historian focuses on maintaining systemic stability over time for the benefit of future generations "by tending with care that which has existed from of old, he wants to preserve for those who shall come in to existence after him the conditions under which he himself came into existence—and thus he serves life" (72-73). This is the ideal antiquarian for Nietzsche as he approaches his historical subject with piety and respect. It is his piety that is the most significant aspect for Nietzsche, but he is less than clear on how such piety serves to create historians and histories that are loving in the preservation of the past but still focused on maximizing the potential for growth and action in present life. Perhaps the antiquarian's piety stems primarily from his or her love of humanity and thus, despite a near obsession with a glorious national or cultural past, the antiquarian remains devoted to using such history wisely to foster new growth. The "antiquarian without piety" according to Nietzsche will be a purveyor of a preserved history in service to nothing other than what they see as the manifest fact that circumstances persevere. They are dangerous to life in no small part due to the lie apparent in their initial premise; if circumstances persevered intact then they would cease to be history. Further, they are dangerous to life because their devotion is to inscribing glorious histories in stone and using them to weight down present life. They seek cultural and individual stasis, rather than reverence to the past in service of the future.

Nietzsche describes the antiquarian man, the pious antiquarian, as saying "Here we have lived...for here we are living; and here we shall live, for we are tough and not to be ruined overnight" (73). The ethos underlying the work of the antiquarian man is the strengthening of present life through a pious preservation of the sense of history, place,

embodiment, and the connection to something grander than oneself. It is difficult to say with certainty whether Francis Fukuyama is a true antiquarian in the way Nietzsche intends it based on his analysis of biotechnology and human nature. What is clear is that he is conducting antiquarian history as he seeks to describe and preserve a stable human nature. The history of humanity according to Fukuyama has been the process of discovering the system of government that maximizes the best aspects of this fixed nature. If Fukuyama truly does approach such history with piety, and I cannot say he does not, it is nonetheless clear from Nietzsche's work that such history is insufficient on its own. The problem with Fukuyama's work, as we shall see, is not that he is impious or seeking stasis for its own sake but that he rejects the validity and utility of other historical perspectives. His history is no less deterministic for being non-monumental and its determinism is the danger it poses to present life from Nietzsche's perspective.

If antiquarian history is afforded undue influence its effect is to act against the living by denying them agency and the opportunity to live beyond the bounds of a piously preserved and meticulously rearticulated history. Nietzsche describes the danger in even properly conducted antiquarian history this way "The antiquarian sense of a man, a community, a whole people, always possesses an extremely restricted field of vision; most of what exists it does not perceive at all, and the little it does see it sees much to close-up and isolated; it cannot relate what it sees to anything else and it therefore accords everything it sees equal importance and therefore to each individual thing too great importance" (74). The outsized importance of human nature in Fukuyama's history is seen here to be a product of his antiquarian sense and, according to Nietzsche, a danger

to life. In neither the case of Kurzweil or Fukuyama—or the many other scholarly works on human enhancement that make use of their methods and analyses—do I adopt Nietzsche's hyperbolic conclusions about a danger to life. However, I do believe they are detrimental to accurate technological assessment and thus to anticipatory governance. In this sense, in the extreme cases, they may be dangerous to life but, for the most part, my concern is more pedestrian as I attempt to reconcile Nietzsche's historical method with robust technological assessment.

Nietzsche has been described as a philosopher with a hammer and in his description of critical history it becomes apparent why he has been called this "If he is to live, man must possess and from time to time employ the strength to break up and dissolve a part of the past; he does this by bringing it before the tribunal, scrupulously examining it and finally condemning it; every past, however, is worthy to be condemned" (75). He is arguing for breaking up the monumental and antiquarian narratives of history in order to forget, or dissolve, those elements that have become dangerous to life. He believes this can be done through a far more minute and scrupulous examination of the historical record than is the case with the previous two types of history. Monumental and antiquarian history each ignores relationships between historical objects and make selective use of the historical record to construct narratives of glory and continuity. Nietzsche describes the process of eliding such elements as an active type of forgetting or living unhistorically and he claims it is essential to fostering life and action in the present. On the other hand, he argues that it is occasionally necessary to remember "Sometimes, however, this same life that requires forgetting demands a temporary suspension of this

forgetfulness; it wants to be clear as to how unjust the existence of anything—a privilege, a caste, a dynasty, for example—and how greatly it deserves to perish" (76). In order to break the hold the past has upon the present and allow for new growth certain domineering elements of the past must be burned away, just as a healthy forest requires a periodic fire to foster new growth. Thus, for Nietzsche, critical history is the agent of change in his method. It is the mechanism by which we can come to know how the present context came to be, what influence historical objects have on present life, and in identifying the relational characteristics of history how the objects that are no longer needed can be cut loose and broken up.

In order to break the hold of history on the path of present development and life a violent forgetting must take place according to Nietzsche. The monuments and revered structures of the past must be periodically diminished in order to prevent their permanently halting or retarding the life of the present. This begins with a process of critically remembering the interconnected minutiae and relations that made the monuments we have narratively assembled possible. The relations of past objects to each other and to the other elements that have been excised in service to monumental and antiquarian historical goals are the data from which we can divine the implications of history for present life. Monumental and antiquarian histories celebrate and cherish historical objects in order to provide examples of how on might live, or should live. Critical histories provide evidence of why one lives as one does and demonstrates the actual, as opposed to the hoped for, effects of history on life. Nietzsche compares monumental and antiquarian histories to mighty trees and, in fact, it would be difficult to

explain to someone how the mightiest of trees looks and lives, or to teach them how to care for and preserve such a tree, without having a record and narrative of the mightiest trees to point to. Similarly, it would be impossible to encourage the growth of new trees without an understanding of the compost and ecosystem that gave rise to such trees in the first place. Critical history provides this relational and vivisectional perspective as it recovers the parts of the forest that are obscured by the trees themselves.

In the case of both Kurzweil and Fukuyama, it is their assertion that a scientific examination and recording of history can yield objective truth with unshakeable power over life that Nietzsche would object to most strenuously. Both men conduct historical analyses in support of preconceived notions about the texture, shape, and utility of life. From this sculpture, they predict future outcomes but their predictions are sold as certainties unfolding from unstoppable historical chains of events, chains indeed. History, in the case of Fukuyama and Kurzweil, has ceased to serve life and instead seeks to constrain and drive it to fulfill visions or to preserve cherished forms. Nietzsche shows us how there is little to gain and much to fear from such histories and their utility to what I consider to be a contemporary continuation of Nietzsche's project of genealogy, technological assessment and anticipatory governance, is null, in fact they are detrimental

Conclusion

In this chapter, I have described a problem inherent in much of the scholarship being produced by science and technology scholars today. Their work, while valuable in many ways, remains theoretically uninformed beyond the informational and organizational theories drawn from sociology, psychology, and economics.

Contemporary democratic theory is also introduced in discussions about the democratization of science. The theories that would seem to be most relevant to science's place within the structure of modern western democracy seem to be largely absent from most STS and science policy scholarship. Machiavelli, Hobbes, Locke, Rousseau, Mill, and Marx are conspicuous for their absence from work related to a system that they helped to create through their theoretical and practical work.

Mark Brown's Science and Democracy is a forceful attempt to bring the work of the canonical political theorists into the discussion about how we manage science and technology in a democratic society. Brown begins with an analysis of Machiavelli and his use of ancient and medieval republican history in informing princes and republics of renaissance Italy on the best way to maintain power and thus stability. Machiavelli's political science was a purpose driven and practical exercise in the use of history to bolster political practice and structures for the benefit of the people. He has often been maligned as a cold realist only interested in power for its own sake but a closer reading of his work reveals that his true interest is in systematically bending power to the task of maintaining stability and prosperity through the power of the prince or the republic.

Machiavelli conceived of systems of princely and participatory rule as technologies for unifying and stabilizing the state. He advocated through his work for the adoption of such technologies and bolstered his advocacy through the systematic use of history. Machiavelli could, in this sense, be called the first political scientist. Hobbes, on the other hand, may rightfully be called the first political theorist. His work on the construction of political institutions to represent a newly constituted public was grounded

in more than just theoretical rumination. Motivated by a fear of instability deriving from the English Civil War Hobbes sought to bring to bear the tools of the developing modern scientific method and mathematics to a systematic review of the real relations between represented and representative. Brown methodically describes the congruence between Hobbes' conception of political representation—a general category congregated into a single entity that then authorizes a single representative—and the scientific understanding of representation in experimentation. This correspondence applies both to the way in which science chooses to represent the objects of its inquiry as well as to the way early scientists chose to represent—and thus co-opt—the public in its experimentation.

Liberal democratic theories like that of John Locke ultimately prevailed in creating modern systems of republican government that are on the surface premised by a more participatory one-to-one form of representation where each individual contracts directly with a representative in order to delegate the authority and tasks of governance. It was neither Locke's nor the constitutional framer's intention to create a robustly participatory system, both were leery of democracy and public participation and would prefer a model of government that more closely corresponded to those discussed by Hobbes and Machiavelli. Over the intervening centuries, history and public pressure have conspired to ameliorate the most robustly republican mechanisms incorporated into the constitution by the framers, like the indirect selection of both senators and the executive.

The significance for the current debate about the democratization of science is that the tension between democratic and republican versions of representation is matched

by similar tensions within science itself. Originally, science was conceived of and conducted as a gentleman's exercise on behalf of the public and in the public's interest. Much of the Royal Society's early work was of a practical nature in pursuit of solutions for societal problems rather than basic science and yet it was hardly a popular enterprise. In order to maintain a façade of inclusion the Royal Society created a method of doing public science that seemed to invite the public in while in actuality maintaining a safe and uncorrupting distance. A similar system was the intention of the constitutional framers in America and it is no coincidence. Democracy and modern science developed simultaneously and were co-productive of one another. The fundamentally utility of reintroducing Hobbes and Machiavelli to the discussion about democratizing science—for as Brown demonstrates they were instrumental in the original debate about the same subject—isn't to push science back toward more abstract forms of representation and deny purchase for popular participation in and governance of science. Rather, it is to demonstrate that just as the forms of representative government conceived of by Hobbes and Machiavelli were by no means democratic they did include robust mechanisms for popular participation in governance like plebian councils and public protest and demonstrations. Further, as Hobbes demonstrates politics is the framework within which all other social activities takes place and thus these systems of popular control apply equally to the social activities within politics as to politics to itself. In short, political theory demonstrates that science is already democratized and the work of making the institution more responsive to popular demands is at the margins rather than the core. The final arbiter of whether, how, and how much science is conducted in the public

interest remains the public itself. Political theory can serve to alleviate some of the urgency with which the project of democratization is viewed as well as providing some basic suggestions for reform, though I believe it is far less useful in the practical and immediate sense of developing strategies for reform than Brown appears to.

The second portion of this chapter is devoted to describing my theoretical method. I have chosen to use Nietzsche's genealogy in analyzing technology of cognitive enhancement as a demonstration of theories utility to the larger project of real-time technology assessment. Nietzsche argued that history ceases to be meaningful when it is no longer conducted in service to present social needs. He believed that scholarly or scientific history—which was dominant in his time and remains so in many areas of scholarship today though it may no longer be so with actual historians—served to confound practical attempts to further the excellence of humanity by overdeveloping the historical sense of individuals and society. It left them crushed under the weight of a seemingly inexorable past. His answer was genealogy: the systematic application of three types of history—monumental, antiquarian, and critical—in varying amounts depending on what was needed to construct historical analysis that were useful in producing new knowledge of present circumstances and problems. The combination of the systematic analysis of individual or event driven history, cultural or national history, and an overarching theoretical commitment to the principle that all history is open to just criticism in pursuit of solutions to present problems produced a method of history Nietzsche believed would free great men to pursue great deeds by fostering their unhistorical sensibility—i.e. the ability to forget about the crushing weight of the past—

while still imparting critical lessons gleaned from the analysis of the webs of relationships between historical artifacts. I am not concerned with freeing men to act so much as with freeing the discipline of STS to act by developing the method of genealogy as it relates to technology such that STS can finally shake of the weight of technology history. Such history seems to freeze many STS scholars by making it appear as if technological progress is, like history in general, inexorable.

In the next chapter, I review two contemporary works of Nietzschean genealogy by Stephen Gould and John Carson. They have taken to task the historical relations that have served to produce the contemporary concept of intelligence or IQ. The two works combined will demonstrate that general intelligence is a socially constructed abstraction rather than a concrete and empirically demonstrable thing in the head. They will also demonstrate how it came to be so, and it is this social history that will become useful in interpreting a public opinion data set on cognitive enhancement in Chapter III. Genealogy will allow us to step back from the various debates about intelligence ongoing in America. It will help us to understand the motives and ideologies underlying many of the scholars and ideologues that continue to pursue and purvey theories of general intelligence. It will pull us out from the seemingly crushing weight of the history of cognitive psychological history and allow us to create spaces for creative thinking about how best to manage cognitive enhancement technologies as a society.

Chapter II: The Misconstruction of Cognition

Introduction

The present state of US public opinion with regard to nano-enabled cognitive enhancement in particular—and cognitive enhancement technology in general—can best be described as schizophrenic. The actual data—from the Center for Nanotechnology in Society at ASU's 2008 National Nanotechnology Survey—will be analyzed in detail in the next chapter. For now, what is most important to note is that our data demonstrates that opposition to such technologies is broad and deep in generic terms but that it tends to vary by application. In this chapter, I will begin to examine two ways of narrating the historical relationship between social institutions and technology. Both are genealogical at their base—genealogical in the sense described in the previous chapter, deep critical historical case studies—but one focuses on individuals and the other on institutional arrangements. In doing so, I will examine two points which are critical to the ensuing discussion in the remainder of my dissertation. The first point is that I view technology as a hybrid type of social institution. In general, I think of social institutions as a type of technology developed to aid humans in the arbitrage—a perspective I support through the work of the canonical political theorists in the previous chapter—of their most common and contentious interactions. Further, this technology has been essential in humanity's proliferation as a species, although clearly the distribution and efficacy of this technology has been uneven at best.

Part I of the chapter describes the individual genealogy of "intelligence" through a close engagement with the work of Stephen Jay Gould. As will be shown in Part I the

significance of intelligence is its central role in the desire for and fear of the development of cognitive enhancements and its relationship with pervasive and powerful social proclivities that might lend themselves to negative social outcomes if allowed to remain implicit and considered irrelevant. Further, as my analysis of Gould's work will show, the desire for—and perhaps more surprisingly opposition to—cognitive enhancement is actually predicated upon a series of common misunderstandings and logical errors with regard to the nature and reality of intelligence. Within the zeitgeist and certain branches of science cognitive enhancement tends to refer to an increase in the overall ability to think, but the lesser known research science—as opposed to the more commonly referenced psychological, psychometric, and sociological research into intelligence—is considerably more incremental and recognizes the fictitious nature of the concept of a centralized, reified, and heritable intelligence (Gould 22). While Gould's work only marginally adheres to the historical method I am using in this dissertation, it does allow us to specifically examine the intersection of science and desire in a way that makes clear the ongoing relationship between the two, a relationship that I argue is fueling an unfortunate social dynamic with regard to cognitive enhancement and which is acting to prepare the public to accept these new technologies in ways which are less than optimal from the perspective of social justice or even economic efficiency.

Part II of the chapter engages with the work of John Carson and his institutional genealogical approach to recounting the history of "intelligence" as it developed more or less simultaneously in France and the United States. I have included an analysis of Carson's work for two reasons. First, he not only offers us access to a meticulously

assembled history of intelligence's development from a perspective distinct from, but sympathetic to, Gould's, but his work also serves as an excellent case study demonstrating the genealogical method I hope to employ with cognitive enhancement technologies. Second, in general I would be remiss if in analyzing the interplay of IQ and the desire for human enhancement if I did not include at least some engagement with Carson, as his work makes explicit the influence of publics and institutions on the development of a technology like IQ. Generally, we tend to see such development in terms of streetcars. I'm referring here to a theory in international relations—first articulated by Ned Lebow in *Contingency, Catalysts, and International System Change*—which argues that rather than institutions or structure being the driving forces behind political activity on the world stage, it is powerful individual actors or significant one-off events (591-593). Lebow refers to these as catalysts but more memorable is his analogy to streetcars (601). Further, this theory holds that there is an inexorable progressive force behind international relations and that if one charismatic actor doesn't come along eventually another will, i.e. if Archduke Ferdinand hadn't come along to instigate WWI some other individual and his circumstances would have (Lebow 594). This emphasis on an inevitable, interchangeable, and essentially individual force behind world events—another streetcar will always be coming along shortly to move you from point A to point B—is similar to the common understanding of technological progress in America. Progress is seen as inevitable and inevitably upward but also driven and shaped largely by individual genius. It will become clear that my own take on technological progress is a hybrid of the institutional and streetcar views demonstrated by Carson and Gould,

respectively.

I will conclude with an analysis of the significance of the genealogy of IQ to the discussion of cognitive enhancement. This will establish a theoretical and historical context with which to examine the national survey data offered in the next chapter. Further, it offers an opportunity to discuss a significant problem of logic and epistemology inherent in the scientific analysis and explication of humans, the development of technology for their alteration or improvement, and the sociopolitical discussions and actions that shape and are shaped by those technological and scientific developments. I will argue that absent what is likely a gross oversimplification of human cognition as represented by the unitary, biological, and heritable understanding of intelligence persistent in American culture today, the push to develop and use such enhancements would be greatly attenuated or radically altered by a change in both expert and lay expectations for and fears of enhancement technology. Much of the opposition to the same research would be radically reshaped and perhaps would assume a form more beneficial for successful governance of technological development. In essence, what I am arguing is that much of the research—and the demographically very specific open enthusiasm for enhancement—is a function of the belief that cognitive enhancement is both functionally possible and simple. The opposition to cognitive enhancement we discovered in our national survey and that has been prominently displayed in a variety of publications from Beyond Therapy—the final report from the President's Council on Bioethics headed by Leon Kass—to the techno pessimism of Bill Joy's Why The Future Doesn't Need Us is equally founded on the belief that intelligence is a single attribute that

is fundamental to the formation of identity and critical to socioeconomic success in a competitive environment. If we were to change this single element—the belief in a heritable general intelligence—then the debate about cognitive enhancement would change radically. Given the complexity of the historical development of IQ, I will argue that it is actually unlikely that we will change it in any way that is significant to the public, and thus I will focus on recommendations for policy and research.

The implicit understanding on the part of many—not all—researchers in psychology and other social sciences is that IQ is a fully fungible stock of ability within the brain and that enhancing any specific function will simply increase the total store of intelligence. The counter-argument—founded on the multiple intelligences championed by Howard Gardner but with its roots firmly anchored in the now anachronistic science of phrenology as Gould shows—often includes the belief that the development of various types of intelligence is a zero sum game. Enhancing one area of human cognition must exact a price among other areas of intelligence, so the argument often goes. This understanding does not dominate—either explicitly or implicitly—the research being conducted either in cognitive science or the various fields producing technologies with the potential to enhance cognitive abilities. If it did, I contend, the very idea of enhancement would be far more controversial at an R & D and policy level than it is at this time. It is important to distinguish between R & D focused on science and technologies with enhancement potential and scholarship focused more generally on the mind, humanity, and the implications of enhancement. I am arguing that the R & D is centered implicitly in the camp of multiple intelligences, while much of the scholarship

on this subject is driven by the theory of unitary intelligence or IQ.

The specificity of potential enhancement technologies is best observed through a few examples of the technologies being developed or already in use. Perhaps the most famous brain implant is the Brain Gate implant developed at Duke University to aid locked-in patients—patients with full awareness but absolutely no fine or gross motor function—interact with the physical and social worlds. The device links the motor cortex of the brain to a computer and interprets the neural signals generated when the user thinks about moving an arm or a cursor on a computer screen into action, either in a robot arm or on a computer monitor. A speech implant being developed by medical device start-up Neural Signals Inc. embeds a sensor in the brain of locked-in patients just above Broca's Area—long recognized as the language center of the brain—and translates neural signals generated when the patient attempts to pronounce a human phoneme into the corresponding sound through a computer speaker. The scientists at Neural Signals report being able to train their patients to pronounce all 39 human phonemes—the basic units of human speech—through a computer. Finally, in terms of implants, deep brain stimulation—which involves inserting electrodes into specific areas of the brain to deliver impulses that disrupt neural activity—has been shown to aid in controlling epilepsy and depression, both of which are believed to be conditions localized in certain regions of neural activity.

Similarly to deep brain stimulation, psychopharmaceuticals for treating depression, epilepsy, Attention-Deficit Hyperactivity Disorder (ADHD), and other mental disorders are localized in both their action and their intention. These drugs are designed

to address a specific function of the brain. In the case of antidepressants, the goal is to control emotion—particularly chronic sadness and hopelessness—through preventing serotonin reuptake in particular areas of the brain. ADHD drugs are, typically, stimulants that increase concentration and executive function, again acting primarily on the cortical regions of the brain. Epilepsy drugs target the temporal lobes of the brain in order to disrupt potentially fatal chains of misfiring neurons and prevent or ameliorate seizures.

Each of the devices and drugs described above is specific in its intended function and its locus of activity. They are designed to modify or repair a specific brain function by addressing a failure in a particular physical region of the brain. Further, each of these drugs and devices has enhancement potential, though just as with their therapeutic value it is specific to the faculty it was originally designed for, and the only real difference is the state of the patient. A more systematic review of the scientific literature on devices and drugs—those that are both implicitly and explicitly enhancement related—I believe, would reveal a persistent relationship between cognitive enhancement R & D and theories of multiple intelligences, which hold that intelligence is application specific, localized within the brain, and can tell us little about the general competitive capacity of the individual. It is true that some cognitively specific enhancement might produce a general and persistent socio-economic advantage, i.e. an implant that allowed you to communicate faster and continuously with Wall Street trading computers might confer a general advantage in economic competition, which could then be translated into political advantage, but that says more about our economic and political systems than it does about the technologies or the underlying political culture. In other words, the more

general advantages operate at a higher level of analysis than I am focused on here and higher than what would be implied by theories of general intelligence.

While enhancement certainly wouldn't be controversial for the same reasons as it is popularly—I'll review public opinion data in a subsequent chapter that demonstrates just how controversial enhancement remains among the public—if we were to change the public and scientific understanding of intelligence, then it would at least be equally controversial. Perhaps less intuitive, I will argue that if intelligence were understood to reside in various non-fungible, application-specific centers in the brain, then enhancement would actually become less controversial with the public, even as it became more so with researchers. I base this contention on the socio-political context in which Americans tend to encounter new technologies, one of supposedly free and fair competition. Choosing to trade excellence in one intellectual area in exchange for enhanced excellence in another would be far less controversial than the prospect of achieving an overall intellectual edge by increasing total intellectual capacity. This, I believe, should sound a strong cautionary note for anyone who is considering the long-term social and political implications of such technologies. I will conclude the chapter with a deeper discussion of the value of this case study—that of the historical and sociological composition of intelligence—to the broader discussion of human enhancement technology and to the specific case of cognitive enhancement.

The value of the case study contained in this chapter is two-fold. First, it is an opportunity to demonstrate the theoretical and epistemological depth that historically rich qualitative analyses can add to efforts at Real Time Technology Assessment (RTTA)

currently undertaken at the Center for Nanotechnology in Society and the Consortium for Science, Policy, and Outcomes (both at Arizona State University). I will treat in detail in the conclusion of the dissertation how such efforts have maximized other aspects of RTTA as defined by David Guston and Daniel Sarewitz in their seminal papers on the subject but leave for the future the historical and psychological comparative analyses (23-24). I believe that genealogy, as demonstrated here, can be one way to begin to fill in the historical and theoretical gaps extant in RTTA as it is being practiced today. I also believe that RTTA is the most promising method currently under development for establishing a regime of monitoring technological development and constructing timely and effective policy responses. Thus, my dissertation's primary value actually lies beyond theoretical and ethical evaluations of human enhancement technologies.

The second point of value is to supply through an examination of a very specific epistemological and logical problem inherent in discussions about cognitive enhancement a framework for evaluating human enhancement generally. It should also be noted that although I will only treat it superficially here, most scientific analyses of humans that stray beyond the confines of severely constrained biological perspectives could be subjected to the same type of critical analysis that I am performing here on human enhancement technology and its attendant scientific researches. I will argue that much of the hope for and fear of cognitive enhancement stems from our misapprehending the nature of human intelligence—this misapprehension being founded generally on well-meaning but misguided attempts to study the subject scientifically—and the tone and content of the national conversation about cognitive enhancement would change radically

if this common misunderstanding of intelligence were to change. Similarly, many of our fears and expectations of human enhancement technology stem from a common conception of human nature that we can generously say is based on scientific and cultural constructions which are far from logically or empirically rigorous. Just as variance in the seat and strength of intelligences radically changes the implications of cognitive enhancement for humanity and liberal democracy, the introduction of variability or scale to the concept of human nature changes the implications of human enhancement technology more broadly conceived.

Part I

In engaging with Stephen Gould's *The Mismeasure of Man*, I will begin to establish working definitions for both centralized and distributed intelligence in an effort to set the boundaries for my concluding discussion of the implications of these two definitions. Intelligence as a centralized, reified, heritable, unalterable, and variably distributed human trait occupies a central role in much of both popular and scholarly thinking on individual difference, equality, and performance in competitive environments. The various elements of the popular definition of intelligence above require a bit more explanation. In terms of the various logical errors in play with regard to intelligence—of which we will learn more in a moment—centralization is perhaps the most contentious. Researchers interested in mental testing or cognitive development can be asymmetrically divided into two groups. The first group—and by far the largest for a variety of reasons, which will become clear as I go on—holds to the definition popularized by Charles Spearman—creator of Spearman's g and the use of factor analysis

in analyzing the results of mental testing—that describes intelligence as a single entity within the head that acts as a sort of centralized bank filled with a more-or-less fungible mental ability we can draw upon for any of the wide variety of mental tasks we typically engage in on any given day (Gould 372-373). Alternatively, the second group of researchers is composed of adherents of the theory of multiple intelligences, the most prominent of which is Howard Gardener. This theory holds that intelligence is divided into various specialized groups—verbal, mathematical, spatial, etc.—and the "stuff" fueling these various intelligences is non-fungible; it cannot be spent across intellectual boundaries. Gould notes that this theory of intelligence corresponds more or less to two schools of neurological research, the long since debunked phrenology and contemporary cognitive, behavioral, and developmental neuroscience (22).

Phrenology held that various types of mental ability were localized under the different prominences on the skull and by measuring or "reading" these bumps, one could tell something about the underlying personality and mental ability of the subject. While this may seem preposterous from our modern perspective, it was the leading scientific discipline investigating intellectual ability through the eighteenth and early nineteenth centuries. It is tremendously significant that as a society we have moved from a theory of multiple intelligences fueling the leading neurological science of the Victorian era, through the rise of centralized intelligence as embodied by Spearman's g, and back into applied research focusing on multiple intellectual centers in the brain. It is significant to the pursuit of human enhancement technology insofar as the leading theories underlying applied research often shape the research agenda and constrain the types of technologies

considered feasible or useful to develop. Researchers focusing on mental testing and much of the public tend to conceive of intelligence in Spearman's centralized terms, but the researchers creating the technologies that may ultimately lead to practical enhancement appear to hold with Gardner and the Phrenologists in conceiving of intelligence as being distributed to various centers within the brain. A theoretical frame that does not correspond with the frame driving the applied research is fueling our expectations, desires, and fears.

Often intelligence and cognition—one a supposed measure of overall mental ability and the other a more functionally conceived attribute separate from, say, memory—are conflated and a measure like Spearman's g becomes a ready substitute for the ability to think. It is a part of American culture to assume that the categorization that follows the measurement of IQ is a function of clearly delineated analytical categories and coherent terms and principles. These assumptions are implicit in the commonplace way in which claims about IQ and stratification are made and accepted in popular culture and the scholarly literature (Herrnstein & Murray; Jensen 1969 and 1985; Pinker). To be sure, there are many who continue to challenge the contemporary conceptualization of IQ and its place within the culture and politics of the United States, but, as will become apparent, the concept is still fundamental in forming American attitudes toward enhancement, particularly the role of IQ in competition. This conclusion is supported by our national survey data, as will be demonstrated in the next chapter.

Intelligence is afforded a special place in American society because it responds to a culturally constituted desire for objective, empirical, and most of all biological

explanations in dealing with social problems (Gould; Carson). The rise of empirical psychology—which combined elements of physiology with European laboratory psychology and the continued influence of the American infatuation with various forms of craniometry to constitute the field of psychometrics—began as a function of the French institutional system of education and its desire to accurately channel the intellectually deficient into special schools and asylums where they could receive the practical training most suited to them and where they would not pose a threat to the education of the nation's best and brightest (Gould 222-225; Carson 113-136). Carson argues that it is one of the principal ironies of the rise of psychometrics in the United States that it was actually rejected in France in favor of the continued influence of panels of experts (113). It was psychometrics' concordance with certain extant American social desires and movements that lent it force in the U.S. that it never was able to muster in the more homogeneous French society (Gould 27-33).

The essence of Gould's analysis is that the current form of intelligence and its implications for society are firmly rooted in the personal politics and ideologies of the prominent figures in the recent history of American psychology and mental testing. A discussion of the form and veracity of intelligence cannot take place without reference to these figures, and this is one of the central problems with the most recent policy oriented piece of scholarship founded on IQ—Herrnstein and Murray's The Bell Curve—in that it takes for granted the authenticity and reality of IQ. It fails to acknowledge what Gould refers to as the soft social construction of the technology of intelligence and mental testing in an effort to more fully entrench the logical errors outlined above: reductionism,

reification, dichotomization, and hierarchy.

While society and many scholars continue to take for granted the centralized, reified, heritable, and hierarchical nature of intelligence, the direction of enhancement research and scholarship as well as the public discussion about this research will continue to be dysfunctional. I will discuss the dysfunctions flowing from this understanding of intelligence in the final section of this chapter in detail. In brief, the hard R & D currently under way—very little of which is explicitly oriented toward enhancement but much of which has enhancement potential—is predicated upon a theory of intelligence which localized mental process and potentials in different areas of the brain and has very little to say about any sort of overall mental ability. Conversely, the scholarship on mental testing, cognition, and enhancement takes as its foundation *The Bell Curve* version of intelligence. The result of this disjunction is that societal expectations—which appear to be fueled by psychological and sociological scholarship more than by familiarity with the actual research underway—do not accurately map onto the medical and technological research being conducted. The fear of the effects of cognitive enhancement—which I will review in the next chapter—is similarly founded on the theory of general intelligence. It is likely that if we could break the hold this definition of intelligence has on society and on significant portions of the academy, then the complexion of the discussion would change considerably as expectations and fears began to correspond more closely to the actual potential technologies under development. However, breaking this hold is significantly more difficult than it might appear upon reviewing only Gould's work. Repudiating the scientific and popular champions of

general intelligence is simply not enough, as much of its development and popular entrenchment is grounded in systemic and historical features of American society. These systemic features have been rigorously treated by John Carson, whose work we will review in the next section.

Part II

In John Carson's The Measure of Merit: Talents, Intelligence, and Inequality in the French and American Republics, 1750-1940 the long and sometimes sordid history of intelligence is told along with the history of the testing implements designed to measure it. The central argument in Carson's work is that the concept of centralized intelligence was quickly exported from the French to the American scientific establishment—Carson and Gould both note that the idea had already existed popularly in both places that and this tended to fuel the direction that researchers chose to go in examining intelligence—and then proceeded to mutate into something that was largely unrecognizable in France because of the very different social forces at play in America. The development of intelligence was simultaneous, but the character of the concept varied greatly based upon the underlying socio-political context in each country. This is in contrast to—or perhaps complements—Gould's position where the difference is driven by the politics and personality of the dominant researchers in the two countries, what I referred to previously as the "Streetcar" theory of technological development.

Carson describes the initial conditions in France that prompted Alfred Binet—among others—to begin looking into mental testing for education purposes. The French system of education depended upon a tiered system of schools. These schools became

progressively more difficult and acted to sort out the less promising students and ultimately funnel them back into industry and agriculture as the "brighter" students passed on to ever more rigorous levels of education. The social and economic fabric of France was—and largely still is—supported by this education system. The most promising graduates are groomed for government, civil service, science, and education, and institutionally the focus had been on using expertise to determine the students best equipped to enter these vital elements of a rigidly organized, top-down social and political structure.

In the late nineteenth and early twentieth centuries, the French government decided to attempt to alter the way in which this system of education operated. They were responding to two systemic problems perceived by both the public and the civil service. First, there was considerable popular fear of and expert frustration at the perceived negative influence of less-promising students on their peers. It was believed that such students were holding back their classmates through disruption and through the expenditure of limited classroom resources on dealing with their special needs. The second problem was one of bias and competence in the expert panels that had, up to this point, made the decisions about which students to advance and which needed remedial or special education. The government turned to scientists working in the burgeoning field of empirical psychology to provide them with a solution.

Alfred Binet—creator of what has become the modern IQ test—was asked to create a method of identifying struggling students so that they could be shifted to special schools and classrooms where they would receive instruction appropriate to what was

seen as their inevitably limited economic role and where they would cease to have a negative impact on their unimpaired classmates. Binet constructed a battery of basic tasks that were believed to measure a representative cross section of mental abilities, the results of which could be used to identify any deficiencies relative to a normative baseline established through applying the same tests to students who had been identified as normal or exceptional. Binet saw no value in the scores of "normal" students beyond establishing a baseline against which to measure the results of struggling children (Carson 140-141). He believed that the tests told us nothing about intrinsic mental ability and was only valuable in identifying students in need of additional instruction.

Binet's test was ultimately scrapped in France in favor of the continued use of expert panels, in part because of the entrenched interests of the expert communities that composed the panels and set the rules. However, in establishing a "normal" baseline measurement Binet—and his partner Theodore Simon—had created a tool with the potential to be applied to all students to establish general mental ability. Binet thought that this was preposterous, but his counterparts in the various fields of American psychology felt otherwise. The test was imported to America and in this different context began to morph into what we know today as a tool for measuring general intellectual ability. The structural differences that lead to this altered development were threefold: first, American society was far more heterogeneous than that in France and was rapidly acquiring ever greater diversity through a much higher rate of immigration; second, the systems of education and government in America were—at least in theory—more egalitarian and less rigidly structured than in France; finally, at the time the test was

imported American society was obsessed with discovering methods for biologically establishing racial difference and hierarchy in the wake of the civil war and the introduction of former slaves into the political and free economic community.

Gould acknowledges these forces but focuses his analysis on the individuals who acted to bring about the symbiosis of science and social proclivity. These actors were shaped by social structure and they in turn acted to shape and reinforce that same sociopolitical environment through the introduction of scientific validation of already extant beliefs about the inherent inferiority of immigrants, women, and blacks. In France, no such justification was required in part because such conflicts were limited in a homogeneous society and because the far more rigid sociopolitical context precluded the possibility of resource and power capture by "out" groups without a need for scientific proof that they were inferior. In short, mental testing as developed in France and refined in America met an existing social need in the states, and it is for this reason that it failed to die out as it did in France where it was not similarly necessary. Its persistence—coupled with the continuing power of those same sociopolitical structures that helped to shape it—can explain the continuing power of IQ in shaping the scientific and political agenda in America. It is also why I am skeptical of efforts to break the hold of IQ and instead will choose to focus on political and policy mechanisms that could serve to retard its influence.

Cognitive enhancement should occupy a significant place in any discussion about technology's impact on competition and equality. In analyzing the genealogy of the concept of intelligence in American society, Carson has demonstrated that its influence is

far more pervasive than simply giving impetus to certain lines of scientific inquiry. It motivates a variety of public policy initiatives, explicitly or implicitly. Stephen Gould rightly noted that it was no coincidence that the publication of Herrnstein and Murray's *The Bell Curve* coincided with the republican takeover of the House of Representatives in 1994 (31). The desire to curtail or redirect social spending is one of the societal events that tend to reinvigorate deterministic biological theories that enable policy makers to attribute socioeconomic disparities to unalterable biological differences.1 Lingering misconceptions about the ability to make group distinctions based on IQ shapes social attitudes with regard to the poor and to minority groups. As recently as the 1990's scholars have issued policy prescriptions for government intervention in minority communities based on group-level discrepancies in IQ, and this despite clear evidence that such distinctions lack logical or empirical support as demonstrated by Gould and Carson. Intelligence continues to wield significant moral and political force in the United States, and thus it is likely to shape the way we respond to and apportion cognitive enhancements.

Intelligence is significant in the context of enhancement and competition not

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[1] Arthur Jensen opened his 1969 paper on racial differences in IQ, How much can we boost IQ and scholastic achievement, with the line, "Compensatory education has been tried and it apparently has failed." Jensen is here being explicit about the ideological motivations behind his study and the policy implications he believes it carries. Common resources—primarily tax receipts—according to Jensen are wasted when they are spent on "compensatory" education because the racial differences in innate *IQ* negate any perceived benefit in providing an equal and quality education to all American children. The paper is a precursor to the 1994 Herrnstein and Murray publication, *The Bell Curve*, which was far more direct in discussing the folly of compensatory education and the need to channel young people in educations and careers that are appropriate to their innate and unalterable intellectual ability.

merely because Americans—largely—remain convinced of its reality, its unity, and its heritability. It is significant because of the way in which it has historically been bound up with pre-existing ideological predispositions. The desire to draw clear social boundaries between racial and ethnic groups—particularly blacks and whites—is certainly less evident today than it has been in the past, but it is far from absent. In the Senate the segregationist proclivities of certain southern members of the Senate is once again under scrutiny, an issue many Americans hoped had died with Strom Thurmond and retired with Trent Lott (Hulse 2009). This desire to separate and distinguish between groups has long been served by the scientific community in the United States beginning with mid-19th century psychologists turned craniometrists like Spearman, Simon, and Terman. Intelligence continues—however quietly—in service of such goals even today. Thus, in establishing policy with regard to cognitive enhancement we must beware of the undue influence of a concept like IQ.

It is easy enough to conceive of circumstances where the presumed inherited disparities in "native" intelligence were used not necessarily to justify the unequal distribution of cognitive enhancers but to justify their results. Unequal wealth distribution and access to the tools necessary for wealth creation—education and high-paying jobs—have been justified in recent history by scholars like Herrnstein and Murray on the basis of racial differences in heritable intelligence, and this logic could easily be extended to quietly underwrite the widening of such disparities through the use of cognitive enhancements (Herrnstein and Murray 1994). Alternatively, the same claims about racial differences could form the basis for government policies at various levels or,

more likely, a social stigma that encourages the use of these products in minority communities. A technological fix for a social problem—particularly when it is supported by centuries of dubious science catering to racist ideology—is very often a seductive proposition and cognitive enhancing drugs could be seen to play such a role.

Conclusion

What is cognition's role in competition within a liberal democratic context?2 In a society which is arranged as a meritocracy, and which holds cognition to be a marginally "fixed" internal attribute that is essential in determining one's ability to compete effectively, cognition assumes a far more central role in constructing hierarchies of power than is commonly acknowledged. It is far more common to hold that democratic institutions are designed to be blind to intellectual capacity and that neither rights nor the ability to equally and fairly participate in democratic governance are predicated upon what is commonly believed to be an innate characteristic. We could refer to this as the Bootstrap Doctrine. The commonly held cultural belief—particularly in the United States—that a desire to compete and better one's self is all that is really required to "pull oneself up by one's bootstraps". The myth of the self-made man is perhaps the most well known example of this trope.

Carson and Gould tell the same story in two different and equally significant

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[2] While there are similarities between competition in democratic societies and competition, in other socio-political contexts, the differences are profound enough to require a completely separate analysis and thus I will not be dealing with non-democratic societies. For the purposes of this paper, I will refer to competition generally but by that, I will mean the very specific circumstances of competition in western liberal democracies. Ideology is pervasive in the formation of institutions and the impact of classical liberal ideology on the formation western liberal democracies and market economies justifies a distinct analysis of the role of competition and technology.

ways. In relating the social history of IQ as a technology, they approached the subject from both the individual and the structural perspectives. Gould relates how intelligence developed in response to the desire for social control and scientific validation of extant racist tendencies on the part of a number of prominent scientists. Spearman, Goddard, Yerkes, and Burt each pursued the development and propagation of IQ as a way of lending the credibility and cache of empirical science to their preconceived notions about the inherent inferiority of immigrants, African Americans, and the socioeconomically disadvantaged. Further, they worked in service to a nation similarly committed. The zeal of any particular scientist notwithstanding, no scientific theory or the conclusions drawn from even the most meticulous data will take root if the social context is not already primed to some degree to accept it.

Post-bellum America from reconstruction onward was primed to look for biological justifications for the retrenchment of many of the social injustices the nation had ostensibly just fought a bloody civil war to end. African Americans were seeking some measure of the freedom and equality they had been promised during and immediately after the war. Conversely, white Americans were, on the one hand, suffering from something akin to buyers remorse and beginning to regret having created a whole new class of economic competitors and having destroyed a system that allowed them to maintain a safe distance from a people they considered wholly other. On the other hand, many Americans, particularly in the newly conquered southern states, had never accepted the prospect of African Americans being granted freedom, let alone equality. These two groups were thus seeking a basis for justifying the establishment of a system of legal and

quasi-legal institutions to replicate the effects of slavery without its explicit reestablishment. For many of the same reasons they were seeking to restrain the flow of immigrants into the country with these very same tools in addition to a variety of anti-immigration legislation.

Gould correctly notes that it was in fact the social and economic circumstances that served to reinvigorate an extant predilection to use science to classify and rank humanity. Carson's work allows us to understand the persistence of the technology created by the prominent psychometricians profiled by Gould. It is the structural elements of American society—particularly the way in which competition among social groups continues to be organized along racial and class lines, though this often goes unacknowledged in contemporary America—that maintain the popular perception of IQ as a centralized, inherent, real, and rankable thing in the head which can be used to segment society based on intrinsic ability without a need for vigorous government intervention. Essentially, IQ is psychology's contribution to the continuing myth of America as an open meritocracy. People are where they are because of a combination of drive and innate ability, and collective efforts to alter those socioeconomic strata are misguided at best.

What are the implications of this ongoing context for cognitive enhancement? Three elements combine to form the current context with respect to cognitive enhancement. The belief that America is an open society that rewards individuals in proportion to their merit, which is a combination of motivation and ability, is the first element. The second is the more factually accurate perception of America as a liberal

democracy predicated upon free and fair economic and political competition. Finally, we have the belief that IQ is not only a real thing, but that it is also central to the formation of identity and that it confers a tremendous benefit in the two principal areas of American competition, economics and education. These three elements serve to produce a bifurcated effect in public perception of cognitive enhancement. In private Americans would appear to be willing to consider seeking cognitive enhancement for the personal benefits that they would gain in competition with their peers. On the other hand, they fear the widespread but uneven introduction of such technologies because of the possibility that they will not be included in the "in group," those that receive the benefits of cognitive enhancement.

I am arguing that a change in the popular perception of intelligence, shifting it away from IQ and toward the theory of multiple intelligences, would radically alter public perception of cognitive enhancement. The public would not fear cognitive enhancement's effects on competition in the same way as they now do or to the same degree if they understood intelligence to be something that is not only distributed to various functional areas of the brain but also variably distributed among the populace, not in terms of greater overall quantities of mental ability but in terms of greater or lesser aptitudes in these same functional areas. In other words, if the public believed that they and their children possessed varying degrees of mental abilities in a variety of functional areas—e.g. some individuals with very high mathematical aptitude but low social intelligence and others with very high verbal intelligence but low spatial intelligence—and that an increase in one application-specific area of intelligence did not translate into

an overall increase in mental ability but to a very specific advantage in a segment of competition, then they would be more comfortable with the idea of cognitive enhancement. It would be possible for them to increase their child's artistic ability without negatively affecting their neighbor's ability to succeed as an engineer through unfairly skewing competition.

It is important to note that the changes I am hypothesizing would bring public expectations and concerns in line with the present state of science and research in the various fields of neuroscience. Contemporary neuroscience is focusing on examining and creating therapies for specific mental functions more-or-less discretely localized within the brain. It is likely that any enhancement technologies deriving from this research would be similarly specialized, i.e. enhancements focusing on memory, or increasing the speed of executive function, adapting verbal abilities, or changing perceptive abilities and processing. These technologies have very different implications for competition in liberal democracy than would a hypothetical technology designed to increase overall mental ability.

There would be other radical changes accompanying a shift away from general intelligence toward multiple intelligences. The use of standardized tests beyond primary and secondary schools would be problematized, as it became clear that they were measuring fiction and failing to capture more specific aptitudes which might be just as useful in determining success within discrete university programs. It would tend to push the American system toward a softer version of the French system of education and economic production. Individuals would be guided by information about their specific

aptitudes toward pursuing advanced education or vocational training suited to those aptitudes rather than being more generically sorted. It is possible to envision increases in overall economic productivity as citizens who were previously prevented from reaching their full potential by the overly general way in which we sorted students by mental ability gave way to a system that focused on helping students find the career that maximized use of their dominant mental abilities. The American system as it stands not only produces unfair socioeconomic advantages both through structural defects and the uneven distribution of extant cognitive enhancers like early childhood nutrition and excellent education, but also denies to some opportunities for higher education through a focus on general mental ability rather than specific aptitude.

Chapter III: 2008 National Nanotechnology Survey

Introduction

Beginning in July and running through October, 2008, the Center for Nanotechnology in Society at ASU, with funding from the National Science Foundation, conducted a national telephone survey soliciting the opinions of Americans about human enhancement, particularly cognitive enhancement. We completed 556 surveys with a response rate of 28 percent. The margin of error was plus or minus 4.1 percent overall. This was the first survey to gather nationally representative data on the public's positions relative to human enhancement, and while the responses tended to support our initial hypothesis that Americans would be somewhat leery of enhancement technologies and particularly leery of those involving the brain, there were a number of surprising results as well.

I am focusing here on a small subset of questions from the survey that tend to bear more directly than the rest on the hypotheses that I have drawn from the genealogy of intelligence in the previous chapter. Given the centrality of theories of general intelligence to the American zeitgeist and its role in helping to construct our rank orderings and systems of competition, I believe cognitive enhancement will be particularly difficult for Americans to cope with, but obviously not for the same reasons normally cited by the moral and ideological opponents of human enhancement like Francis Fukuyama and Leon Kass. Further, I believe that this situation would change dramatically if the popular understanding of intelligence were brought more fully into line with the theories underlying much of the actual R & D currently being conducted in

neuroscience. The public continues to hew to a general theory of intelligence, which sees cognition as a centralized bank of more-or-less fungible cognitive ability that is highly heritable within and across racial groups. In other words, intelligence is a singular thing in the head that is responsible for all of the various mental faculties that bear directly on an individual's identity and competitiveness in American society, and that it is an inherited trait that is resistant to environmental adjustment. Thus, it is useful for establishing rank orderings for individuals and groups.

The theories of general intelligence that are popularly dominant and dominant within many areas of the social sciences have little in common with the theories of distributed intelligence underlying much of the research in neuroscience. Distributed or multiple intelligences—championed by Howard Gardener—conceive of cognition as a system of stockpiles of functionally specific vouchers (as opposed to the fungible currency at play in general intelligence). The vouchers cannot be spent across categories, i.e. emotional intelligence cannot be transferred on demand to augment the stockpile of spatial intelligence. Theories of multiple intelligences tend to see cognitive abilities as being more susceptible to environmental influence and as something of a zero-sum game within the head. It is possible to augment a specific intelligence in a variety of ways, but it will always be at the expense of another intelligence if only because you must neglect the environmental enrichment of the losing intelligence in favor of the winner. The fact that multiple intelligences are seen as being a zero-sum game *within* the head changes the way they factor into competition *outside* the head.

Under a theory of general intelligence and within a highly competitive social

context where resources are scarce, my enhancement—which can be applied to any competitive area I choose—serves to tilt the field in my favor and works to the detriment of my opponents across the board. Further, even if enhancements—and this is already the case even absent some of the technologically advanced enhancements currently under development; e.g. think early childhood nutrition and education—are evenly distributed, those individuals and groups possessing a native intellectual advantage will still possess a relative advantage after enhancement, and in fact it is probably more realistic to argue that enhancement would be unevenly applied and serve to exacerbate the difference in native intelligence. In a sociotechnical context where intelligence is perceived to be immutable and central to identity and competitive advantage it is likely that the public would express strong opposition to any technology that may be seen as conferring a relative advantage to another group or individual, particularly a technology that is believed to be well beyond the financial means of the average American.

2008 National Nanotechnology Survey

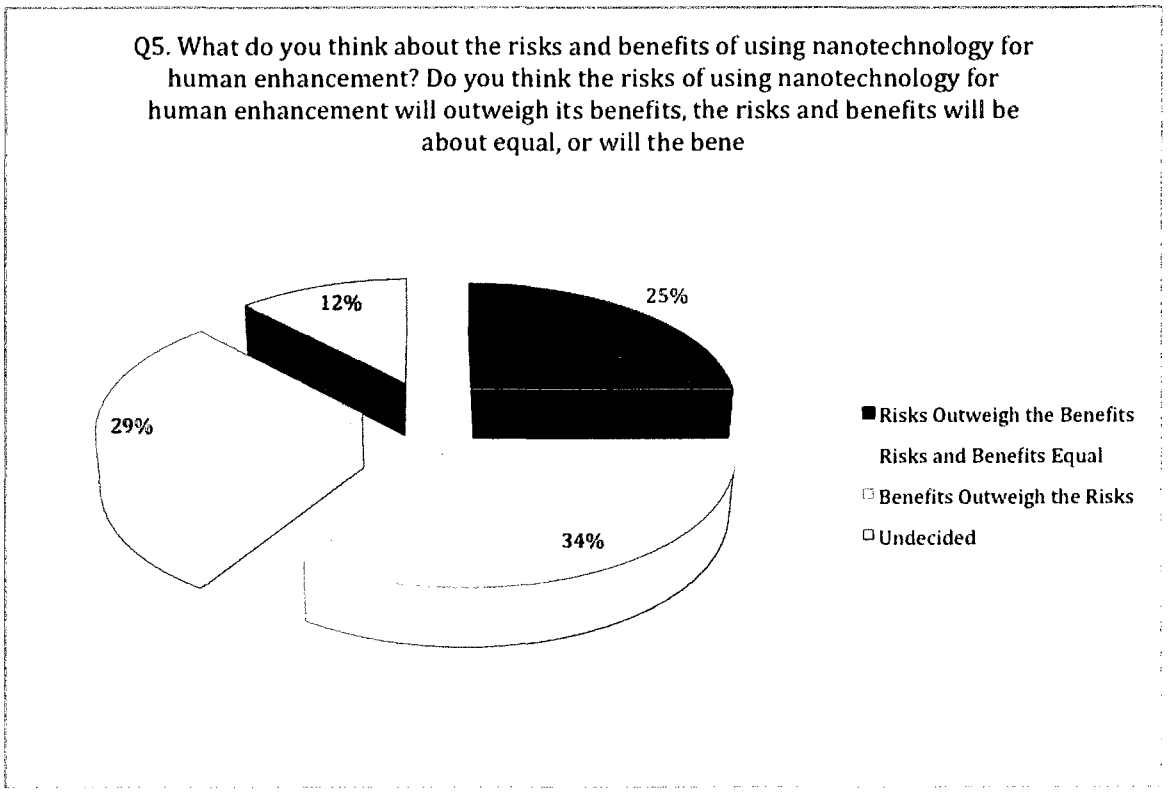

Figure 1

When asked how they believed the risk vs. benefit ratio of human enhancement technology would fall out, a plurality (34%) of respondents indicated that they thought the benefits would be equal to the risks. This is most likely a neutral answer, indicating a lack of confidence on the part of the respondent in properly weighting the costs and benefits. I would argue that this response could not be properly considered as either for or against enhancement in terms of cost-benefit analysis. Instead, it is an indicator of the low level of knowledge of either nanotechnology or human enhancement on the part of respondents. Perhaps more interesting, 29 % of respondents indicated that they believed

the benefits would outweigh the costs. These respondents are not likely to possess significantly more knowledge than the neutrals, but they certainly appear to exhibit a greater optimism about the outcome of technological development. This is one proposition that is testable within the data and is a part of my plan for a multivariate analysis in the future. A still substantial 24% of respondents indicated they believed the costs would outweigh the benefits. Again, we are probably not capturing a substantially more knowledgeable subset of the sample group here—demographic data gathered at the beginning of the survey indicated abysmally low levels of knowledge about nanotechnology and human enhancement across all demographics—but, rather, a subset with a more pessimistic perspective with respect to technology overall.

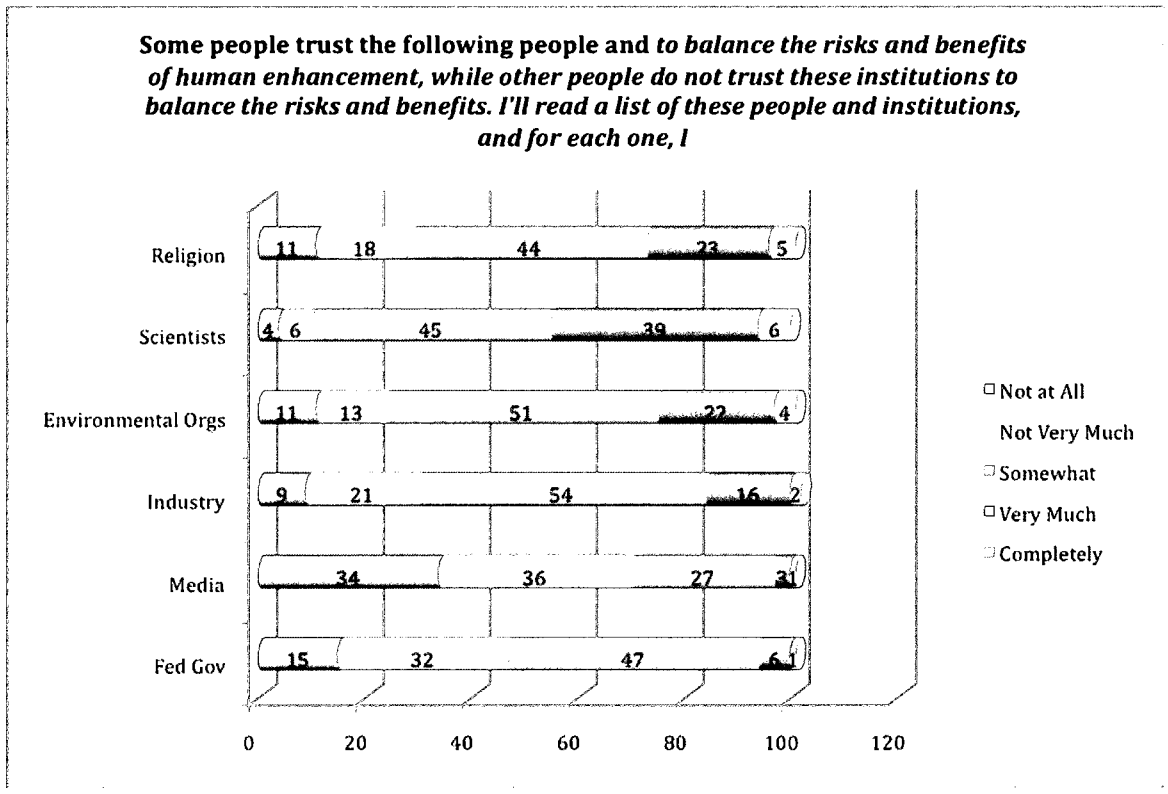

Figure 2

One of the goals of the survey was to ascertain which social institutions respondents were most likely to trust to balance the costs and benefits of human enhancement as they develop over time. As Mark Brown describes in his analysis of the evolution of laws and regulations seeking to balance representation on scientific advisory panels, there is some skepticism on the part of both the public and policy makers about the neutrality of experts. Given that skepticism, we would expect to see low trust in scientists, but we found just the opposite. Scientists, with 45% of respondents indicating that they trusted scientists Very Much or Completely to balance the costs and benefits of human enhancement, were the group most trusted to protect the public interest. They were followed closely by another interesting choice, given the prevailing skepticism about experts and interest groups: 26% of respondents indicated that they trusted environmental organization to balance costs and benefits. Industry scored fairly low at 18% suggesting that some of the energy with which the public and policy makers sought to balance expert advisory panels was driven more by anti-industry populism than by a distrust of experts overall. The media and the federal government were both in the single digits in terms of the public's willingness to trust either organization to balance the costs and benefits of human enhancement. Neither result was surprising.

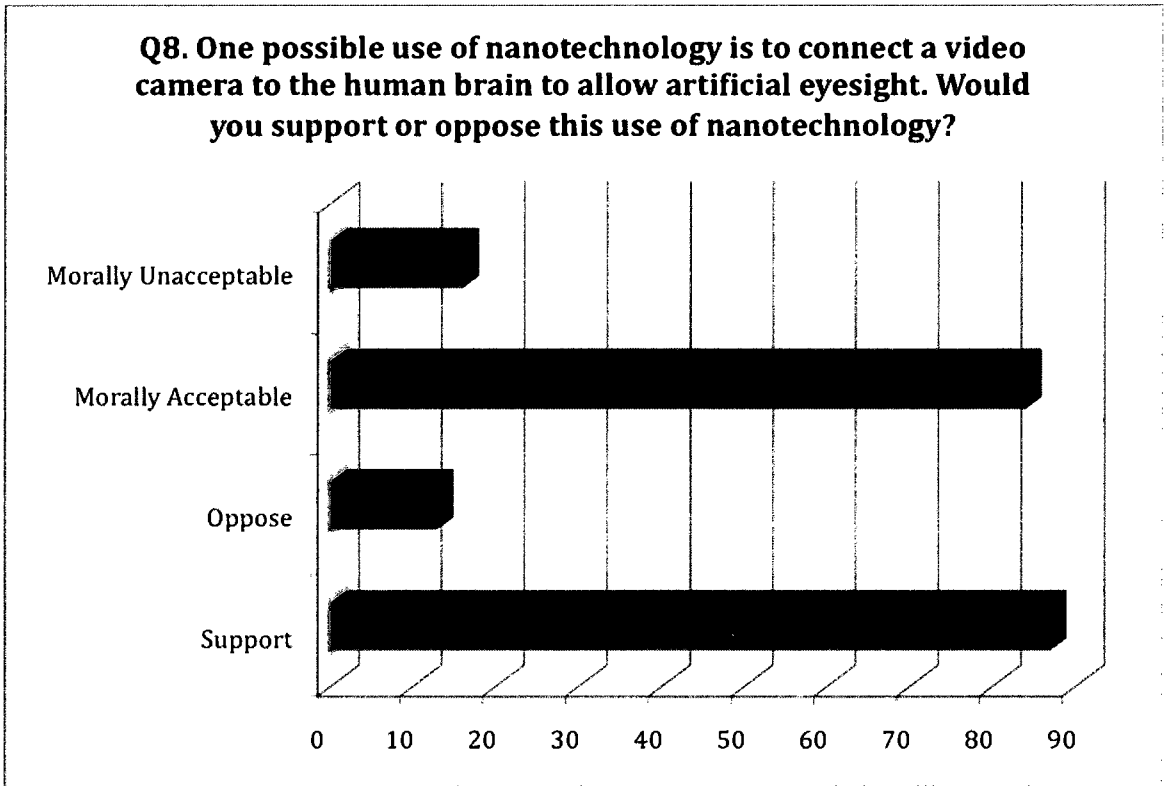

Figure 3

One hypothesis that we were attempting to test through the survey was the proposition that support for enhancement technologies would vary by application. We discovered that while support for generic brain enhancements was very low with most respondents indicating strong opposition to such technologies, when we asked specifically about brain implants designed to attach a camera to the brain in order to restore sight, we found overwhelming support for such an application at 85% with an equally high number of respondents indicating that such a technology was morally acceptable as well.

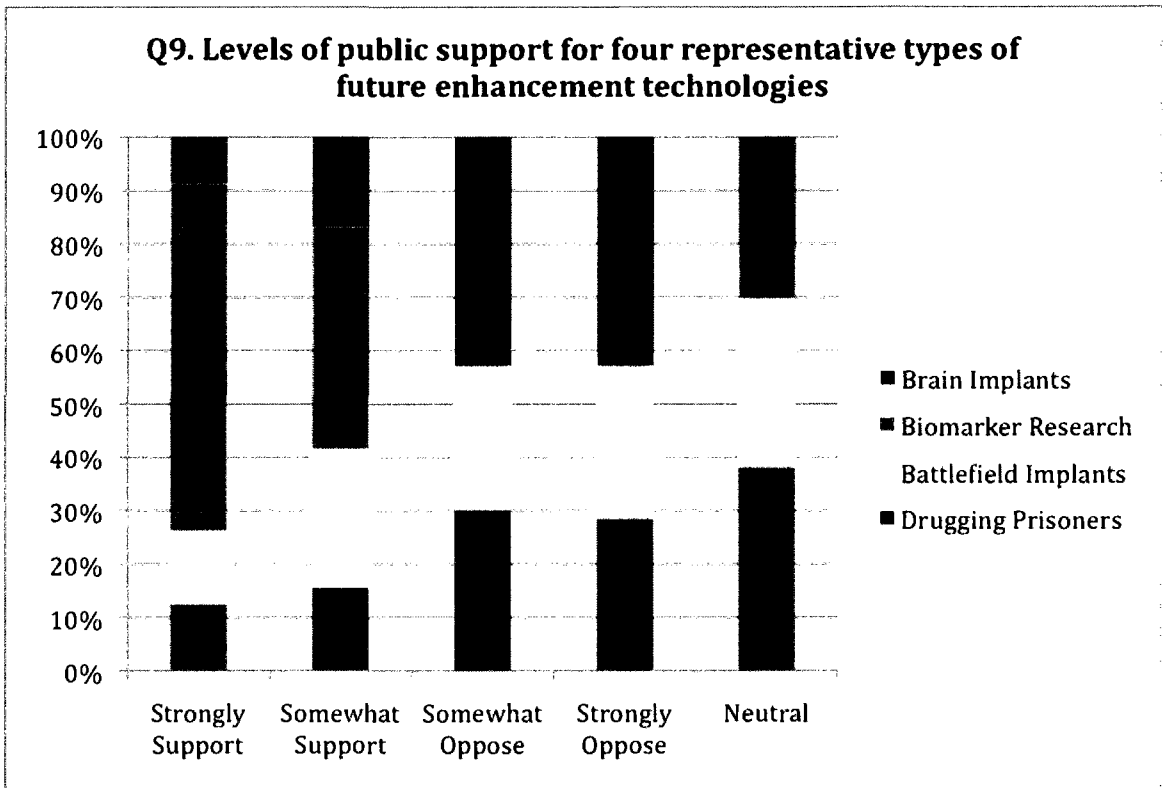

Figure 4

When we broke down support levels based on other applications, we discovered low support for anything that was not therapeutic in nature. Biomarker research—technology that could monitor biomarkers in the body in order to facilitate earlier disease detection—garnered 84% support from respondents, while battlefield implants for communications or sensory enhancement came in a distant third at 31% support. Using nanotechnology to implant devices into prisoners to administer drugs designed to increase institutional control was close to brain implants for communications and learning at 49% and 64% in opposition respectively.

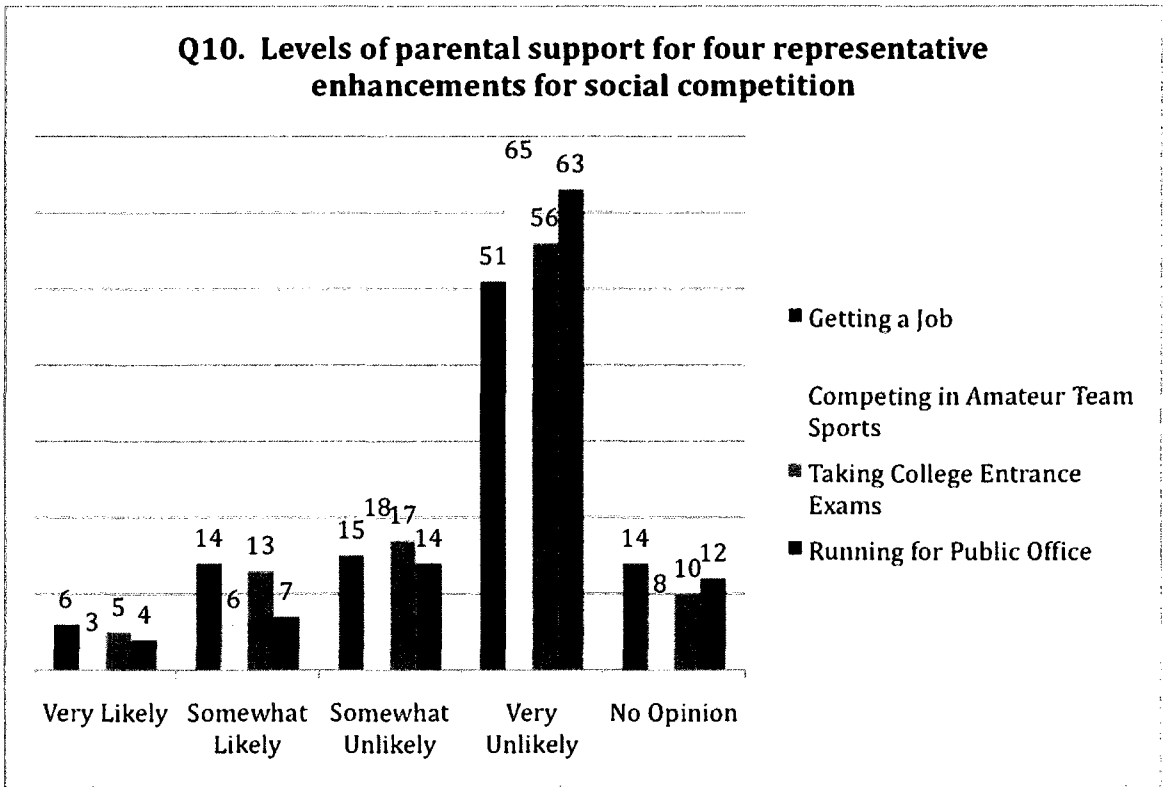

Figure 5

We next asked respondents to evaluate how likely they would be to support their children (real or hypothetical) in seeking cognitive enhancements for four categories of competition that I believe are representative of competition in the broader American political culture: economic, educational, non-economic social, and political. I believe that the competitive context in America breaks down into economic competition, educational competition, purely social competition, and political competition with overlap between the categories of varying degrees. In order to capture these four categories we asked about support for their children seeking enhancement in getting a job, taking college entrance exams, competing in amateur team sports, and running for

public office. Support was very low in each category with only 20% of respondents indicating they would be willing to support their child seeking enhancement in getting a job, 10% for competing in amateur sports, 18% in taking college entrance exams, and 11% in running for public office. We asked this question in three different forms, using subtly different wording in each to evaluate question effects. The numbers above are the overall frequencies for the three questions, and part of the future analysis of this question will involve running a regression analysis to sort out the effects of the question wording.

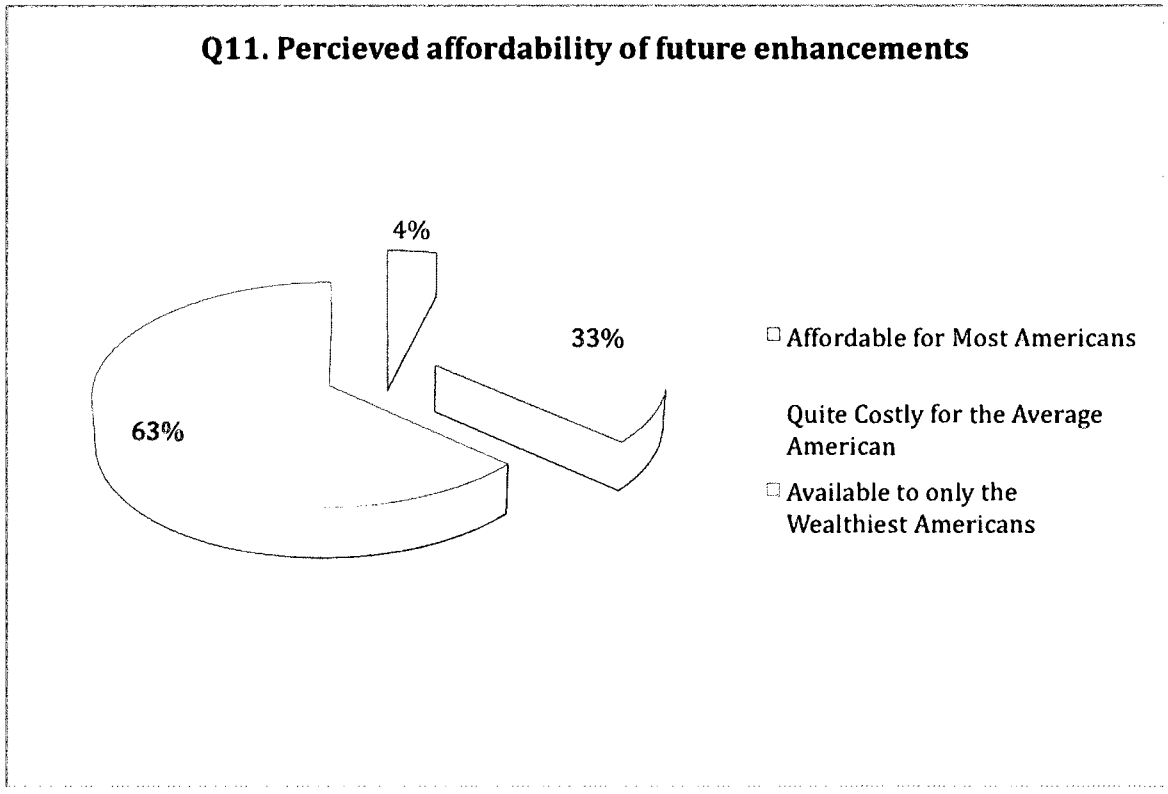

Figure 6

We next tried to evaluate the impact of the public's perception of the affordability of these technologies on their support for the development and deployment. Predictably, only 4% of Americans indicated that they believed enhancement technologies would be affordable for most people. Another 33% indicated that they believed such technologies would be quite costly for the average American, though, apparently, not entirely out of reach. The overwhelming majority (64%) believes these technologies will be available only to the wealthiest Americans. Our results indicate that Americans are fairly skeptical about the high costs of new technologies; however, when combined with their earlier optimism about the ratio of cost to benefits this indicates that they are as optimistic—perhaps overly optimistic—about the benefits that enhancement technologies will deliver as they are skeptical about how much it will cost, at least in monetary terms. This iteration of the survey was not able to capture the public's perceptions about non-monetary costs of such technologies, and this is one of the things that I believe we should correct in future iterations.

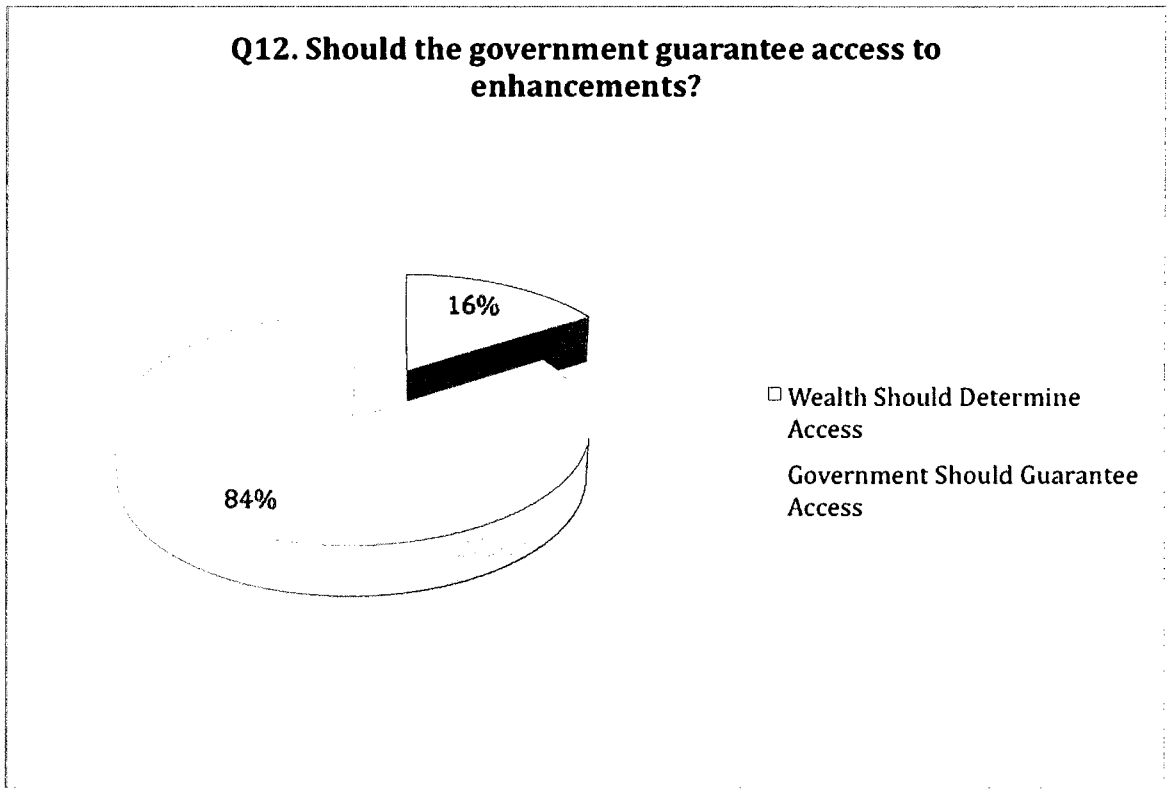

Figure 7

Despite their skepticism about the government's ability to balance costs versus benefits on their behalf, a supermajority (84%) of respondents indicated that they believed the government should guarantee access to these technologies. A still substantial percentage (16%) believes that wealth should be the sole determinant of who has access to enhancement technologies.

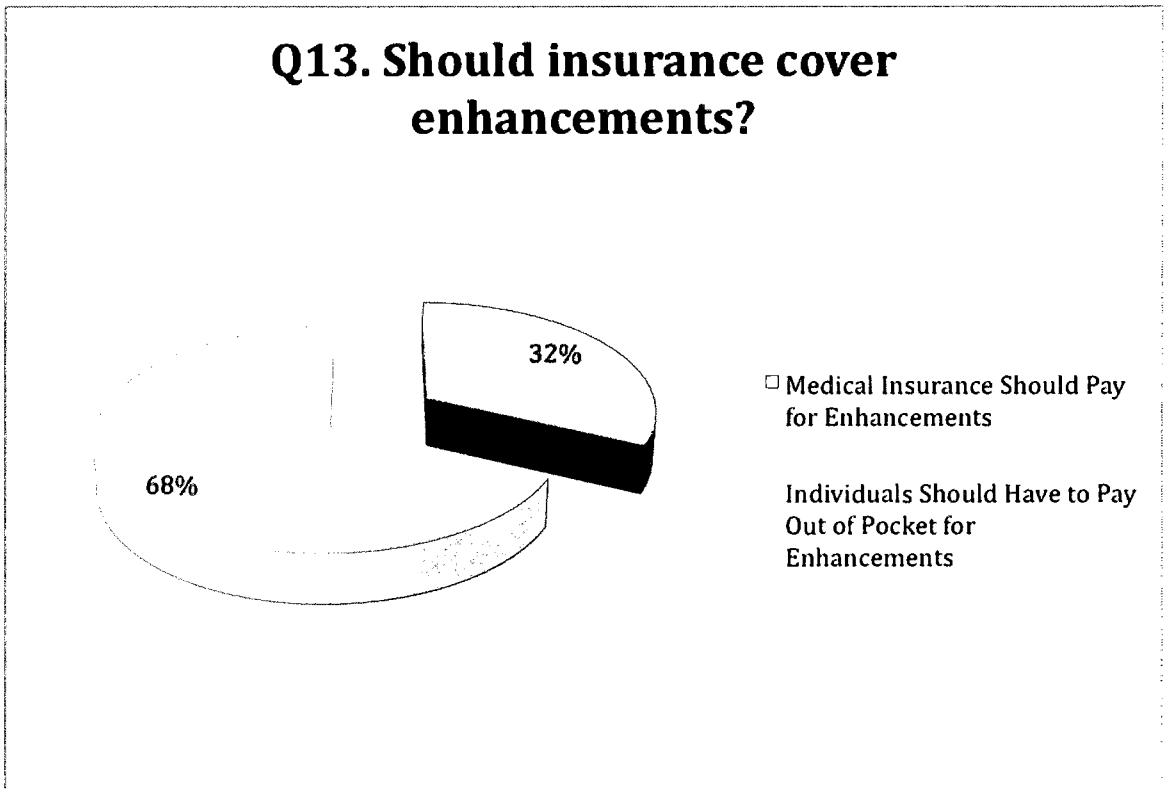

Figure 8

A majority of respondents (68%) indicated that they did not believe insurance should cover enhancement technologies, while only 32% indicated that insurance should cover such devices. Respondents could have been building on their earlier support for the government guaranteeing access to enhancement in this question, but we were unable to say definitively. The response to this question would seem to be at odds with both the perception of affordability and support for government guarantees.

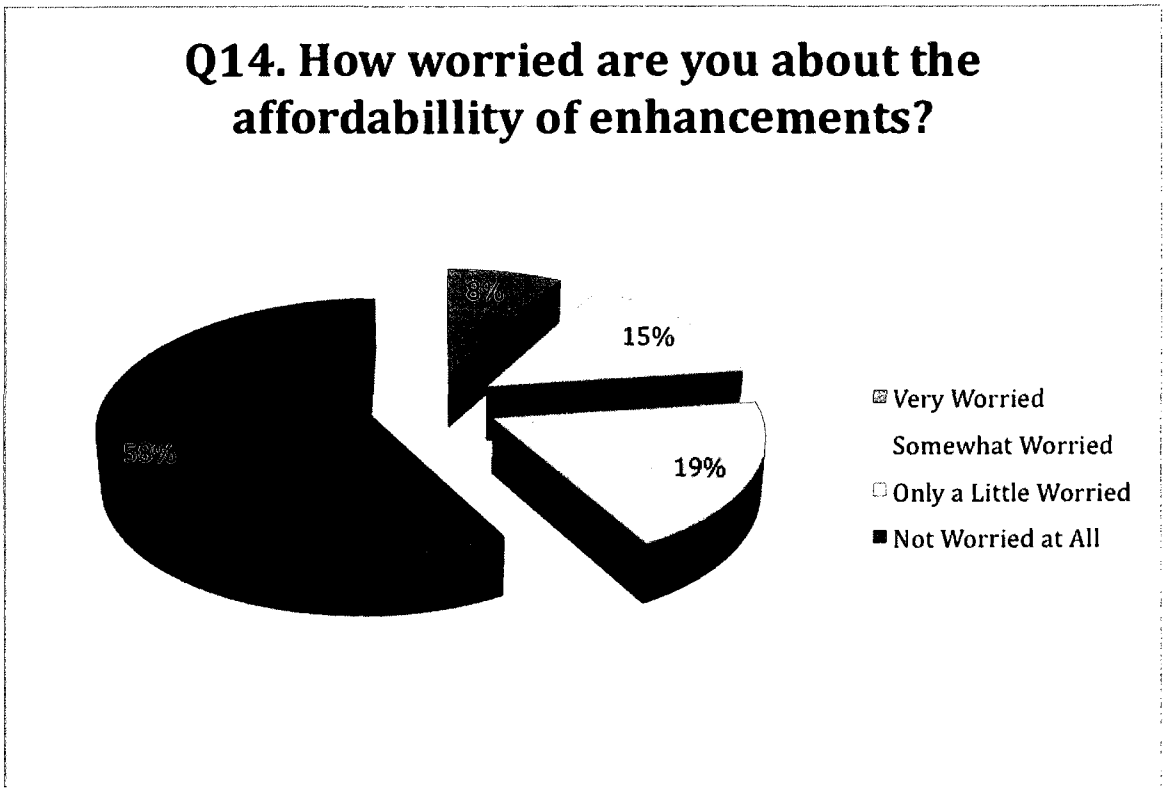

Figure 9

In asking whether our survey participants were worried about how affordable these technologies would be for their families we received another seemingly contradictory response. While 63% of respondents indicated above that they believed enhancement technologies would be affordable only for the wealthiest Americans and an even greater percentage indicated that the government should guarantee access to such technology, a baffling 58% of participants indicated they were not worried at all about whether these technologies would be affordable for their family. Our survey sample was representative in terms of income distribution, and so it is unlikely that these responses are dividing according to personal wealth. I would argue that there are two possible

explanations for this response. First, respondents may be overestimating their future earnings and ability to afford such technologies. Far more likely is that respondents are indicating with their answers here that they do not believe such technologies will be available in their lifetime or that of their children. Skepticism about timeline for developing such technologies is identified by Ray Kurzweil as one of the principal failings of scientists and other experts; of course, as I will demonstrate later that Mr. Kurzweil tends to err in the opposite direction but for similar reasons (11).

Narrative Overview

The way that citizens perceive the balance of risks and benefits of a technology is telling in several ways with reference to the overall social context. The fact that according to our survey data a strong majority of citizens perceives the benefits of human enhancement technology as being equal to or in excess of any associated risks indicates that despite the discomfort with specific applications, we found elsewhere in the survey that there is a willingness to compartmentalize the various ways in which risk can be analyzed with regard to human enhancement. Risk vs. benefit analysis is typically perceived in terms of financial or material risks and benefits, i.e. monetary or health risks. While it is impossible to determine what respondents were thinking when they calculated that the benefits would be equal to or greater than the risks, it is likely that they were not including social or political risks and benefits when they answered. This conclusion is supported by down-ballot answers supplied by these same respondents.

Respondents were not convinced of the equality of risks associated with various enhancements, and their support tended to divide along the lines of application (see

Figure 4). Support for biomarker research was high and support for battlefield implants was consistent but mediocre. In contrast, brain implants (a subject we'll come back to as support here was even more specific than in other areas) and prisoner control were consistently low. The risks and benefits in financial and material terms are equal in terms of the knowledge that we can assume respondents could apply to their decisions. This is not to say that the risks and benefits are in fact equal across categories of enhancement, but the prior knowledge that respondents could apply is equal given the extremely low number of respondents who indicated that they had any prior knowledge of nanotechnology or human enhancement. Given the low prior knowledge, we can assume that respondents are making distinctions here based on moral or ethical acceptability, decisions that would be driven by ideology or perceptions about fairness in social outcomes. In sum, we can assume from the data that while respondents are squeamish about the potential social or moral costs of enhancement technologies they are moderately upbeat about the financial or material costs or benefits that might accrue from such technologies. This opens the door to the possibility of an easing of opposition to robust human enhancement technologies in the future. The context in which these technologies are being developed is shaped largely by social—rather than economic—concerns.

Given that there are high levels of concern about some of the implications of human enhancement technologies, it is important to determine which organizations are perceived as being best equipped and motivated to protect the public against possible negative externalities. In some ways, the results displayed in Figure 2 are unsurprising.

The fact that the media are the least trusted organizations to protect the public is more-or-less in line with the practical perspective, which would indicate that the media has little actual ability to protect the public, but a greater ability to inform both the public and policy makers, who could then act in a capacity to protect public interests. It also lines up with the socio-political perspective, which indicates in polling data that the public has very little faith in the media to actually perform the function which they are believed to be best equipped to carry out. In a 2007 Pew Research Center poll 53% of respondents indicated that they believed news stories were often inaccurate, and an astonishing 39% described the news media as being damaging to democracy.

The federal government is perceived as being equally unable to balance the risks and benefits of human enhancement technologies in the public interest, with 47% of the public indicating little or no faith in the government to perform this function and a substantial percentage indicating that they trusted the government only somewhat in this respect and a mere 7% indicating positive levels of trust. Corporations were seen as somewhat more trustworthy than the government or the media, but the overwhelming majority of trust, 54%, was tepid at best, and only 18% indicated positive trust levels. The lack of public trust in the media, the government, and corporations to balance the risks and benefits attendant upon human enhancement technologies is most likely driven by three separate factors. The media are seen as incompetent and generally untrustworthy. The government suffers from the long-standing public perception that the government is incompetent and a poor solution to public problems. Corporations are seen as motivated by profit and as not being sufficiently incentivized to protect consumer

interests when balanced against the interests of shareholders.

In a country where the sociotechnical context has been substantially shaped by the work of experts as demonstrated in the previous chapter's review of the symbiotic relationship between social demands and research into a general theory of intelligence, it is unsurprising that scientists are perceived as being the group most likely to balance the costs and benefits of human enhancement technologies in the public interest. While it is in line with the hypothetical conclusions developed in the previous chapter, it was nonetheless remarkable to discover that 45% of Americans trust scientists somewhat or very much to balance the risks and benefits, while an equal number trust them at least somewhat. The persistent influence of experts in shaping the American sociotechnical context is both a blessing and a curse. It is a blessing in that at the very least the group most trusted to balance the risks and benefits of human enhancement is the group with the most direct control of research agendas and the search for beneficial outcomes. It is a curse in that experts in America have a checkered history with regard to wielding their influence in ways that are unconsciously motivated by ideology.

Interestingly, the other two groups viewed positively by the public in terms of its trust in their ability or willingness to balance risks against benefits in the public interest are environmental groups followed closely by religious leaders and institutions. The moral dimensions of the work of these two groups seems to resonate with Americans relative to the question of human enhancement. We found strong support for implanted enhancements when we asked about respondents' support for and their evaluation of the morality of implanting devices in the brains of blind people to restore their sight.

Respondents indicated that they approved overwhelmingly of such a technology (87%) and that they found such a device to be morally acceptable in large numbers (84%). Given that brain implants in general were perceived negatively (see Figure 4), we can glean from a data that respondents are making fine distinctions based on application—and these distinction tend to favor medical applications in all cases—and that they are willing to parse human enhancement technologies based on moral factors.

Americans appear to believe that this particular application is acceptable for three primary reasons. First, and generally, it is an explicitly medical application. Second, it is therapeutic or restorative in nature, despite the fact that it has rather obvious non-therapeutic or off-label uses. Third, despite directly affecting the brain, it is not perceived as being related to actual cognitive enhancement. It is seen as restoring a lost sensory faculty rather than enhancing or even restoring a cognitive ability like memory or executive function. When asked about using similar devices to enable brain-machine-interface—the direct connection of a human brain to a computer—an application that could serve as an indirect cognitive enhancement, support dropped dramatically. I conclude from this that the fourth factor in the deliberations—and the interviewer notes provide evidence that they did deliberate in a number of unexpected ways, another source of future research requiring a textual analysis of the quotes themselves in combination with focus group work to try and parse out the actual distinctions they were looking to make—of our respondents was the device's implications for the system of competition and rank ordering in American society predicated largely upon cognitive function.

When asked to compare the acceptability of four different enhancement

technologies that we believe to be broadly representative of the types of enhancements likely to be developed in the future, respondents again told us that they were sorting the enhancements principally on social factors rather than strictly economic or material concerns. The only application to draw broad support was biomarker research that was explained as an implant that could continuously monitor certain health characteristics of an individual and help with early disease detection. Such a devise drew considerable support, despite persistent concerns that it would be unequally distributed primarily based on personal wealth (see Figures 6,7, & 8). The support for such technologies is likely driven by the sense that in general technologies designed to improve individual and public health are morally acceptable and even desirable. In addition, we have some indications that the perceived likelihood of personal benefit from a particular technology increased the level of support it received.

The two varieties of cognitive enhancements that we asked about in this question—brain implants for communications and machine interface as well as battlefield implants—drew dismally low support for similar reasons. Respondents simply could not identify with the possibility or personal utility of such devices and were not willing to lend their support to such a radical technology if it were not geared toward a socially and morally acceptable end. Altruism—in this case a concern for the welfare of others given that respondents clearly had little hope to of ever needing or using such devices (also see figure 9)—is a significant driver in developing support for advanced technologies with potential for enhancement based on our research. However, altruism faces a serious obstacle in the way in which our sociotechnical context has been constructed around

competition and rank ordering of groups and individuals. The influence of theories of general intelligence militates against the success of using altruism as a wedge for developing space within the public to introduce enhancement.

In order to further parse the public's support for or opposition to enhancement within a competitive context we asked about the likelihood that parents—including prospective or hypothetical parents—would seek cognitive enhancements for their children within four different competitive contexts. We asked about the likelihood of allowing a child to seek enhancement for competition in getting a job, competing in amateur sports, taking college exams, and running for public office. I believe these four contexts generally capture the breadth of social competition in America and can give us some indication of under what specific competitive circumstances respondents would be willing to override their aversion to non-therapeutic cognitive enhancement.

Respondents were uniform in opposing such enhancements for their children; the most significant support was a mere 18% for seeking enhancement to increase competitiveness in seeking a job. However, the opposition did evince one notable trend in that Americans seemed to see employment and college exams as two competitive arenas where they might be willing to consider enhancements in the future. I mean to say that if we can eliminate what appear to be the primary motivations for supporting cognitive enhancement which are altruistic and personal medical benefits and consider only the competitive aspects of the sociotechnical context—aspects which are significant given the pedigree of the context as described in the previous chapter—then we can better explain why respondents were willing to separate out employment and education from

politics and more purely social forms of competition like athletics.

In breaking down the competitive context in America I divided it into four general competitive categories: economic, academic, non-economic social, and political. There is overlap between categories, and the social category is necessarily broad as it encompasses a variety of much smaller or less easily defined activities that are certainly competitive but not necessarily related to any of the other three competitive groupings. I have chosen to use athletics as a proxy for the other assorted activities that make up the non-economic social category. Athletic competition plays a central role in American society, and it is directly or indirectly related in many of the other competitive social activities that make up the category like romance or art. Gould and Carson demonstrated in the previous chapter that theories of general intelligence are central to how our competitive context is constructed. Hobbes claimed that politics provides a framework within which all other social activities take place, and the framework has an impact on the complexion of those activities. Liberal representative democracy—particularly the American first-past-the-post variety—is at its core a competitive activity, and it has colored the way in which other social activities taking place within its frame develop. In combination with the social and ideological motivation underlying the concept of intelligence—the desire for individual and group hierarchy within a competitive and resource scarce environment and entrenched racial antagonisms—the competitive frame of politics in American has shaped sociality into a distinctly competitive rather than cooperative environment. Competition is central to who we are as a people, and intelligence is central to competition in the American context. Thus, cognitive

enhancements should hold particular interest and pose particularly difficult problems for Americans.

In figure 10, it becomes apparent that our understanding of the social context in America is accurate. The intense aversion to cognitive enhancements with reference to the various forms of social competition in America—as compared to the acceptance seen with responses to other frames like therapy or to a lesser extent the battlefield—is indicative of the centrality of the concept of intelligence to both identity and competition in America or at least its perceived importance, though there may be little practical difference. On the other hand, the fact that respondents made fine distinctions based on the relative importance of the competitive category—expressing less opposition to cognitive enhancements in those competitive arenas which they experience as more personally relevant and more likely to be affected in their favor by enhancement—supports both the contention that Americans are beholden to theories of general intelligence, and that as moral objections abate the competitive environment shaped by intelligence could be crucial in directing outcomes with respect to cognitive enhancement.

In the previous chapter I described how social context would differ based on the popularity of theories of general and multiple intelligence. Under a theory of general intelligence, cognitive enhancement would assume an outsized level of importance due to the radical way in which IQ would be seen to impact identity and one's competitive prospects. If intelligence is immutable, heritable, centralized, and any increase in cognitive capacity would confer a benefit equally across competitive categories, then

respondents would see enhancement within the context of competition as particularly repulsive and that appears to be the case here. In contrast, under a theory of multiple intelligences the zero-sumness (to coin an awful turn of phrase) is transferred from the external competitive context into the individual's head. In seeking enhancement, individuals would only be able to increase one cognitive capacity at the relative expense of other unaffected categories. This increase would only impact discrete competitive arenas and would not so obviously threaten to reproduce the dreaded natural *aristoi* described by Hobbes and other early theorists. Similarly, a shift away from the dominance of theories of general intelligence would dramatically affect the importance of affordability in the minds of Americans. A supermajority of Americans believes that enhancements will only be available to the very wealthiest Americans; a mere four percent indicated that they thought such technologies would be affordable for average folks.

Concerned about the impact that existing income and wealth disparities would have on the distribution of enhancements, respondents expressed overwhelming support (84%) for government guarantees of access to enhancement technologies, though they did not think that insurance should have to pay for such technologies and that individuals should have to bear the cost (see Figure 8). This would seem to contradict the mandate for government guaranteed access, but in truth, they are complementary. Given the incomplete coverage of Americans under the present health insurance system and the fact that insurance is largely provided either as part of employment or through personal purchase, it would make sense for a majority of Americans to express reluctance to have

these technologies provided as part of health insurance. Those without coverage would be unable to afford the devices, and those with coverage could see dramatic cost increases in premiums due to the increased cost of providing these expensive new technologies (see Figure 6). It could be that what respondents are indicating is that the government should provide these technologies or no one should have access to them outside of those extremely rare individuals of great wealth.

Just as in the previous figures, our respondents seemed to express a contradictory view to their previous answers. Previously they had indicated that they believed these technologies would be incredibly expensive and that the government should guarantee access. Subsequently they indicated that insurance should not cover the new technologies, and here in figure 9 a supermajority indicates that they are not concerned about whether their family will be able to afford enhancements. I would argue that here respondents are simply indicating that they believe that it is unlikely that either the government or insurance will ever finance these devices, and thus the enhancements are so far outside their reach that they do not believe it will ever be an issue as to whether they can afford them; they simply can't. This would also contribute meaningfully to the reluctance of Americans to support cognitive enhancements in a competitive context, as they believe such devices would confer a tremendous advantage, but there is no hope they personally would ever be able to get them. Just as a shift away from theories of general intelligence would help to change this equation, the potential overhaul of the nation's healthcare system may have a serious impact on the way in which Americans perceive enhancement technologies. A shift toward a theory of multiple intelligences and

a change in the cost equations through the introduction of universal health care that could provide access to many of the therapeutic devices with the capacity to also be used as enhancements could change the sociotechnical context dramatically in favor of cognitive enhancements. The potential for such a change—which I believe is entirely within the realm of possibility—makes a critical historical perspective with respect to technological enhancement even more important.

Conclusion

The 2008 National Nanotechnology Survey conducted by the Center for Nanotechnology in Society with funding from the National Science Foundation has provided a wealth of data with which to test the hypotheses I drew from my historical analysis of the development of the technologies of intelligence and mental testing in the previous chapter. I concluded that the centrality of theories of general intelligence to the sociotechnical context in America, in combination with the competitive nature of social interactions in American society as described in Chapter II, would produce a context where cognitive enhancements would have an importance disproportionate to the actual state of their development or to their likely impact. I also predicted that a shift toward multiple intelligences would positively affect the acceptability of such technologies and bring public expectation in line with the state of the research currently being done, but that it would also dramatically increase the importance of the critical historical perspective developed by Nietzsche and its application to the broader history of technological enhancement.

The data indicates that Americans do generally see enhancement technologies as

an important issue. Further, they tend to judge them principally along moral and ethical lines, and such judgments support therapeutic technologies while condemning all other applications. Therapeutic technologies with the capacity to be used off-label for enhancement thus appear most likely to be the first to market and the first to receive broad public support. There is some evidence that this is already the case with psychopharmaceuticals. However, the data also indicate that Americans are willing to consider non-therapeutic enhancements and that they tend to judge these technologies principally with regard to their impact on social competition. Personal gain in the areas of economic and academic competition seems to have the potential to override the existing distrust of the impact enhancement technologies are perceived to have on social competition by our respondents. Changes in the economic and theoretical aspects of the context—i.e. a shift away from general intelligence and changes in the health care system—could serve to overcome American's reluctance relating to competition. Both changes are plausible, and while a shift toward theories of multiple intelligences would serve to bring public expectations in line with the actual research and development taking place in neuroscience, it would also dramatically increase the need for a critical history of enhancement technology to provide more topical and nuanced guidance to Americans as they decide how to incorporate these new technologies into the competitive sociotechnical context in which they operate. Such critical history along with further public opinion research to gain a finer resolution on some of the economic questions that seemed to be in conflict in our survey are sorely needed before we can construct a meaningful policy prescription with regard to cognitive enhancement.

Our demographic data indicate that our survey sample was representative across the standard categories of race, age, gender, religious identification, religiosity, socioeconomic status, and education. With 556 respondents and a 4.1% margin of error, we feel confident in being able to make some limited generalizations to the American public. Preliminary multivariate analysis has shown very little movement in levels of support for either specific applications or human enhancement in general based on any of our demographic categories indicating a broad consensus among respondents about the economic, practical, and moral virtues of human enhancement technology. There are three areas where more sophisticated analysis is called for in the current dataset and for a number of areas that can only be made clear through future survey iterations.

A multivariate analysis of the series of questions on affordability and distribution—Figures 6 through 9—could help resolve some of the contradiction apparent in the frequencies described above. Logically it cannot be the case that the same respondent believes that these technologies will be affordable only to the wealthiest Americans, will be available in their lifetime, desirable based on specific applications, and yet is unworried about affordability for their family. Two candidates for resolving this conflict would be socioeconomic status and religious affiliation where socioeconomic status could be driving an overestimation of respondents' future earnings or religious affiliation could be driving down concerns about individual affordability because the respondent would not seek such devices out of ideological concern.

Question 10—where we attempted to get some details on the relationship between human enhancement and competition in American political culture by asking about the

likelihood of respondents supporting their children seeking cognitive enhancement for four representative activities—requires further analysis along two lines. The first would be regression by socioeconomic and ideological indicators to determine whether the slight increase in support for economic and educational enhancement is being driven by market ideology or personal interest. Further, the three-question version requires a comparative analysis to determine not only if there were any possible question-effects, but also to establish the impact various examples of enhancement technologies have on support levels. In one question we offered examples of contemporary psychopharmaceuticals being used off-label, in another we cited several more advanced enhancements, and in the third, there were no examples at all.

In future iterations of the survey additional questions are needed to measure public knowledge in two categories. First, is the role of intelligence in forming American political culture; second, is to determine whether respondents believe that these technologies are likely in their lifetimes and what they are basing that belief on these would be useful in resolving some of the conflicting responses in the section on affordability and access. I believe that it will be the case that respondents are answering in the abstract when they rate these technologies as being incredibly expensive and when they support government guarantees of access. In later questions, however, when they indicate that insurance shouldn't cover them and that they are not worried about affordability for their family, we are recording more personal responses in so far as they don't believe they'll be likely in their lifetime and that the proto-enhancement technologies like the drugs referenced in question 10 shouldn't be covered by insurance

for enhancement purposes.

Finally, the examples of enhancement technologies used in the survey instrument were the product of an extensive review of the scientific literature by several researchers, including me. In addition to the literature a variety of scenario planning and visioning exercises were conducted with scientists and analysts to try to determine what the most likely enhancement technologies in the near future might be. The process for constructing the survey instrument suggests further uses for the historical method I am attempting to operationalize in this dissertation. The accurate mapping of both political culture in the broader sense and those aspects of it specific to sociotechnical context could prove useful in establishing the structure of future scenario planning exercises. In particular, it would be useful to pursue a fuller exploration of the relationship of general and multiple theories of intelligence in order to establish a method for destabilizing preconceived notions about intelligence among planning participants in the interest of focusing more accurately on the technologies actually being developed and their most likely social outcomes.

Chapter IV: The "linear fallacy"

Introduction

Stephen Gould and John Carson have shown that much of the science of mental testing and the underlying theories of general intelligence actually developed as direct correlates to a pervasive social tendency to attribute rights on the bases of cognitive capacity. A hierarchy of intellectual ability by group and individual was encoded in society and occasionally in the law. Justice Oliver Wendell Holmes Jr.'s now infamous opinion in *Buck v. Bell* read in part, "It is better for all the world, if instead of waiting to execute degenerate offspring for crime, or to let them starve for the imbecility, society can prevent those who are manifestly unfit from continuing their kind...three generations of imbeciles are enough" (Buck 1927). This was written in the majority opinion upholding a state law, which ordered the forced sterilization of a patient institutionalized for imbecility and is representative of other legislation and legal decisions designed to limit the rights of individuals on the basis of the combined influence of the prevailing social climate and its accompanying science of mental testing and theories of general intelligence.

This chapter argues that the unfortunate relationship between the technology of intelligence, social prejudice, and cognitive enhancement technology was—and is—facilitated by a deficit of critical history in the social science literature on human enhancement. Further, in some cases the lack of critical history has lead to the creation of a flawed syllogism. In the past three chapters I have demonstrated, first, the kind of critical history I am prescribing to understand the sociotechnical context in which

enhancement technologies are developing. Next, through the work of John Carson and Stephen Jay Gould I showed how the central concept of the context in question—intelligence—developed and what its relationship to American society has been over time and continues to be in many respects. The central message is that while intelligence and mental testing are no longer coupled to overt racism, their pedigree continues to queer the sociotechnical context in a way that disjoins public expectations from the actual R & D being conducted producing both skewed expectations and unwarranted fears while masking what are, in fact, the more legitimately worrying negative externalities associated with cognitive enhancement. In Chapter III I tested the hypotheses developed in the previous chapters using data gathered during the 2008 National Nanotechnology Survey and demonstrated that the sociotechnical context does conform to the expectations developed from the previous qualitative analysis. In this chapter, I will focus on the malformed logic at play in much of the scholarship on human enhancement.

I will first define the "linear fallacy" with reference to technology assessment. I believe the ""linear fallacy"" is far more common than can be demonstrated here, but in the interest of time and clarity, I will focus exclusively on its relationship to scholarship on technology. In explaining the nature of the "linear fallacy" further through the work of Stephen Gould on category mistakes, I can offer a brief glimpse of how such an unfortunate logical error functions in reference to other types of history. Gould examines category mistakes—of which, the "linear fallacy" is a subset—in reference to the tendency of psychometricians and evolutionary psychologists to infer group heredity of intelligence based on evidence in support of the individual heredity of intelligence. The

category mistake aspect of such comparisons—and I hope to make it clear in a moment that this is exactly what is happening in the historical analyses offered by Ray Kurzweil—is to infer support for one proposition where the data is far less certain and stable on the basis of evidence of the veracity of another proposition with a far better evidentiary foundation, i.e. there is considerable support for some amount of individual heredity involved in the formation of intelligence, but very little real evidence of any sort of genetically based group differences and it would be a category mistake to infer the reality of one on the basis of the other. Gould's most powerful treatment of category mistakes is his analysis of the work of Christopher Brown, a sixteenth century author who created an encyclopedia of canards and included a logical refutation of each. The example for category mistakes cited by Brown is the slander that "all Jews stink", which was common in the Europe through the middle ages and renaissance, and unfortunately remains popular in many parts of central Asia today.

Once I have established the nature of the "linear fallacy," I will engage with the works of Ray Kurzweil and Francis Fukuyama in an effort to demonstrate the presence of such a logical error in the scholarship on human enhancement. I will also show how the roots of this error, specifically in the case of human enhancement scholarship, can be found in the inappropriate historical methods employed by many, though not all, scholars analyzing human enhancement. In the first chapter of this dissertation, I attempted to operationalize Nietzsche's genealogy in service to technology assessment. In the subsequent chapters I have attempted to demonstrate what sound genealogical analysis of a salient aspect of political culture would look like, particularly the critical aspect of

genealogical history. In this chapter, through the work of Kurzweil and Fukuyama, I will show how monumental and antiquarian histories operate in isolation. Kurzweil's history is of an obviously monumental nature and the result is his Law of Accelerating Returns. Fukuyama, on the other hand, is an antiquarian and the history he provides tends to bolster the existence of a static human nature that must be defended from the advances of human enhancement technology. His analysis attempts to substitute a partial and ill-conceived history of human nature for the actual scientific research that could, and aught to, demonstrate the existence or non-existence of such a thing.

Finally, before I begin to define the "linear fallacy" I will explain my selection of Fukuyama and Kurzweil for analysis as scholars of human enhancement. It is easier to explain my selection of Fukuyama as his work is principally concerned with the political and regulatory questions deriving from human enhancement technology. Fukuyama functions somewhat differently from some of the other scholars attempting to tackle the issue of human enhancement in part because of his attempts to blend a partisan approach to human enhancement with actual scholarship, making him something of a public intellectual. Other authors in the human enhancement literature have attempted to tackle the political aspects of human enhancement, Michael Sandel and James Hughes are two excellent examples, but non have combined the thoroughness and broad reach of Fukuyama. He has managed to access a much more extensive audience than most other scholars working on human enhancement. Further, Fukuyama's narrative offers the most stark example of antiquarian history of any in the human enhancement literature, and thus he makes an excellent point of reference in examining what I believe is dysfunctional in

our attempts thus far to grapple with human enhancement from a political and social perspective.

It is more difficult to make the case that Kurzweil is a scholar, or that his work is scholarly. I would respond that one of the principal reasons Kurzweil's work is so valuable as an exemplar of human enhancement scholarship is the pervasiveness of both his historical model and his Law of Accelerating Returns. I will show in this chapter how even Fukuyama, who could not possibly disagree with Kurzweil more about the social and political ramifications of human enhancement technology, adopts Kurzweil's meme of an uncontrollable linear and accelerating technological progress, it provides the jeopardy for his investigation. Authors who do not adopt his law or his models still engage with them in their own work, typically in an effort to repudiate or supplant them from an ethical perspective. Just as with Fukuyama, Kurzweil's work is more widely read outside of scholarly circles than most, if not all, of the other scholars working on human enhancement. His prominence makes him a useful target for this investigation, and, again as with Fukuyama, Kurzweil provides the most accessible example of a monumental history and its implications.

Given the breadth of work on human enhancement technology, there is potential for further research to determine the exact extent to which monumental and antiquarian histories in general, and Kurzweil's logic in particular, have penetrated the field. A case study using genealogy to trace the precise origins of the three principal elements of Kurzweil's work: monumental history, uncontrollably accelerating progress, and technological optimism in the broader literature on the history of technology would likely

offer some explanation of how the scholarship on human enhancement came to be so thoroughly infused with them or embroiled in attempting to refute them. Further, it might be useful in attempting to determine if these are, indeed, the issues related to human enhancement we should be dealing with.

A Logical Error

In general, citizens of western liberal democracies continue to perceive technology's role in society through the lens of a flawed syllogism. Technology is believed to facilitate much broader and more equitable participation, and this militates toward fairness in both politics and economics. In American politics in particular, though this view has spread successfully throughout the west due in large part to American efforts, a dearth of regulatory interference in the operation of markets is still perceived as a good thing, or at least it was before the current recession. The Tea Party phenomenon and the attempts through the nineties to deregulate the financial markets, culminating in the repeal of the Glass-Steagall Act, are illustrative examples of the powerful role anti-regulatory sentiment plays in American political culture. The myth that unregulated economies produce more and better technology, which facilitates greater participation and ultimately results in fairer democratic systems, persists in large part because we continue to make the error of assuming an unbroken linearity in socio-political context, what I refer to as the "linear fallacy".

I am using the term fallacy in its most technical sense, rather than many of the more or less pejorative definitions more common to contemporary usage. I mean by fallacy a formal or material flaw in the logic of an argument that tends to render the

syllogism false or incomplete. In particular, I understand the "linear fallacy" to operate as follows: man has a history of interacting with technology x, technology y is similar to technology x in many ways, ergo the future of man's interaction with technology y can be predicted through a close examination of his history with technology x. Material logic is concerned primarily with the truth or falsity of the contents of a syllogism. In the case of the "linear fallacy," I will argue that it is the premises of the syllogism, which are largely false, or at least misunderstood, and that formally the logic in play has validity on its face.

The material premises of the ""linear fallacy"" are arguable in terms of their truth-value. In explaining what I mean I will use the example of a common syllogism in play in contemporary political parlance, viz. the movable type printing press and the Internet (Bimber 2003). The syllogism can be summarized as follows: the Gutenberg press had a profound impact on the political structures of Europe following its introduction in the fifteenth century, the Internet is very much like the movable type press in its ability to "democratize" information and make it more readily available to the masses, thus the internet will have—or is having depending on your degree of hyperbole—a similar impact on modern political systems. The first premise—that the printing press had a profound impact on the political structures of Europe—is nominally true. The ability to mass produce political pamphlets—and do so largely outside the control of the aristocracy—fundamentally changed the dynamics of message control in Europe and made it far more difficult to exert absolute top down control of the masses. It introduced a means for the merchant class to bypass the aristocracy in their attempts to indoctrinate

the public with ideas about new political forms and the rights necessary to them, i.e. democracy, property, and capitalism. However, the significance of the press is generally overplayed, particularly with reference to the aforementioned syllogism.

The myth that has developed around the press is that it almost single handedly took down the aristocracy in Europe. The impact of political pamphleteering and the mass printing of bibles in languages other than Latin did have a destabilizing effect on the extant systems of social and political control in Europe but a number of other significant forces played far greater roles, though they too were intimately bound up with the press. The development of the merchant class and the schism in the Catholic Church combined with the generally decrepit state of the aristocracy in Europe at the time were probably the prime movers in bringing about its eventual downfall. Granted, the press played a significant role facilitating Luther's revolution. Would these things have been possible without the press? Most likely the answer is yes and in any case the effect was neither as immediate nor as stunning as is commonly held today.

The next premise is that the Internet is much like the movable type press in its impact upon society. It is here that we first see the true effects of what I refer to as the ""linear fallacy"". This premise appears to be plausible on the surface but it is incomplete as far as it fails to account for the impact of the press itself. The implicit assumption here must be that society today is largely unchanged from the society that greeted the printing press in the fifteenth century. This cannot possibly be the case as is demonstrated in our discussion of the impact the press had on Europe. Even if its effects are largely overplayed, they nevertheless exist and interacted with a number of other

important social and economic upheavals to produce massive political change over the ensuing centuries. The Internet emerged into a context that was radically different from late medieval Europe, particularly with regard to political structure. Political power has devolved from the hands of two massive institutions—the church and the aristocracy—to a large number of much smaller socio-political actors. Political institutions themselves have changed to accommodate the different rate at which information penetrates and saturates society via mass media. The press itself was partially productive of the institutional changes that vitiate the second premise of the syllogism. It is, simply put, impossible for the Internet and the printing press to be very much alike in the ways in which they interact with man and his institutions.

The conclusion of the syllogism, that we can predict future outcomes of the interaction between man and the Internet—particularly with regard to socio-political institutions—as an extension of the materially flawed logic of the second premise, must also be false. The history of man's interaction with the movable type press can only tell us part of the story with regard to the Internet. A third premise is necessary to restore the syllogism's validity: man and his institutions are not static and the similarities between technology x and technology y are significant only in relation to the contextual changes wrought in part by technology x. In other words, the points of similarity between the printing press and the Internet are insignificant when compared to the points of difference. The institutional changes and the changes in man himself over the intervening centuries are profound and must be taken into account if we are to gain any useful knowledge from examining the history of man's relationship with the press and its

import for his continuing relationship with the Internet. What is most important to understand about the "linear fallacy" is not that the material premises are simply wrong and that the technologies are too dissimilar to make simple analytical comparisons. It is that the premises are flawed precisely because it is man who is dissimilar. If twenty first century man—and his institutions—were identical to fifteenth century man then the syllogism would be apt without adaptation.

While it is certainly the case that some technologies in the past have had a significant impact on society and have tended to increase participation or equity, it is equally true that the mark those technologies made impacts the creation and adoption of technology today. The human enhancement technologies related to cognition we are now beginning to face are a product of a system that was shaped by the "enhancing" technologies of the past and cannot be dealt with as being strictly analogous to those technologies. Our national survey data tends to indicate that the public grasps this even if technologists, researchers, and policy experts do not. The public seems intuitively to grasp that is possible to situate new enhancement technologies within the context of existing enhancements but that they cannot be compared directly to one another. It is insufficient to argue that cognitive enhancing drugs are no different from early childhood nutrition and that just as we were able to overcome inequities in the provision of vital foodstuffs without prohibiting access for those fortunate enough to be able to afford them we should similarly be able to overcome inequities in access through subsidized distribution of drugs or implantable devices. This ignores the cumulative advantages that already redound to the benefit of the socio-economically advantaged classes and the

increased relative advantage that will accrue because of having early access to these enhancing drugs.

If we go beyond problems of distribution and first-mover advantages, we find yet another problem stemming from the prevalence of the "linear fallacy". We tend to overlook the fact that past methods of enhancing cognition were developed in a different socio-political context. Efforts at improving cognition were developed by the patrician class and for the patrician class, and then programs were developed to allow marginal access to these improvements for the productive classes in an effort to improve output and reduce losses attributable to negative externalities of the unequal distribution of wealth (Rosenzweig 1985). The Social Progressive movement's early attempts to reform nutrition and education for the working class never had in mind the goal of equalizing the distribution of techniques for enhancing cognition, and they certainly weren't doing it out of fairness (Rosenzweig 1985). The goal stated often and overtly, was to arrange the lives of workers outside of the factory and plantation so that they could be more productive on behalf of the patricians, and no further.

The changed context of contemporary society, despite persistent inequalities in wealth and access, not only allows us to develop and distribute the enhancing technologies of today and of the future differently, but it also demands it. It is, simply put, impossible to utilize a top-down development and distribution model for these new technologies. The Social Progressives were too adept in their attempts to improve the lower classes, and, as a result, America, and many other western societies, has become far more participatory and more highly regulated than they were during the industrial

revolution. This is the lesson Monsanto learned to its chagrin, an effective strategy for engaging and informing the public—even going so far as partnering with them in product development—is essential to avoid the type of counterproductive backlash which met GMO's in Europe (Jasanoff 2005). Scientific and technological progress, whether the goal is human enhancement or something else, requires the acknowledgement that advances of the past have radically altered the context not only for producing a better more socially responsible product, but also for avoiding a sort of obstruction-at-all-costs political movement arising in reaction to an insensitive R & D and marketing program. Democratization of science and R & D does not necessarily need to be a goal; it is a functional reality—and a growing one—because of the socio-political impact of past scientific and technological developments alongside the process of coproduction with representative democracy I described in Chapter II.

Gould on Category Mistakes

The flawed syllogism at play in the literature on human enhancement is that there is a linear history of technological progress and that we can draw from this history precise lessons about how technology will develop and be incorporated in the future. Further, authors like Kurzweil and Fukuyama typically include a category mistake in their writing when they analogize from one type of technology—most often computers—to a much broader, more contentious, and far more complicated technologies like cognitive enhancement. A category mistake occurs in science when we infer support for one proposition based on evidence of the veracity of a separate proposition when the two share a seemingly important feature. Gould's initial example of such an error comes

from one of the common features of Down's syndrome. He writes, "Just because people with Down's syndrome tend to have quite short stature as a result of an extra twenty-first chromosome, we would not infer that short-statured people in the normal distribution of the bell curve owe their height to possession of an extra chromosome" (Gould 33). The two groups—people who occupy the short-statured area on the normal distribution of heights and people with Down's syndrome—share the common trait of short stature, but we cannot infer that the cause of the trait is always an extra chromosome simply because we have positively identified that as the cause for those with Down's syndrome. The characteristics of a subset cannot be universally applied to the larger group automatically.

Gould then goes on to describe how this type of mistake most commonly played out in the development of the technologies of intelligence and mental testing. He claims that category mistakes are "among the most common errors of human thought" (Gould 33). The category mistake essential to my analysis here is when scholars argue, "because IQ has a moderate heritability within groups, the causes for average difference between groups must be genetic" (Gould 33). Gould's concern is with the role that category mistakes play in fostering reductionism and biodeterminism. He argues that while most—if not all—scholars in the fields relevant to mental testing agree that individuals arise as a complex mixture of environment and genetics, the tendency toward category mistakes results in what he describes as "silly statements [such] as 'Intelligence is 60 percent genetic and 40 percent environmental'" (Gould 34). Statements like these reduce complex patterns of heritability within groups to blanket statements about the heritability of traits for the entire species. They foster biodeterminism by reinforcing the claim that

intelligence is substantially a permanent and heritable trait that can be used to establish rank ordering of groups within society. Such claims are not substantively different from the earlier claims of psychometricians—detailed by both Gould and Carson in their examinations of the subject—that intelligence could be used to establish a rank order by race without regard to social circumstance as Cyril Burt, Louis Agassiz, and Carl Brigham did in the 19th and early 20th centuries, when they each argued for strict limits on immigration on the basis of the intellectual inferiority of certain races and societies, principally eastern and southern Europe.

I am arguing that the "linear fallacy" is a variety of category mistake. When scholars construct linear histories of a specific technology and then use that as evidence of the sustainability of all technological development or even simply transpose that history onto another specific variety of technology, it is logically identical to the scholarship that applies the within-group heritability of intelligence to between-group heritability. An example of such a mistake can be found in Ray Kurzweil's *The Singularity is Near*. Kurzweil spends some time explaining Moore's law, which was the discovery by Gordon Moore, co-founder of Intel, in the 1970's that processor speeds tended to double every eighteen months. Kurzweil then goes on to explain how Moore's law constitutes an exponential growth curve where the early doubling of processor speeds produces very little absolute change in the functionality of computers and the line of the curve is relatively flat. Eventually the growth reaches what is known as the "knee of the curve," where it angles sharply upward, eventually assuming an almost vertical trajectory. This is analogous to the children's game of trying to fold a standard-sized sheet of paper

in half more than seven times. The initial folds are easy and produce very little in the way of additional thickness, but eventually the continuous doubling of layers produces a small stack of paper several hundred layers thick, and it becomes impossible to fold it any further. This hard limit is reached very quickly, as the number of layers explodes in only a few of the final folds. The processing speed of computers can be charted on such a graph and some time in the late nineties reaches the knee of the curve. Random Access Memory can be plotted on a similar curve and in just a few short years at the beginning of the twenty-first century went from standard thumb-drive sizes of 256 megabytes to ten-dollar thumb drives with 16 gigabytes of capacity. In the next section of this chapter, I will examine Kurzweil's monumental history and his category mistakes in detail.

Two Examples of Unsustainable Historical Modeling in Human Enhancement Scholarship

In this section, I will review the work of Raymond Kurzweil and Francis Fukuyama in light of this chapters focus on the "linear fallacy." I will demonstrate how the two principle interlocutors in the debate about human enhancement are employing the same faulty model of historical development to fuel disparate ideologically driven projects. Kurzweil and Fukuyama are each guilty of obscuring the complexity of the history of life on Earth in order to justify prediction about the future of technological change. They each employ their predictions to suggest a set of implications for future human institutions and argue for changes—or an absence and futility of change in Kurzweil's case—in policy and institutional structure in order to cope with a future they believe to be beyond certain in its likelihood. I will demonstrate how such modeling is

ultimately a function of a series of category mistakes that transpose limited, local histories of easily recorded technologies onto the larger and far more complex general history of life itself.

Francis Fukuyama begins his analysis of the political implications of human enhancement technology—specifically biotechnology—with the following caveat "The current volume does not deal with biological weapons, but the emergence of bioterrorism as a live threat points to the need, outlined in this book, for greater political control over the uses of science and technology" (viii). Here is the first indication that he does not differentiate between political and democratic control. In my engagement with Mark Brown, I demonstrated that one of the fundamental dysfunctions located in discussions about the democratization is the conflation of political with democratic processes. All democratic processes are political but the vast majority of political processes are not democratic.

Fukuyama is interested in greater democratic or popular control over science and technology. His rhetorical tactics include the occlusion of the already existing political nature of science and technology: "Human nature shapes and constrains the possible kinds of political regimes, so a technology powerful enough to reshape what we are will have possibly malign consequences for liberal democracy and the nature of politics itself" (7). The driving force behind Fukuyama's tendency to conflate politics and democracy is a misunderstanding about history and political culture. As Fukuyama notes above, he believes that human nature has shaped the pantheon of political systems available for organizing human activities. There are actually two problems cooperating to confound

Fukuyama here. The first is the belief that human nature has shaped the political space over time in a relationship that is unidirectional and definitive. The second is the contention that there is a stable and measurable thing called human nature. It is in defense of this second element that Fukuyama works to condense history and to obscure the web of historical relations necessary to the task of establishing the very concept of human nature and Fukuyama's faith in it.

If it is the case, that human nature shapes politics, and, as he acknowledges elsewhere, if much of what we consider human nature is culturally transmitted, then on what basis do we determine the nature of humanity in the present moment? Do we freeze it in the interest of preserving liberal democracy, or do we allow the changes incumbent on a continuously evolving human nature to play out? Fukuyama establishes his opponents as straw men easy to knock over by claiming that their principal response to the contention that human nature has value, is stable over time, and is worth preserving is to claim the following: "So who is to tell us that being human and having dignity means sticking with a set of emotional responses that are the accidental byproduct of our evolutionary history" (6)? He is taking the least sophisticated representatives of both science and human enhancement advocacy and establishing them as the standard bearers for a more malleable conceptualization of human nature. Ultimately, these two arguments are nearly identical in their implications for political culture; they simply place the locus of control in different hands.

Francis Fukuyama quotes Thomas Jefferson in the introduction to *Our Posthuman Future*—his analysis of the political implications of human enhancement technology—as

saying that "'the general spread of the light of science has already laid open to every view the palpable truth, that the mass of mankind has not been born with saddles on their backs, nor a favored few booted and spurred, ready to ride them legitimately, by the grace of god.' The political equality enshrined in the Declaration of Independence rests on the empirical fact of natural human equality" (9). The salient point for Fukuyama is that Jefferson is acknowledging the preeminent role of an absolutist understanding of human nature in constituting the American system of government. This is, as noted previously in this dissertation, not the same as saying that such a view of human nature is influential in constructing American political culture.

Implicit in the quote from Jefferson is a change in the perception of human nature. King George clearly did not accept the premise of Jefferson's argument and did, in fact, hold that some natures were created more equal than others. The exceptional nature of the king, imbued with divine right by God, was the foundation of George's power in England and in the colonies. Further, even a cursory examination of the political culture in America and the system of government that Jefferson helped to establish would belie Jefferson's quote. Enshrined in the Constitution of the United States is the contention that a substantial number of humans were individually a mere 3/5s of a man and thus not fit to enter into full political communion with the rest of society. In Chapter II, I reviewed in detail the cultural influences that produced the concept of intelligence and the technology of mental testing in the United States, and these influences certainly did not reflect the equanimity on display in Jefferson's quote.

What Jefferson's quote demonstrates is that despite any evidence supporting one

conceptualization of human nature or another, political culture and systems of government need not rely upon a stable understanding of human nature. The American political culture and system of government is clearly constructed on multiple and often competing understandings of what it is to be human, particularly a human in full possession of the civil and political rights enumerated in the Declaration of Independence and the Constitution. Fukuyama understands Jefferson to be not just declaring the death of alternative understandings of human nature but to be actualizing it with his words here and elsewhere. The basis for his judgment is his misperception of history as being linear and progressive.

Fukuyama not only understands history—including technological development—to be linear and progressive, but also to be accelerating. He is particularly concerned with biotechnology and claims that it requires an immediate response because of the possibility that it could alter the human nature upon which our political system is predicated. Fukuyama sums up the importance of his study, and in the desire to enact new regulations when he writes, "the broader debate [about the ethics of biotechnologies] is of course an important one, but events are moving so rapidly that we will soon need more practical guidance on how we can direct future developments so that technology remains man's servant rather than his master" (10). Here Fukuyama is implicitly adopting the Kurzweil meme, that technology's progress is accelerating exponentially and that we are approaching the knee of the curve. But rather than celebrate, he argues that such acceleration demands a more rapid and radical response than would normally be possible if we took the time to debate the ethics of biotechnology.

Fukuyama argues that technological development is not only linear and progressive, but it is also inexorable: "One of the biggest problems in making the case for regulating human biotechnology is that even if it were desirable to stop technological advance, it is impossible to do so" (11). While claiming here that stopping such progress is impossible, he claims also that it is possible to control it, though he does so in the context of lumping together those who argue for the impossibility of halting progress with those who argue it cannot effectively be controlled (11).

There are two salient points to make about Fukuyama's thinking from his argument here. The first is that he seems blind to the biological determinism in his own argument of a fixed and dominating human nature, while he criticizes proponents of enhancement technology for being deterministic in their claim that the development that such technologies cannot be controlled. The second is that the very fact of effective control of technology, which Fukuyama acknowledges, is indicative of the already political nature of science and technology. The threat Fukuyama wants to address is not to American political culture (which is not predicated upon a fixed human nature) but to American liberal democracy (which, after a civil war and a number of constitutional amendments, is).

Fukuyama's theory of history and his problem with biotechnology can be summarized as follows: thousands of years of philosophical dickering about the nature of humanity were resolved by the invention of liberal democracy. There was a titanic struggle for the soul of man between democracy and communism/totalitarianism. Democracy won and thus history—defined as the quest to force human nature to coalesce

into something more or less intelligible—was ended (Fukuyama 1993). The struggle now resumes because of a new existential threat to democracy from biotechnology. Thus, history restarts. Communism was a challenge to democracy because it perceived human nature differently, i.e. as infinitely malleable; biotechnology is a challenge on the same basis. Fukuyama uncritically accepts the Enlightenment trope of the rational nature of man and its transposition onto systems of government crafted that take it as a referent and even claims that the entire purpose of western philosophy was to "...differentiate the natural from the conventional, and to rationally order human goods" (13). An order predicated on nature is assumed here to be more rational than an order predicated upon convention, and the varieties of Marxist socialism against which the west struggled through much of the twentieth century were systems of convention. Fukuyama ultimately argues that western philosophy contrived to produce over the course of several thousand years the following conclusions about human nature: human nature is real and predictable; human nature is not a product of convention in any way; despite not being a product of convention, human nature can be challenged by convention and culturally evolved and transmitted memes. Fukuyama wants to add to this accumulation of knowledge by arguing that it can also be challenged by technology.

Right up front, Fukuyama reveals the weakness of his argument inherent in his bias: "Socrates and Plato initiated a dialogue about the nature of human nature that continued in the Western philosophical tradition right up to the early modern period, when liberal democracy was born" (13). What of the non-Western philosophical traditions that define human nature differently and are no less thoroughly debated or

philosophically sophisticated? Are the people in these cultures then faced with a choice: adopt democracy and abandon your perception of human nature or maintain your perception of human nature and suffer tyranny? I do not think Fukuyama would really foresee or commend such a choice, but it is the logical outcome of his reasoning.
If the truth of human nature is somehow coproductive of democracy, and modern science is capable of revealing this truth to a far more accurate and useful degree than western philosophy was capable of doing, then is it not reasonable to argue that if that same science reveals that human nature *is* plastic, then what can we conclude about democracy? If the nature of human nature is its plasticity and its malleability under the influence of technology but democracy is incapable of effectively and fairly ordering our lives given that nature, then why should we conclude that it is democracy, and not human nature, that should be preserved?

Fukuyama wants to argue that biotechnology is an unmitigated threat to his classically formulated notion of human nature, but he must admit that not all biology is bad in this respect: "Modern biology is finally giving some meaningful empirical content to the concept of human nature, just as the biotech revolution threatens to take the punch bowl away" (13). I would answer by asking, why would biotechnology not be another indication of the contours of the punch bowl? If it is true that modern biology is adding meaningful empirical content to the philosophically constructed understanding of human nature, what is it that would prompt us to stop short of accepting all of the ensuing

consequences?[3] In other words, modern biology is adding meaningful empirical content to our understanding of human nature and it is defining human natures contours by exploring what aspects of that nature can be challenged or changed. The fact that biotechnology may be capable of altering human nature is itself indicative of the nebulous contours of human nature.

Fukuyama goes on to argue, "the fact that there has been a stable human nature throughout human history has had very great political consequences" (13). He bases his contention that human nature has been stable throughout history on no meaningful historical evidence. In fact, a critical review of the evidence that he does cite indicates that human nature has been anything but stable either as a means of defining political culture or as a thing in itself. A critical examination of the historical web of relationships and technologies that have defined what we have retroactively come to understand as the western philosophical concept of "human nature" is precisely what is needed and exactly what he fails to provide.

Fukuyama then argues that history is the record of the failed attempt to overcome a static and intrinsic human nature through cultural technology. He writes, "Mankind's constant efforts at cultural self-modification are what lead to human history and to the progressive growth in the complexity and sophistication of human institutions over time" (13). Communism, according to Fukuyama, was one such effort to overcome human nature through social institutions, but it failed because "human behavior is plastic and

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[3] Note that this is something of a tautology as modern biology is itself a product of that same Western philosophy and thus it should be totally unsurprising that many biologists are endeavoring to interpret their work in the context of that philosophy and its perception of human nature.

variable, it is not infinitely so; at a certain point deeply rooted natural instincts and patterns of behavior reassert themselves to undermine the social engineer's best-laid plans" (14). Now, he argues, history is the record of an attempt to challenge human nature through biotechnology, and the only way to make that attempt fail is through swift regulation. Given his firm belief that at some point natural instincts will take over to thwart any threats to human nature, why swift regulation is now necessary is less than clear. The important question Fukuyama never attempts to answer as he simply assumes the reality and fixity of human nature is what if science proves otherwise. What do we do with democracy if it turns out that these deeply rooted patterns of behavior and natural instincts are actually tenacious cultural attributes, and that human nature is infinitely malleable? This is just as plausible and just as supported by the evidence in both history and science.

Fukuyama makes clear his equation of communism and fascism with the extremism he perceives in biotechnology (14). Liberal democracy creates rules according to justice and need but does not interfere with human nature. It does not reshape so much as it restrains. This is the classic conservative response to any attempt to deny or reshape human nature. He argues that in addition to human nature there have been other important factors "affecting the trajectory of history", one of which is "the development of science and technology, which is what determines the horizon of economic production possibilities and therefore a great deal of society's structural characteristics" (14-15). It is here that Fukuyama provides the most direct evidence that he is employing the "linear fallacy" in constructing his history. The assumption that

history has a trajectory and a velocity assumes a lack of agency and a simplicity to sociotechnical relationships that is belied by the historical record. However, the complexity of the historical record of technological development—as we saw with the history of intelligence testing—would make it exceedingly difficult to argue that there is a progressive trajectory of history in service to a static human nature. Can we call a stochastic increase in complexity progress? Is the desire to maintain the illusion of progressing from something toward something ideological?

Fukuyama refines his argument to a discussion of biotechnology and the brain: "Biotechnology and a greater scientific understanding of the human brain promise to have extremely significant political ramifications. Together, they reopen possibilities for social engineering on which societies, with their twentieth century technologies, had given up" (15). He is assuming a division between society and science without having first demonstrated it. If, instead, we assume that science acts within a space of politics alongside all of the other collective institutions and activities we associate with society then it would be more accurate to say that societies had not given up on social engineering. Instead, societies have switched from governmental methods to scientific methods. If they had given up, then why is science continuing to produce the necessary data to reinvigorate them? He is assuming that science has its own trajectory and velocity quite outside the control of politics. The urgency of the situation would be greatly attenuated if we were to acknowledge the already political nature of science and the complexity of the historical co-production of science and political culture. Linearity is seen here to be on the side of ideology and hyperbole when Fukuyama writes

"If wealthy parents suddenly have open to them the opportunity to increase the intelligence of their children as well as that of all their subsequent descendents, then we have the makings not just of a moral dilemma but of a full-scale class war" (16). In chapter III of this dissertation, we saw that the public tends to disagree with Fukuyama and that; strong cultural inclinations toward fairness in competition will work to retard the adoption of such technologies and could mitigate the social damage they might cause. Rather than provide any evidence of the innate and unconquerable American desire to technologically modify their children for competition's sake, Fukuyama returns to the meme of accelerating technological progress: "The advance of technology is so rapid we need to move quickly to much more concrete analysis of what kinds of institutions will be required to deal with it" (17).

Fukuyama and I are in partial agreement on the need for much more concrete analysis as to which institutions will be required to deal with any negative externalities that might attend the introduction of cognitive enhancement technologies. However, we diverge in how we make the case for such analysis or, apparently, in how we would carry it out. I believe that a deep and critical historical review is in order to establish the contours of sociotechnical context. Fukuyama would preclude any such review through his assumption of Kurzweil's linear model. He is accepting here the contention of Kurzweil that technological progress is accelerating exponentially; he simply reached a different conclusion from Kurzweil. I am not sure whether technological progress—such as it is—is accelerating, or whether it can even be said to have a velocity, and I do not know how such a claim could be sufficiently validated. Kurzweil's analysis certainly

seems inadequate, but Fukuyama does not believe so. I agree with Fukuyama, however, that more concrete analysis of the institutional relationships relating to technology is necessary, though I don't know yet whether it can be, or should be, expected to yield policy recommendations.

In considering how to respond to biotechnology through political policy Fukuyama asks, "What new possibilities will exist for modifying or controlling human behavior on a macro level, and in particular, how likely is it that we might someday be able to consciously modify human nature" (18)? If you accept Kurzweil's theory of exponential increase in complexity over time, and Fukuyama clearly does, there is simply no way to answer this question. The relationship between technology and political culture continuously alters the calculus about its own implications. The point at which we become technically capable of effecting the changes that Fukuyama fears may very well be the point at which political culture obviates the need for such change. Fukuyama poses just such a hypothetical with regard to homosexuality in *Our Posthuman Future* (40). He asks what might happen if we achieve the technical capacity to reduce the incidence of homosexuality at birth in a sociotechnical context which has become entirely accepting of homosexuality. Astonishingly, he claims that there would still be a rush to reassign sexual orientation because of the natural urge to produce descendents, an urge that is frustrated by homosexuality according to his analysis. Yet just pages before he acknowledged that if there is a basis for homosexuality that is genetic and a product of evolution, then it likely exists because it produces some advantage in reproduction for the group, but not for the individual.

He is essentially saying that evolved mechanisms positively affecting group reproductive success produce no behavioral correlates but evolved mechanisms effecting individual reproductive success do. His claim is both contradictory and indicative of the problems attendant upon accepting the linearity meme in evolutionary history. Fukuyama obliquely acknowledges the difficulties attending the construction of technological assessments on the basis of limited historical knowledge: "Technological prediction is notoriously difficult and risky, particularly when talking about events that may still lie a generation or two away" (19). The difficulty derives from the opacity of the history of technological change even just two or three generations behind. Inherent in our history is the urge to reduce relational complexity in support of certain theoretically derived assumptions about progress. He feels confident, however, in arguing "...modern biotechnology has already produced effects that will have consequences for world politics in the coming generation, even if genetic engineering fails to produce a single designer baby before then" (19). The myth he is reproducing here, by obscuring the historical relationships a critical history reveals, is of an adversarial relationship between science and politics that is only made possible through conflating politics with democracy. Politics is a relational regime of which democracy is a subset, and it is possible for something to be political without being democratic or having and direct implications for democratic politics. Fukuyama betrays all of his former concessions to the power of culture and politics not only to shape human behavior but also to be its origin when he writes, "...molecular biology, including cognitive neuroscience, population genetics, behavior genetics, psychology, anthropology, evolutionary biology, and neuropharmacology. All of these areas of scientific advance have potential political

implications, because they enhance our knowledge of, and hence our ability to manipulate, the source of all human behavior, the brain" (19). He also fails to acknowledge that not only is our knowledge of the brain politically constituted but also the disciplines designed to develop scientific knowledge of the brain are likewise politically constituted. It is thus insufficient to merely point to the political implications of these fields of research without also exploring the implications of politics for these disciplines if it is your aim to propose a policy response to their products.

Ray Kurzweil and the Law of Accelerating Returns

Ray Kurzweil is a technological optimist. He holds to a philosophy that says, "no matter what quandaries we face—business problems, health issues, relationship difficulties, as well as the great scientific, social, and cultural challenges of our time—there is an idea that can enable us to prevail" (2). In this section I will show how his optimism stems from the way he models technological and evolutionary history. In his conceptualization of history, Kurzweil and I tend to agree in so far as we see technology as encompassing a broad variety of things going well beyond mere material technologies. Kurzweil summarizes this view: "The power of an idea—this too is an idea" (2). Social institutions, epistemologies, mythologies, and even individual concepts like intelligence are technologies, and thus we are capable of analyzing them using similar methodologies and types of data. The problem with Kurzweil is that he makes a category mistake similar to Fukuyama in that he then transfers the conclusions of such a review from his review of technology to his review of evolution. The problem is that Kurzweil envisions a linear progress in the development of all complex systems including the evolution of life on Earth based on his theorizing about the development of computers over the last

forty years.

In reminiscing about his life as an inventor, Kurzweil describes how in the 70's he came to the realization that "inventions need to make sense in terms of the enabling technologies and market forces that would exist when the inventions would be introduced, as that would be a very different one from the one in which they were conceived" (3). It was this realization that led Kurzweil to become interested in forecasting so that he could develop more sophisticated models of future sociotechnical contexts in order to better refine his inventions to match them at the stage of conception. He and I share an interest in modeling contexts in order to evaluate technologies, but we diverge in our understanding of what level of depth and complexity of analysis is required in order to achieve the best models. Kurzweil sees inventing as "a lot like surfing: you have to anticipate and catch the wave at just the right moment" (3). I would argue that this statement anticipates his whole understanding of history as far as he sees it as a single massive entity moving forward inexorably, like the perspective of the person on a surfboard standing at the crest of a wave. To accurately understand and to anticipate the wave you need to examine the complex web of relationships that makes waves semi-predictable. You have to know where the reef is or where the coastal shelf begins so that you know where the wave is going to break. A wave will break in water half as deep as the wave is tall. The weather off shore and the dominant seasonal and local currents will determine the strength and size of the swells as they approach the shore also affecting the breakpoint of the wave. The topography of the seabed or the reef will affect the shape and speed of the wave. There are dozens of other factors affecting waves that would be necessary to make predictions before you hit the water or swam out to the lineup. In

other words, most surfers come to understand the waves on a particular day at a particular beach through a combination of intuition and experience and not through a minute understanding of the local and global characteristics that go into making the waves they will be riding that day. If we intend to practice anticipatory technology assessment either as inventors or as policy analysts and scholars, we should not approach it as a surfer would the waves but perhaps as an oceanographer might. Kurzweil's approach to surfing and inventing might work better if he were surfing in a wave pool. His monumental approach to history is closer to the way surfers learn to anticipate the waves, a method wholly inappropriate for truly understanding the systems of relationships at work. He may end up being right in his predictions or, as even the best surfers know, any wave in the set might surprise him and drill him into the reef. A broken clock is right twice a day, but you would not want to depend on it to tell time.

Kurzweil often flirts with the idea of a more complex model of evolutionary change over time. He often speaks in terms that suggest that linearity and progress are illusions, as when he writes: "Often a key advance is a matter of applying a small change to a single formula" (5). The massive and sweeping quantitative models that he produces in his analysis of technological change seem far less stable from this perspective. If it is the case that a single, small change can alter a formula in inventing it seems obvious that this would be doubly true of the far more complicated mass of historical change. Yet, Kurzweil must—and does—elide such complexity throughout his work by suggesting that these small changes are insignificant when compared to larger meta-trends. He describes this through an analogy between historical change and the human body: "the particles composing my brain and body change within weeks, but there is a continuity to

the patterns that these particles make" (5). I do not find fault with his sensing a pattern, but, rather, with his bolstering the reality of this pattern through the misapplication of conclusions from the analysis of dissimilar systems or through ignoring crucial congruities between analyses. An example of the latter mistake is his failure to apply his belief in the power of small changes to his own analogy. Yes, there is a pattern to human cellular composition that is stable over time, but as cells die and are replaced, a very small change in DNA encoding can change the end result from a healthy human body to one riddled with cancerous growths never countenanced by the original pattern. Kurzweil makes selective use of contingency in his work, and, as a result, his models are impoverished to say the least.

Kurzweil asks early on in his most recent text on human enhancement what the singularity might be, and he answers, "it's a future period during which the pace of technological change will be so rapid, its impact so deep, that human life will be irreversibly transformed" (7). If we think back to Fukuyama, the similarity is striking. The impetus for Fukuyama's analysis and the *cri de Coeur* of his work is that the pace of technological change has accelerated beyond the means of extant systems of political and social control to cope with adequately and that an emergency regime of regulations at the national and international level is needed in order to preserve human nature and the political systems founded upon the western understanding of the same, which he considers to be universal. The two philosophers are proceeding based on an identical understanding of technological and historical progress, one that is linear, and rapidly accelerating. Ironically, this model of historical progress could be described using the same words Kurzweil reserves for much of contemporary human though, "derivative,

petty, and circumscribed" (9).

In attempting to further define the singularity, Kurzweil claims "the Singularity will represent the culmination of the merger of our biological thinking and existence with our technology, resulting in a world that is still human but that transcends our biological roots" (9). It is at this point that Kurzweil and Fukuyama dramatically part ways. While for Fukuyama a future in which we have transcended the limits of human nature as he understands is one in which we will no longer be recognizable as human and thus our institutions will fail, for Kurzweil such a future will be all the more remarkable for its consistency with human nature as he understands it, "Ours is the species that inherently seeks to extend its physical and mental reach beyond current limitations" (9). The dangers of attempting to universalize any conception of human nature are apparent in this exchange. The elements of Fukuyama and Kurzweil's human nature are strikingly similar but arranged in different orders, resulting in divergent conclusions about the outcome to be expected from identical understandings of historical progress.

In a further irony, Kurzweil compares his "historical exponential view" against the "intuitive linear view" of history. I call it ironic because the non-linearity of Kurzweil's history is an optical illusion made possible by shoehorning all of history into very simple graphs of exponential growth. Recall that Kurzweil's understanding of history is that "human progress is exponential (that is, it expands by repeatedly multiplying by a constant) rather than linear (that is, expanding by repeatedly adding a constant)" (10). Further, Kurzweil argues that human progress is truly exponential in that the exponent also increases with each cycle of doubling (11). Kurzweil's quibble with the "intuitive linear view" of history is not its linearity but its perceived rate of progress.

Note that he shares with Fukuyama the notion of a progressive history. Kurzweil claims that scientists consistently underestimate the rate of change—and thus the potential for further and faster growth—by assuming that the next century of progress will proceed at a similar pace to the last century. The linear view according to Kurzweil fails because it only adds to the volume of technological progress and fails to account for the impact of technology on its own rate of progress, i.e. this generation's technology will be used to design the next generation both faster and better than the last because of the new capabilities it imparts.

Kurzweil argues that scientists—from whom the public most often gets a sense of how far and how fast we have progressed technologically—fall prey to what he calls "scientist's pessimism" (12). He argues that many scientists fail to perceive the historical trends of which they are a part, because "they are so immersed in the difficulties and intricate details of a contemporary challenge" and because they are "trained to be skeptical, to speak cautiously of current research goals, and to rarely speculate beyond the current generation of scientific pursuit" (12-13). In one sense he has correctly identified one failing of many current researchers and labs in so far as they do tend to miss the larger social implications of their work because of the necessary myopia involved in solving their particular problems. However, they are also cautious because they have been trained not to fall into the very historical snare Kurzweil has built for himself.

Stephen Gould continued his work on combating the influence of category mistakes in science with an essay on the myth of progress in the history of life on Earth. He argued that many have confused Darwin's explanation of natural selection with a

description of a progressive and predictable course of evolutionary history (92). This mistake derives from the category mistake of applying the rather limited conclusions about evolution one can derive from the mechanism of natural selection to all of evolution, or, in other words, mistaking natural selection for evolution itself. Gould explains why natural selection is insufficient to explain evolutionary change, "...many other causes are powerful, particularly at levels of biological organization both above and below the traditional Darwinian focus on organisms and their struggles for reproductive success" (92). Gould explains that at the lowest levels—epigenetics and the substitution in individual DNA base pairs—change is often effectively random and only appears progressive taken together. Further, Gould argues that according to his theory of punctuated equilibrium evolutionary trends can often be produced by "selection of species based on their rates of origin and extirpation, whereas mass extinctions wipe out substantial parts of biotas for reasons unrelated to adaptive struggles of individual species" (92).

Gould goes on to describe how the complexity of what he calls the "actual pathway of life's history" is often "underdetermined by our general theory of life's evolution" (92). Gould is arguing here that general theories of linear historical progress like those employed by Fukuyama and Kurzweil obscure the incredibly complex networks of relationships and change that underlie historical change taken together. They fail to account for the strong roles played by contingency and random change in arranging that network (92). He believes that it is possible to map these networks adequately in hindsight "with satisfying rigor if evidence be adequate, but it cannot be predicted with any precision beforehand" (93). The roles of contingency and random

chance in arranging the network of relationships that constitute life's history and the complexity of the network itself render prediction a near impossibility. Yet, this is precisely the business of scholars like Kurzweil and Fukuyama, making predictions about the future pathway of life's history. If they are convincing in doing so it is only by virtue of the elision of complexity in their historical models. Kurzweil celebrates the future based on his linear models while Fukuyama dreads it; both of them make policy recommendations and predictions of institutional change on the basis of them and neither of them seems aware of the paucity of their own historical reviews.

In closing, I return briefly to Kurzweil's exponential historical model. I noted above that it was ironic that he compared it favorably to what he refers to as the linear model when the failing of his own model is, in fact, its reliance on a linear and progressive theory of historical change. At one point, he even goes so far as to describe the work of evolution as "a process of creating patterns of increasing order" (14). He demonstrates his fidelity to the impoverished understanding of evolution as natural selection excoriated by Gould when he writes, "Evolution works through indirection: each stage or epoch uses the information-processing methods of the previous epoch to create the next" (14). In essence, Kurzweil constructs his model of exponentially increasing order based on a review of monumental history, conflating the historical record with history itself. He fails to acknowledge that the historical record is not a map of the actual course of history as when he writes, "Despite the diversity of approaches, however, if we combine lists from a variety of sources (for example, the *Encyclopedia Britannica*, The American Museum of Natural History, Carl Sagan's "cosmic calendar", and others), we observe the same obvious smooth acceleration" (18). Of course, he is

right, but only by virtue of the fact that those sources are not history itself, but, rather, are models of history constructed on the same flawed theory of historical progress Kurzweil is now using. He achieves the appearance of non-linearity by taking this linear historical review and modeling it based on exponential growth formulas and then plotting them on a chart that shows smooth linear progress up to the knee of the curve at which point growth explodes upward. The change in trajectory is a function of the math in the model, not of history itself, and this is the optical illusion that I noted at the outset of this review.

In this section, I have attempted to demonstrate that on both sides of the dialogue about human enhancement there is in play an impoverished model of historical change. This model suggests a linear and progressive movement to history that is belied by the evidence of history when it is viewed without being prearranged according to any general theory of historical progress. The model is an outgrowth of a more general trend toward category mistakes in human thought as described in my review of Gould's work on the subject. Clearly observable trends in linear and progressive history like that of the growth of processor speed and other recent technologies are used to construct a general theory of historical change which elides the complexity and contingency found in more rich review of the evidence of history. Further, such models are frequently an exercise in what Nietzsche referred to as monumental history, which focuses exclusively on the most significant individuals and events in the historical record and avoid the messiness of historical review at other levels. Such history is useful in pursuit of ideological goals but useless in anticipatory governance, because it results in a system prone to overestimating its capacity to predict events and underdetermining the role of chance in driving historical change. It produces political cultures that have difficulty in establishing the flexibility

necessary to cope with the unpredictable nature of life.

Conclusion

In this chapter, I attempted to define a problem within the scholarship on human enhancement technology by engaging with the work of Stephen Jay Gould, Francis Fukuyama, and Ray Kurzweil. Using the grounded theory method in two previous chapters, I attempted to demonstrate the non-linear and culturally contingent nature of intelligence and, at the same time, intelligence's importance for American political culture. The difference in culture and outcomes deriving from a transition away from a theory of general intelligence and toward a theory of multiple intelligences cannot be underestimated. Further, in these two chapters I began to explore the category mistake, a common logical error, by using the work of Gould. It is based on these prior analyses that I have developed the concept of the "linear fallacy."

The "linear fallacy" is a logical error that occurs when we attempt to generalize about one large and non-linear historical development on the basis of a small and more (though still not perfectly) linear trend. This transposition is what produces the illusion of linearity. It may be true that there is a linear and progressive trend of exponential doubling in computer processor speeds, but this does not mean that we can apply the same logic to the history of life as Ray Kurzweil does and as Gould expressly warns us against. The "linear fallacy" tends to produce magical thinking with regard to our ability to anticipate and prepare for our technological future. It is an extremely poor fit with any attempt at anticipatory governance for just this reason. Yet, it is the model most often employed by both opponents and proponents of human enhancement as I tried to demonstrate in my engagement with Fukuyama and Kurzweil.

Gould explained the category mistake through work of American psychometricians who argued that if a mental trait had a high heritability in individuals, it would have a similarly high heritability in a group, and that rank-orders could be established within society on that basis. I have shown that same logical error to be at play in the work of human enhancement scholars in so far as they argue that if there is a trend toward linear, progressive, and exponential increase in one technology—or even many technologies—then we can construct a model for all technological progress on this basis and even shoehorn all of evolution into such a model. Based on such a theoretically and historically impoverished model these scholars attempt to found various policy prescriptions and institutional reforms.

Conclusion

Summary

This dissertation has begun to bring to bear a more sophisticated combination of theoretical and historical analysis on the subject of human enhancement and American political culture. I rely on the use of grounded theory—developed from a combination of historical and empirical data as well as canonical political theory—and genealogical history to develop a more sophisticated map of the current sociotechnical context than is the norm in scholarship on human enhancement. In chapter II, I described a problem inherent in much of the scholarship being produced by science and technology scholars today. Their work, while valuable in many ways, remains theoretically uninformed beyond the informational and organizational theories drawn from sociology, psychology, and economics. Contemporary democratic theory is also introduced in discussions about the democratization of science. The theories that would seem to be most relevant to science's place within the structure of modern western democracy seem to be largely absent from most STS and science policy scholarship. Machiavelli, Hobbes, Locke, Rousseau, Mill, and Marx are conspicuous for their absence from work related to a system that they helped to create through their theoretical and practical work.

Mark Brown's Science and Democracy is a forceful attempt to bring the work of the canonical political theorists into the discussion about how we manage science and technology in a democratic society. Brown begins with an analysis of Machiavelli and his use of ancient and medieval republican history in informing princes and republics of renaissance Italy on the best way to maintain power and thus stability. Machiavelli's political science was a purpose driven and practical exercise in the use of history to

bolster political practice and structures for the benefit of the people. He has often been maligned as a cold realist only interested in power for its own sake but a closer reading of his work reveals that his true interest is in systematically bending power to the task of maintaining stability and prosperity through the power of the prince or the republic.

Machiavelli conceived of systems of princely and participatory rule as technologies for unifying and stabilizing the state. He advocated through his work for the adoption of such technologies and bolstered his advocacy through the systematic use of history. Machiavelli could, in this sense, be called the first political scientist. Hobbes, on the other hand, may rightfully be called the first political theorist. His work on the construction of political institutions to represent a newly constituted public was grounded in more than just theoretical rumination. Motivated by a fear of instability deriving from the English Civil War Hobbes sought to bring to bear the tools of the developing modern scientific method and mathematics to a systematic review of the real relations between represented and representative. Brown methodically describes the congruence between Hobbes' conception of political representation—a general category congregated into a single entity that then authorizes a single representative—and the scientific understanding of representation in experimentation. This correspondence applies both to the way in which science chooses to represent the objects of its inquiry as well as to the way early scientists chose to represent—and thus co-opt—the public in its experimentation.

Liberal democratic theories like that of John Locke ultimately prevailed in creating modern systems of republican government that are on the surface premised by a more participatory one-to-one form of representation where each individual contracts directly with a representative in order to delegate the authority and tasks of governance.

It was neither Locke's nor the constitutional framer's intention to create a robustly participatory system, both were leery of democracy and public participation and would prefer a model of government that more closely corresponded to those discussed by Hobbes and Machiavelli. Over the intervening centuries, history and public pressure have conspired to ameliorate the most robustly republican mechanisms incorporated into the constitution by the framers, like the indirect selection of both senators and the executive.

The significance for the current debate about the democratization of science is that the tension between democratic and republican versions of representation is matched by similar tensions within science itself. Originally, science was conceived of and conducted as a gentleman's exercise on behalf of the public and in the public's interest. Much of the Royal Society's early work was of a practical nature in pursuit of solutions for societal problems rather than basic science and yet it was hardly a popular enterprise. In order to maintain a façade of inclusion the Royal Society created a method of doing public science that seemed to invite the public in while in actuality maintaining a safe and uncorrupting distance. A similar system was the intention of the constitutional framers in America and it is no coincidence. Democracy and modern science developed simultaneously and were co-productive of one another. The fundamentally utility of reintroducing Hobbes and Machiavelli to the discussion about democratizing science—for as Brown demonstrates they were instrumental in the original debate about the same subject—isn't to push science back toward more abstract forms of representation and deny purchase for popular participation in and governance of science. Rather, it is to demonstrate that just as the forms of representative government conceived of by Hobbes

and Machiavelli were by no means democratic they did include robust mechanisms for popular participation in governance like plebian councils and public protest and demonstrations. Further, as Hobbes demonstrates politics is the framework within which all other social activities takes place and thus these systems of popular control apply equally to the social activities within politics as to politics to itself. In short, political theory demonstrates that science is already democratized and the work of making the institution more responsive to popular demands is at the margins rather than the core. The final arbiter of whether, how, and how much science is conducted in the public interest remains the public itself. Political theory can serve to alleviate some of the urgency with which the project of democratization is viewed as well as providing some basic suggestions for reform, though I believe it is far less useful in the practical and immediate sense of developing strategies for reform than Brown appears to.

Chapter II also built upon my introductory discussion of Nietzsche's genealogy to develop grounded theory about the current American political culture. I have chosen to use Nietzsche's genealogy in analyzing technology of cognitive enhancement as a demonstration of theories utility to the larger project of real-time technology assessment. Nietzsche argued that history ceases to be meaningful when it is no longer conducted in service to present social needs. He believed that scholarly or scientific history—which was dominant in his time and remains so in many areas of scholarship today though it may no longer be so with actual historians—served to confound practical attempts to further the excellence of humanity by overdeveloping the historical sense of individuals and society. It left them crushed under the weight of a seemingly inexorable past. His answer was genealogy: the systematic application of three types of history—monumental,

antiquarian, and critical—in varying amounts depending on what was needed to construct historical analysis that were useful in producing new knowledge of present circumstances and problems. The combination of the systematic analysis of individual or event driven history, cultural or national history, and an overarching theoretical commitment to the principle that all history is open to just criticism in pursuit of solutions to present problems produced a method of history Nietzsche believed would free great men to pursue great deeds by fostering their unhistorical sensibility—i.e. the ability to forget about the crushing weight of the past—while still imparting critical lessons gleaned from the analysis of the webs of relationships between historical artifacts.

In Chapter III, I engaged with Stephen Gould and John Carson on the development of intelligence and mental testing as technologies that are mutually constitutive of American political culture. They have taken to task the historical relations that have served to produce the contemporary concept of intelligence or IQ. The two works combined will demonstrate that general intelligence is a socially constructed abstraction rather than a concrete and empirically demonstrable thing in the head. They will also demonstrate how it came to be so and it is this social history that will become useful in interpreting a public opinion data set on cognitive enhancement in Chapter IV. Genealogy will allow us to step back from the various debates about intelligence ongoing in America. It will help us to understand the motives and ideologies underlying many of the scholars and ideologues that continue to pursue and purvey theories of general intelligence. It will pull us out from the seemingly crushing weight of the history of cognitive psychological history and allow us to create spaces for creative thinking about how best to manage cognitive enhancement technologies as a society.

What are the implications of this ongoing context for cognitive enhancement? Three elements combine to form the current context with respect to cognitive enhancement. The belief that America is an open society that rewards individuals in proportion to their merit, which is a combination of motivation and ability, is the first element. The second is the more factually accurate perception of America as liberal democracy predicated upon free and fair economic and political competition. Finally, we have the belief that IQ is not only a real thing but that it is central to the formation of identity and that in it confers a tremendous benefit in the two principle areas of American competition. These three elements serve to produce a bifurcated effect in public perception of cognitive enhancement. In private Americans would appear to be willing to consider seeking cognitive enhancement for the personal benefits they would gain in competition with their peers. On the other hand, they fear the widespread but uneven introduction of such technologies because of the possibility that they will not be included in the "in group," those that receive the benefits of cognitive enhancement.

I am arguing that a change in the popular perception of intelligence shifting it away from IQ and toward the theory of multiple intelligences would radically alter public perception of cognitive enhancement. The public would fear cognitive enhancement's effects on competition if they understood intelligence to be something that is not only distributed to various functional areas of the brain but also variably distributed among the populace not in terms of greater overall quantities of mental ability but in terms of greater or lesser aptitudes in these same functional areas. In other words, if the public believed that they and their children possessed varying degrees of mental abilities in a variety of functional areas—some individuals with very high mathematical aptitude but low social

intelligence and others with very high verbal intelligence but low spatial intelligence—and that an increase in one application specific area of intelligence did not translate into an overall increase in mental ability but to a very specific advantage in a segment of competition they would be more comfortable with the idea. It would possible for them to increase their child's artistic ability without negatively affecting their neighbor's ability to succeed as an engineer through unfairly skewing competition.

It is important to note that the changes I am hypothesizing would bring public expectations and concerns in line with the present state of science and research in the various fields of neuroscience. Contemporary neuroscience is focusing on examining and creating therapies for specific mental functions more-or-less discretely localized within the brain. It is likely that any enhancement technologies deriving from this research would be similarly specialized, i.e. enhancements focusing on memory, or increasing the speed of executive function, adapting verbal abilities, or changing perceptive abilities and processing. These technologies have very different implications for competition in liberal democracy than would a hypothetical technology designed to increase overall mental ability.

There would be other radical changes accompanying a shift away from general intelligence toward multiple intelligences. The use of standardized tests beyond primary and secondary schools would be problematized as it became clear that they were measuring fiction and failing to capture more specific aptitudes which might be just as useful in determining success within discrete university programs. It would tend to push the American system toward a softer version of the French system of education and economic production. Individuals would be guided by information about their specific

aptitudes toward pursuing advanced education or vocational training suited to those aptitudes rather than being more generically sorted. It is possible to envision increases in overall economic productivity as citizens who were previously prevented from reaching their full potential by the overly general way in which we sorted students by mental ability gave way to a system that focused on helping students find the career that maximized use of their dominant mental abilities. The American system as it stands not only produces unfair socioeconomic advantages both through structural defects and the uneven distribution of extant cognitive enhancers like early childhood nutrition and excellent education but also by denying opportunities for higher education through a focus on general mental ability rather than specific aptitude.

I will just briefly mention what I argue are the best methods for addressing the problem of general intelligence in American society and then I will return with a greater degree of attention in the final chapter of my dissertation. I have already stated that I believe it is unproductive to try to attack the dominance of the technology of general intelligence directly. It is far too heavily entrenched and continues to work in symbiosis with the same structural proclivities—a desire to biologize difference and use science to justify continued stratification and division based on class, race, and gender—that helped to shape it in the first place.

In chapter IV, I analyzed the 2008 National Nanotechnology Survey conducted by the Center for Nanotechnology in Society with funding from the National Science Foundation. It has provided a wealth of data with which to test the hypotheses I drew from my historical analysis of the development of the technologies of intelligence and mental testing in the previous chapter. I concluded that the centrality of theories of

general intelligence to the sociotechnical context in America, in combination with the competitive nature of social interactions in American society as described in Chapter II would produce a context where cognitive enhancements would have an importance disproportionate to the actual state of their development or to their likely impact. I also predicted that the context would such that a shift toward multiple intelligences would positively impact the acceptability of such technologies and bring public expectation in line with the state of the research currently being done but that it would also dramatically increase the importance of the critical historical perspective developed by Nietzsche and its application to the broader history of technological enhancement.

The data indicates that Americans do generally see enhancement technologies as an important issue. Further, they tend to judge them principally along moral and ethical lines and such judgments support therapeutic technologies while condemning all other applications. Therapeutic technologies with the capacity to be used off-label for enhancement thus appear to be most likely to be first to market and the first to receive broad public support and there is some evidence that this is already the case with psycho-pharmaceuticals. However, the data also indicates that Americans are willing to consider non-therapeutic enhancements and that they tend to judge these technologies principally with regard to their impact on social competition. Personal gain in the areas of economic and academic competition seems to have the potential to override the existing distrust of the impact enhancement technologies are perceived to have on social competition by our respondents. Changes in the economic and theoretical aspects of the context—i.e. a shift away from general intelligence and changes in the health care system—could serve to overcome American's reluctance relating to competition. Both changes are plausible and

while a shift toward theories of multiple intelligences would serve to bring public expectations in line with the actual research and development taking place in neuroscience it would also dramatically increase the need for a critical history of enhancement technology to provide more topical and nuanced guidance to Americans as they decide how to incorporate these new technologies into the competitive sociotechnical context in which they operate. Such critical history along with further public opinion research in order to gain a finer resolution on some of the economic questions that seemed to be in conflict in our survey are sorely needed before we can construct a meaningful policy prescription with regard to cognitive enhancement.

In chapter V, I attempted to define a problem within the scholarship on human enhancement technology by engaging with the work of Stephen Jay Gould, Francis Fukuyama, and Ray Kurzweil. Using the grounded theory method in two previous chapters, I attempted to demonstrate the non-linear and culturally contingent nature of intelligence and, at the same time, intelligence's importance for American political culture. The difference in culture and outcomes deriving from a transition away from a theory of general intelligence and toward a theory of multiple intelligences cannot be underestimated. Further, in these two chapters I began to explore a common logical error through the work of Gould, the category mistake. It is based on these prior analyses that I have developed the concept of the "linear fallacy."

The "linear fallacy" is a logical error that occurs when we attempt to generalize about one large and non-linear historical development on the basis of a small and more (though still not perfectly) linear trend. This transposition is what produces the illusion of linearity. It may be true that there is a linear and progressive trend of exponential

doubling in computer processor speeds but this does not mean that we can apply the same logic to the history of life as Ray Kurzweil does and as Gould expressly warns us against. The "linear fallacy" tends to produce magical thinking with regard to our ability to anticipate and prepare for our technological future. It is an extremely poor fit with any attempt at anticipatory governance for just this reason and yet it is the model most often employed by both opponents and proponents of human enhancement as I demonstrate in my engagement with Fukuyama and Kurzweil.

Gould demonstrated the category mistake through work of American psychometricians who argued that if a mental trait had a high heritability in individuals it would have a similarly high heritability in a group and that rank-orders could be established within society on that basis. I have shown that same logical error to be at play in the work of human enhancement scholars in so far as they argue that if there is a trend toward linear, progressive, and exponential increase in one technology—or even many technologies—that we can construct a model for all technological progress on this basis and even shoehorn all of evolution into such a model. Based on such a theoretically and historically impoverished model these scholars attempt to found various policy prescriptions and institutional reforms.

Real-Time Technology Assessment

Nano-scale R & D, an enterprise that is central to many emergent technologies, presents regulatory and governance challenges which are, if not unique, certainly of a vastly different magnitude than the technologies our social and political institutions are familiar with. The distributed nature of nanotechnological research—both geographically and across fields of scientific endeavor—makes it particularly difficult to situate

contextually and to analyze in a systematic way with regard to its social and political implications. One of the central aspects of Real-Time Technology Assessment (RTTA) under development at the Center for Nanotechnology in Society at ASU is the integration of "socio-technical mapping and dialogue with retrospective (historical) as well as prospective (scenario) analysis" in an effort root technological development and its governance in historical context (Guston and Sarewitz 93-101). The attempt to develop some sense of historicity in the U.S. innovation system is intended to make it more malleable to social—including regulatory—intervention in two ways: first, the development of reflexivity in laboratory scientists, rendering them more amenable to and better prepared for the integration of social values into their work; and, second, the development of meaningful feedback mechanisms to provide a sense of the social implications of science and technology for both policy makers and the public. Guston and Sarewitz point out that a deep sense of historicity is largely absent from the current mechanisms for evaluating technology in the U.S. innovation system, particularly Constructive Technology analysis (CTA), which focuses only on the "the systematic plotting of recent technical dynamics" (97). They note that CTA is designed to let "societal aspects [of innovation] become additional design criteria" (98). Yet, it focuses only on the contemporary elements of the sociotechnical context without allowing for complex and critical historical analysis in an effort to establish the pedigree of that context and better inform our mapping of it.

Guston and Sarewitz write that RTTA is in some ways continuing the work of CTA in establishing reflexive mechanisms within the U.S. innovation system. However, the points of departure that they describe each hinges in some way on expanding the

historical anchoring of technology assessment in an effort to deepen and expand on the mapping function of CTA and allow for a more accurate and believable evaluation of societal needs and perceptions (98). In particular they note that RTTA will "[integrate] sociotechnical mapping with retrospective (historical) as well as prospective (scenario) analysis, attempting to situate the innovation of concern in a historical context that will render it more amenable to understanding and, if necessary, to modification" (98).

Guston and Sarewitz argue that a robust program for RTTA should include four stages a number of different activities driven by different research and analysis methodologies, the describe it as follows:

> The first component is the development of analogical case studies, as studying past examples of transformational innovations can help to develop frameworks for anticipating future interactions between society and new technologies. The second component is mapping the resources and capabilities of the relevant innovation enterprise to identify key R&D trends, major participants and their roles, and organizational structures and relations. The third component is eliciting and monitoring changing knowledge, perceptions, and attitudes among stakeholders, because empirically grounded, research-based strategies can enhance the quality of science communication about the societal implications of innovations. The fourth is engaging in analytical and participatory assessments of potential societal impacts, conducted because informed societal response to innovation depends on how well various societal actors – ranging from scientists to the general public – are prepared for the evolving impacts of the innovation (100-101).

The method I have employed here would be valuable at each of the four stages of RTTA as Guston and Sarewitz define it. The case study in Chapter II of this dissertation is an example of the type of analogical case study Guston and Sarewitz identify as stage one of a robust program of RTTA. The combination of my historically and theoretically informed method of inquiry with well constructed public opinion data can provide a robust first step toward the construction of the context maps they cite as stage two of RTTA. That same public opinion data alongside expert surveys and deeper focus group work can establish the third component. Finally, gauging societal impacts and informing stakeholders--the activities of stage four--must proceed from first having established a contextual map and an accurate assessment of the perceived value to stakeholders of the technologies being assessed.

On the other hand, I believe that deep historical analysis not only of technology but also of the innovation system in general is a necessary stage in its own right and one that should be prior to each of the subsequent four stages. The development analogic case studies should proceed from as complete an understanding as possible of the historical relationships that produced it. Guston and Sarewitz describe the analysis as producing "knowledge about who has responded to transforming innovations in the past, the types of responses they have used, and the avenues selected for pursuing those responses" (101). They suggest that the key to this activity is "the capacity to identify appropriate analogous cases" (101). I would argue that while analogous cases would be one valuable output of such a historical review, it is not the most important.

The remaining three stages of RTTA are in some way predicated upon previous historical analysis. As noted above, the case studies are derived from an analysis of the

innovation system. Research program mapping (RPM) is intended to evaluate programs within their current context (102). However, it is impossible—as I believe I have demonstrated in this dissertation—to establish that context with any degree of clarity without recourse to a deep and critical history. RPM must, perforce, begin with a historical review designed to elicit the contours of the current context. Communication and early warning (CEW), the next stage of RTTA, focuses on analyzing and improving the means of communication employed by scientists and citizens to relay values, expectations, evaluations of present research, and warnings of potential negative externalities from technologies under development (103). Just as with RPM, a meaningful analysis of the current mechanisms for communications between scientists and citizens requires an understanding of the sociotechnical context that can only be derived from deep historical analysis. The final component of RTTA is technology assessment and choice (TAC). The initial stage of TAC involves "traditional methods [such] as forecasting, foresight, road-mapping, and expert elicitation" (104). If chapter V of this dissertation accomplished nothing else, it was to demonstrate that forecasting conducted without a critical historical model of society and technology is a doomed enterprise.

Given the centrality of historical research to each of the four stages of RTTA I would argue that such research should be a stage unto itself conducted prior to the subsequent stages. As an ongoing activity, extensive historical mapping could be conducted of the innovation system in a given country in anticipation of the need for historically developed knowledge of antecedent relationships at any particular stage of assessment of a particular technology. Further, developing the mechanisms for targeted

historical review should itself be an aspect of RTTA. History plays a vital part in each of RTTA's four stage, and yet nowhere in the enterprise is it explicitly the object of concern. The development of methods for historical analysis—as well as the debunking of popular but flawed methods employed in other analyses—should be a fundamental component of any program for technological assessment.

Suggestions for Future Research

One of the obvious setbacks with the public-opinion data that we collected on public attitudes toward human enhancement technologies is that this was the first time such data has ever been collected. We had no representative set of questions and no baseline against which to measure the potential impact of the questions that we posed on down-ballot answers. Future research in this area would involve repeated iterations of the survey on an annual basis for several years to establish a longitudinal measurement of these attitudes and to confirm the soundness of our survey instrument in order to increase confidence in our data.

Additional analogical studies of representative technologies in the family of human enhancement technologies is needed in order to better understand the contours of the field and to substantiate the hypotheses established in this dissertation about the impact of naive history on their development. Furthermore, such studies are necessary in order to continue to develop a better understanding of the public values involved in human enhancement technology and their correspondence to the actual research being conducted.

Central to the continuing analysis of cognitive enhancement would be to gather better empirical data on the public's attitudes toward and understanding of intelligence.

Additional questions added to the future survey iterations in order to sharpen the focus of our public opinion data on cognitive enhancement are needed. Also, focus group work in order to get at the public attitudes that simply cannot be elicited or understood in the context of a brief telephone surveys would be needed to supplement the survey data on this subject.

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APPENDIX A

IRB AND HUMAN SUBJECTS APPROVAL FOR 2008 NATIONAL NANOTECHNOLOGY SURVEY

ARIZONA STATE UNIVERSITY
Research Compliance Office
Office for Research & Sponsored Projects Administration
P.O. Box 873503
Tempe, AZ 85287-3503
Phone
(480) 965-6788
Facsimile
(480) 965-7772

To:	Clark Miller SS
From:	Mark Roosa, Chair Soc Beh IRB
Date:	07/10/2008
Committee Action:	**Exemption Granted**
IRB Action Date:	07/10/2008
IRB Protocol #:	0806003034
Study Title:	Public Attitudes Toward Nanotechnology

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(2) .

This part of the federal regulations requires that the information be recorded by investigators in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. It is necessary that the information obtained not be such that if disclosed outside the research, it could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

You should retain a copy of this letter for your records.