Journal of Evolution & Technology

A peer-reviewed electronic journal published by the Institute for Ethics and Emerging Technologies

ISSN 1541-0099

21(2) – December 2010

The Transhuman Security Dilemma

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Journal of Evolution and Technology - Vol. 21 Issue 2 – December 2010 - pgs 32-48

Abstract

Developments in genetics, cyber-technology, nanotechnology, biotechnology, artificial intelligence, and other areas hold the promise – and the peril – of redefining what it means to be human. In addition to hedonism or a desire for self-improvement, the possibilities of these technologies plus the rational concern of falling behind a potential adversary produce a classic security dilemma. These competitive pressures among states, firms, and emerging "super-empowered individuals" encourage the development and dissemination of these technologies, and already the possibilities are being explored by actors in conflict. This security dilemma, plus the nature of the technologies themselves, makes it virtually certain that attempts at regulation will fail. Instead, we should expect "arms races" of quantity and quality of improvements, complicated by differing conceptions of what improvement means. This paper explores these pressures and outcomes, as well as general consequences of the potential modification of "human nature" for global and human security. It finds that whatever forms or enhancements we possess, in a transhuman or posthuman future politics will not be transcended. Critical problems of security will continue to challenge ourselves and our descendants.

Introduction

> Homo sapiens, the first truly free species, is about to decommission natural selection, the force that made us… Soon we must look deep within ourselves and decide what we wish to become.[1]

There is a set of emerging technologies which, singly and synergistically, have the potential to overshadow nuclear power in their effects on the international system. Nano-Bio-Info-Cogno (NBIC) technologies have progressed to the point that they raise the prospect of the evolution-through-design of human beings – as individuals, as societies, and as a species. By challenging our most basic assumptions regarding what it means to be a human in society, NBIC technologies may well render much of contemporary sociology, political theory, and economics obsolete. They raise the immediate possibility of a transhuman era, with transhuman or even posthuman politics. By altering what have been assumed as defining characteristics of humanity – including individuality, empathy, mortality, physicality, and levels of intelligence – they change the context of politics.

It is safe to assume that transition through a transhuman era will not be smooth. It will not affect all persons at once, or to the same degree. It will also be shaped by current structures, conflicts, and notions of what improvement actually means. It will take place from within a system of competitive states, firms, nongovernmental organizations, and "superempowered individuals," each with an interest in the application of NBIC technologies for relative advantage. Although the designs will not be random, there will still be the interaction of types within a competitive environment that leads to evolution – and evolution by its nature leads to unexpected and contingent outcomes. The security implications are enormous, up to and including the possible extinction of the human species.

1. Technologies of directed evolution

NBIC technologies are in fact a constellation of four converging technologies. Nanotechnology involves structures on the scale of 10^{-9} meters. It is the construction and manipulation of objects on the scale of a single molecule. Biotechnology refers to the modification and use of organisms, or parts or products thereof, to achieve ends. Information technology refers to the integrated systems of computer hardware, software, and networking. The cognitive sciences and their applications refer to the study of intelligence and intelligent systems, both cybernetic and biological. The convergence of these fields comes from the fact that at the nanometer scale the differences between living and nonliving systems are indistinguishable. The body (including the brain, and whatever we call "mind") can be restructured.

Human genetic engineering, the most commonly recognized of these technologies, may either modify somatic (body) cells or germ cells (gametes, zygotes, early embryos). Somatic modifications, sometimes known as gene transfer or "gene therapy," never result in a heritable trait. Germ modification, or germline manipulation, affects future generations (Adams 2004, 16-17). While germline manipulation has taken place on animals for around twenty years, there are as yet no confirmed cases of human experiments. Some experts have suggested for legal and regulatory reasons it will be at least fifteen more years before human tests will be conducted (Adams 2004, 19-20); if these considerations were ignored germline manipulation could be underway today. Already, cultural differences exist in the regulation of stem cell research. As of 2004, a survey of thirty countries found no two shared a common regulatory regime. Instead, "policymakers must accept the reality of international 'dissensus'" (Pattinson and Caufield, 2004). Moreover, history indicates that even when there is a consensus on the limits of human testing, it may be deficient or ignored in practice.

The addition of nano-scale machines adds new possibilities. One is implantation of medical devices that will produce as well as dispense drugs inside of the host, including the brain. Another is the implantation of supercomputers the size of a cell, monitoring for and preventing disease before it could be noticed by the host (Canton 2005). Cybernetic breakthroughs point to continued blurring of "common sense" distinctions between the mechanical and the biological. NBIC technologies force one to reconsider what it is to be human.

Political science and practical politics are grounded in assumptions about the nature of humans as individuals and in groups. Within the field of international relations, for example, theoretical and policy disagreements – associated with such viewpoints as political realism, neorealism, neoclassical realism, liberalism, neoliberalism, Marxism, neomarxism, institutionalism, feminism, and various forms of constructivism – rest in large part on differing assumptions about human nature. Yet in one regard they are all alike: the assumption that there is a single "human nature," fixed in time and universal in scope. The divergence of humanity into new and different forms and capabilities renders that assumption obsolete. Or, as Jurgen Habermas (2003, 14) observed, "the breadth of biotechnological interventions raises moral questions that are not simply difficult in the familiar sense but are of an altogether different kind. The answers touch on the ethical self-understanding of humanity as a whole."

Consider some of the more speculative possibilities for directed evolution:

- The mind, once understood, could be loaded and run on different hardware. Bodies would be understood to be temporary. Death would not be permanent so long as one maintained a "backup."
- Movement from "meat" to electronics opens the possibility of increasing the speed of thought. Electrical impulses among neurons would be replaced by nanosecond-speed electronics.
- Transhumans could inhabit harsh environments, including outer space, without cumbersome life-support systems.
- Knowledge could be downloaded at computer speeds, and integrated instantly into memory.
- High-bandwidth communications could lead to mental networking, or a hive mind (or competing hive-minds).

Legal regimes are notoriously slow to cope with, let alone anticipate, the potentials of new technologies. Politicians are, if anything, even less likely to do so.

2. The politics of the transhuman

What will be the goals of human intelligences if, "freed from the limits of the human meat-machine," these "humans can change and improve their own hardware" (Robinett, 2002)? How will the goals themselves change as a result of the process and prior choices? An imaginary team of proto-humans, if it were tasked with designing their next evolutionary step, might have focused on doing better the things they already knew how to do, with the capabilities they already have. Their goal might be to be larger, or stronger, or better able to climb. Would they have imagined the range of possibilities opened by intelligence, language, and technology? When considering the prospect of a radical breakthrough in capabilities, we proto-posthumans may be in a similar situation. The most important developments will literally be the things we can not imagine.

Among specialists, a debate over biopolitics is already under way (for examples, see Fukuyama 2002, Hughes 2004, Bailey 2007, Darnovsky 2010), but these have tended to focus on the path to encourage or regulate change. More advanced NBIC technologies make that debate all the more important, and all the more immune to compromise. For the most part, these debates have occurred within nations, and while the UN and EU have encouraged the consideration of common standards for experimentation, these standards do not exist. Many states continue to consign the issues of experimentation and transition to a regulatory void.

Perhaps because there is so little to be certain of, discussion of the actual politics of transhumans and posthumans – as well as those who would attempt to use them for various ends – have tended to be simplistic. They also reflect the participants' own assumptions of what it means – or can mean – to be human.

On one side, there is a movement to ensure the widespread distribution of these technologies for the good of all people. Sometimes described as "radical technophilia," transhumanism as an ideology lies at the intersection of "popular culture, genetics, cybertechnology, nanotechnology, biotechnology and other advanced technologies, bio-ethics, science speculation, science fiction, mythology, the New Age Movement, cults, commerce and globalization" (Bendle 2002, 45). Its proponents have described themselves as a "loosely defined movement that has developed gradually over the past two decades" which "can be viewed as an outgrowth of secular humanism and the Enlightenment" (Bostrom 2005b, 202; Dacey 2004), as well as "a burgeoning lifestyle choice and cultural phenomenon" (Dvorsky 2004).

Transhumanism is at its core an "intellectual and cultural movement that affirms the possibility and desirability of fundamentally improving the human condition through applied reason, especially by developing and making widely available technologies to eliminate aging and to greatly enhance human intellectual, physical, and psychological capacities." It also seeks to study "the potential gains and problems associated with such technologies" (WTA 2008a). Transhumanists expect technological innovations to result in the emergence of several varieties of "posthumans," defined as "future beings whose basic capacities so radically exceed those of present humans as to be no longer unambiguously human by our current standards" (WTA 2008b). Given the range of transhuman technologies, from the genetic to the cybernetic, there is no reason to assume posthumans would be a single species, rather than a set of them (Agar 2007, 13). In a very real sense we cannot know what posthuman will be, any more than a proto-human could have imagined modern man, but we should assume a wide range of variation.

In its faith in reason and technology, transhumanism began within the general liberal tradition, but over time the model of technological change held by transhumanists has grown more complex. 1980s "extropians" called for an immediate and unrestricted application of all technologies, limited only by the reason and conscience of individual adopters. Today, even among those who promote their use, there is an emerging understanding of a potential threat from NBIC technologies. Nevertheless, the vast majority of transhumanists hold an essentially "progressive" view of technological change, despite the fact that there are good reasons to have a pessimistic view of "progress" (Verdoux 2009).

One observation that suggests the scope of potential threat is the Fermi paradox, named for Enrico Fermi, who is credited with first articulating it. Science starts from the assumption that our species and our world do not have a privileged position in the universe. Given the age of the universe, the probability of life-bearing star systems far older than our own, the potential for technology to accomplish more and more, and the adaptive quality of intelligence, we should expect to see evidence of older, more technologically-advanced civilizations. Fermi's paradox is this: where are they?

Several possible solutions have been offered to Fermi's paradox, but none so far is universally accepted, let alone emotionally satisfying. Many of the "solutions" suggest that there is some natural function that prevents the development of advanced technological civilizations past the point where we are today. (With available instruments, a civilization at a technological level similar to our own could already be detected at the range of nearby stars.) More ominously, perhaps advanced technology does not, in fact, have survival value. Perhaps there is a natural developmental gap between a species' ability to eradicate (or cripple) itself and the development of mechanisms to prevent that from happening. In a universe of existential threats to living worlds, the most dangerous may be the ones we create – or will create – for ourselves. This insight has encouraged the establishment and growth of such organizations as Humanity+ (formerly the World Transhumanist Association) and the Lifeboat Institute, which engage in projects to anticipate and reduce the potential for catastrophic or extinction events.

Yet even in their discussions of existential threats and the Fermi paradox, there remains relatively little discussion by transhumanists of the political, social, and economic factors that would continue to promote the adoption of extinction technologies. The focus is generally on the risks of technology out of control, or of human error. It is as if, blinded by their liberal faith in reason and the improvement of mankind, transhumanists find it hard to imagine that actions that are rational for an individual or a state might lead to catastrophic outcomes for the world.

Pressures for the adoption of these technologies are analogous to the "security dilemma" discussed by political scientists and game theorists. The term "security dilemma" was coined for the argument that in arming for self-defense a state or other autonomous political actor might in fact decrease its security (Herz 1950). If such armaments are perceived as threatening by others, they are prompted to arm in response. This, in turn, leads the original actor to maintain its security by increasing its own arms. The eventual result of this can be a spiral of rivalry and mistrust (Jervis 1986). Logically, the severity of a security dilemma is related to the ability to distinguish offensive from defensive capabilities, as well as to the perception of the degree of vulnerability to marginal change, the so-called "offense-defense" balance (Glaser 1997).

How does this apply to the politics of transition? In history, technological change has rarely been smooth or rational. The standard model of such change consists of three stages: invention, innovation, and diffusion. Invention is the idea and the demonstration of its feasibility. Innovation is the process by which the invention is brought into use. Diffusion is the spread of the innovation into general use. The process resembles an S-curve, where the cost for early adopters limits diffusion, the costs drop while diffusion increases, and diffusion stabilizes when economies of scale maximize and innovation slows (Schumpeter 2005; Girifalco 1991). Early adopters may have significant advantages, but they have to pay more for them, and late adopters can come to undermine those early gains.

Historically, the period of maximum diffusion has been the most disruptive for social and political structures predicated on the old technologies. The nation-state, for example, was challenged by the development of nuclear weapons and long-range delivery systems. In principle, these technologies undermined one of the primary justifications for the existence of the state, the ability to protect its population from attack. Some intellectuals perceived the situation to mandate the development of a world authority to replace the state, or at least its defense function. This prospect of "one world or none" was undermined by the politics of the Cold War, as well as by the limited distribution of states with stockpiles of nuclear weapons. The situation was also seen as more manageable over time as the superpowers (especially after the Cuban Missile Crisis) recognized the reality of mutual deterrence, developed regimes and routines to control their own forces, and slowed the proliferation of nuclear weapons technology. Today, as Gray (2010) has observed, there has been a transition to a "second nuclear age" in which the fear of vertical proliferation (within the great powers) has been superseded by concern for "horizontal proliferation" to smaller powers and non-state actors. Today the United States has declared its willingness to live in a nuclear-weapons-free world, so long as these weapons also stay out of the hands of others. But the diffusion of the more general technologies of globalization is such that even that is no longer a solution. Increasingly, all states are becoming "hollowed out," unable to provide basic services and unable to maintain legitimacy (Robb 2007).

Given this general pattern, there is even more reason to be concerned with biotechnology, "among the most radical innovation clusters ever introduced" (Adams 2004, 4), and more so the constellation of mutually-reinforcing changes under the rubric of NBIC. Even more than nuclear technology, these new multi-use technologies can be expected to move beyond the control of governments, to smaller groups and to individuals.

If, as seems likely, biotechnology takes the same path as computer technology did a generation ago, a limited set of complex centers will be replaced by hobbyists and home genetics labs, and the hackers and computer virus-writers of today will be joined by genome hackers designing and unleashing biological viruses and nanites. In a nightmare scenario, self-replicating nanomachines might escape confinement, consuming resources and doubling each generation until they consume the planet. But the "gray goo" scenario, as it is sometimes called, is not the only – or anything like the most probable – outcome. More generally, there is nothing to limit the proliferation of NBIC technologies only to users who are able and willing to use them without harm to the innocent. Even if it were possible, there is no agreement on what constitutes "harm" or "improvement."

Change brings unanticipated consequences. If parents or governments take the role of determining exactly what constitutes a "normal" or "acceptable" child, the desires of the parents (if any can be identified) and the state come into conflict. There is a potential for machine intelligences (or previously typical human intelligences stored – or replicated – on a machine) to conflict with the "meat" intelligences that originally created them. There is also the fear that the distinctions among human and (various kinds of) posthuman will lead to conflict amongst the differently abled. Some, such as George Annas, Lori Andrews, and Rosario Isasi, go so far as to describe the modification of human genetics as a "crime against humanity, given that

> The new species, or "posthuman," will likely view the old "normal" humans as inferior, even savages, and fit for slavery or slaughter. The normals, on the other hand, may see the posthumans as a threat and if they can, may engage in a preemptive strike by killing the posthumans before they themselves are killed or enslaved by them. It is ultimately this predictable potential for genocide that makes species-altering experiments potential weapons of mass destruction, and makes the unaccountable genetic engineer a potential bioterrorist. (Cited by Bostrom, 2005b, 206)

From this perspective,

> in a world where designing children has been perfected, the very foundations of democracy could crumble. The Posthuman individual would likely be stronger, smarter, and more attractive. If genetic enhancements of intelligence or strength remain prohibitively expensive to all but the wealthy, however, does government then step in

> and, practicing a beneficent eugenics, guarantee improvements to all? Or do we face a world in which, to recall Jefferson, some arrive in the world with saddles on their backs and others with boots and spurs? (Anderson 2002, 45)

To be sure, a world of powerful and weak, rich and poor, privileged and exploited is nothing new. What are new are the injustices of race and class that could be engineered into the genome itself. Even if these technologies are not abused, they are likely to raise suspicions, promote political and social differentiation, and exaggerate problems that already exist. But most of all there are the consequences we can not anticipate at all. This is, at its base, the root of much of the fear among the bioconservatives. Oddly enough, it is also in keeping with much of the radical critique of neoliberal globalization.

Whatever the concerns, however, there will be technological diffusion. The conflicts and structure of present systems, plus the technical difficulty of verifying and enforcing a global regime to control these technologies, make it likely that their proliferation – much like the proliferation of WMD and computer viruses – could at best be managed and endured.

3. Pressures to adopt transhuman technologies

Even as critics point to the potential for harm from NBIC technologies, they have their own blind spots. In particular, they tend to deemphasize the competitive and hedonic pressures encouraging the adoption of these products. Even in a political environment where U.S. government advisory panels are stacked to limit the research and application of stem-cell treatments, NBIC as a general research program has received substantial and growing support. Current sponsors of NBIC programs in the U.S. government alone include the National Aeronautics and Space Administration (NASA), the Department of Defense (DoD), the Department of Energy (DoE), the National Institutes of Health (NIH), and the Department of Agriculture. Much of the most promising work is under the auspices of the Defense Advanced Research Projects Agency (DARPA). Excluding "black" programs, U.S. government funding for nanotechnology alone has doubled between 2001 and 2005 (Michelson 2005, 52). Outside of the government, corporate spending in all of these fields virtually exploded over the same period. Again, nanotechnology is an indicator of the general trend, with 63 percent of the 30 companies in the Dow Jones Industrial Average funding research and development in that field in 2004 (Michelson 2005, 58).

Neither transhumanism nor its critics have yet to have any substantial impact on open-source military literature or planning (Evans 2007). The idea of human enhancement in the service of the state, however, has become a subject for research and speculation. DARPA has engaged in a program for "Metabolic Dominance" which would "enable superior physical and physiological performance of the warfighter by controlling energy metabolism on demand" (cited by Auer, 2004, 1). There is also a Metabolic Engineering Program, which "seeks to develop the technological basis for controlling the metabolic demands on cells, tissues, and organisms," beginning with blood and blood products (Goldblatt 2002, 337). Peak performance is encouraged by devices to control body temperature, "nutriceutical" foods and "first strike rations," and "tweaking" mitochondria to increase energy and reduce fatigue. An Augmented Cognition program has aimed to extend the ability to manage information, while the Continuous Assistance Performance (CAP) program has as its goal "to discover pharmacological and training approaches that will lead to an extension of the individual warfighter's cognitive capability by at least 96 hours and potentially by more than 168 hours without sleep" (Goldblatt 2002, 339-340). The soldier, in this vision, will be more focused, smarter, and have a better memory. He or she would be stronger, fast-healing, and capable of functioning for days at a time without food or sleep

(Auer 2004, 1). War, and the threat of war, have already accelerated human evolution (Bigelow, 1970). But now it can be by design:

> Today DARPA is in the business of creating better soldiers – not just by equipping them with better gear, but by improving the humans themselves. "Soldiers having no physical, physiological, or cognitive limitations will be key to survival and operational dominance in the future, " Goldblatt once told a gathering of prospective researchers. Until mid-2003 he was head of the Defense Sciences Office (DSO), a DARPA branch that focuses on human biology. "Imagine if soldiers could communicate by thought alone," he went on. "And contemplate a world in which learning is as easy as eating, and the replacement of damaged body parts as convenient as a fast-food drive-thru. As impossible as these visions sound ... we are talking about science action, not science fiction." (Garreau 2005)

At present, the technology is not sufficiently developed to apply to battlefields, but the potential is there. Will individuals consent to this kind of augmentation? Competitive pressure may leave them with no practical alternative. For others, the choice could be perceived as liberating. At one time the marketing slogan of the U.S. Army was "be all that you can be." In the future it may become "be *more* than you could be."

From the perspective of the military, once one starts down this path there are few logical places to stop. Surveys of research, for example, find that the typical human "clearly shows inhibitions against killing which are part of our biological heritage. The command 'thou shalt not kill' is, so to speak, based on a biological filter of norms" (Eibl-Eibesfeldt 1977, 139). This is inconvenient, to say the least, for armies.

> Upon the biological filter of norms which inhibits killing, is superimposed a cultural filter of norms commanding killing of the enemy. The biological filter of norms is not eradicated by his process of self-indoctrination; since it is still there, it leads to a conflict of norms which is felt as guilt, particularly when the encounter with the enemy becomes a face-to-face one. (Eibl-Eibesfeldt 1977, 139)

Would it not make sense, for both the good of the state and the psychological well-being of the soldier, to mute the biological imperative not to kill?

What happens next? It is possible the treatment may not be reversible. In that case, releasing "enhanced" ex-soldiers into the general population could put that population at risk. If the alterations are heritable, it would mean that there would be children born without the inhibition against killing. The logical response would be never to release the soldiers, and/or to see to it they are incapable of reproducing. On the other hand, if the moral reprogramming can be reversed, a soldier may have to deal with the memory of what he or she was willing to do.

This is speculation. By design, DARPA is in the business of exploring far-out ideas that often don't pan out (Weinberger 2006). At the same time, this is the agency that laid the foundations for the modern internet. Even if its original goals are not met, whatever is found is likely to have significant effects, and some of these effects may be far different from what program managers intend. It is useful to remember the connections between classified research with LSD and other agents as "truth drugs" and the spread of these chemicals into more general use. First adopters and test subjects may find that new technologies meet their needs, even if those technologies fail to meet the requirements of the researchers (Lee 1994).

Besides the military and hedonic motives, a final driver in the adoption of NBIC and enhancement technologies will be economic. "The incentives that drive private-sector innovation" are, in the words of one observer, "real-time, unforgiving, and essentially Darwinian – survival of the smartest." Popular demand, and the profit to be made in meeting that demand, may establish enhancement as a "right," at least for those with the wealth to get it, and "human nature being what it is, improvement and enhancement become a product offering in the global marketplace" (Canton 2005).

In fact, this has already begun. Consider the expansion of the pharmaceutical industry as it has defined new illnesses and promoted "improvements" in the human condition. For several years this industry has been the most profitable in America. By the early 1980s, the most profitable drugs were those to treat anxiety, followed in early 1990s by antidepressants. Later, when Pfizer put Viagra on the market in the late 1990s it became the fastest-selling drug in the history of pharmaceuticals. The enhancement of neurocognitive and other functions with drugs is already normal, and increasingly these drugs are used by people who are not considered "ill" (Sententia 2005). If the pharmaceutical and biotechnology firms can find a way to profit from a new enhancement technology, "it's hard to imagine that they'll resist" (Elliot 2003). Any firm that would do so would be at a competitive disadvantage in the marketplace. Even if these tools are prohibited by law, the experience of the U.S. "war on drugs" suggests that the ban would only drive their use underground.

Thus, there are at least two reasons to expect the adoption of transhuman and NBIC technologies. First, the transcendence of past limitations feels good. Second, these technologies will provide a comparative advantage for those who adopt them. Ford (2007) refers to the projection of laissez-faire competition between families to accrue competitive advantage in the "new eugenics." Others predict that an "unregulated market would naturally create disincentives for parents to have gen-natural children due to the competitive disadvantage they would face and the medical costs of children with inherited diseases. The gap between the haves and have-nots, Caucasians and minorities, males and females, and able and disabled would widen" (Adams 2004, 62-63). Any attempt to close these gaps through action by the state would lead to "an unprecedented expansion of the welfare state as it sought to ensure a baseline for genetically healthy humans." In a democracy, "norm creep" (Adams 2004, 63) would be a natural result as advantaged parents sought to exceed whatever floor the government set, which in turn could lead to countervailing political pressure for the government to raise the floor and guarantee a competitive "head start" to all the recipients of its enhancement-welfare program.

At an international level, a competition to provide enhancements could take a form similar to tax havens and weak regulatory zones found today. For military and economic reasons, the danger that could come from being left behind would prompt actors to match or exceed the programs of potential rivals. The fear of being caught by surprise can be a powerful motivation for research and development. A security dilemma is the logical result.

Perhaps a "clash of genomes" will emerge as the tendency for national styles in military technologies and strategies is reflected in the choices of enhancements and techniques. Today, different countries have distinct styles in their design of weapons (Cohen 2010, 143). Just as a dictator would not design the same kind of "improvements" in his people as those people would choose for themselves, a fundamentalist society would not encourage the same "enhancements" as a liberal one.

More generally, different cultures emphasize varying elements of our common humanity as being praiseworthy. They have different notions of what it means to be human, and the responsibilities, if any, that one human owes another. We should expect that "different cultures will define human performance based on their social and political values" (Roco 2007, 78). Those groups will have a capability to remake themselves to reflect those values. The most simple of sorting techniques – to choose the sex of a baby – when coupled with local cultures and state policies, has already altered prior demographic balances, and with them the dimensions of future international and internal conflict (Hudson and Den Boer, 2005). What would be the consequences of more advanced techniques of directed evolution for global politics?

4. Security and conflict in a transhuman world

Even without modifying our basic humanity, current technologies have altered the relationship between individuals and states. Globalization "gives more power to individuals to influence both markets and nation-states than at any other time in history" (Friedman 2002). In the words of author William Gibson (1999), "the future is already here – it is just unevenly distributed." Sometimes the distribution is not to the benefit of states. Consider, for example, the "war" between the United States and Al Qaeda, led by the "superempowered" Osama bin Laden.

Even when the methods of empowerment are external, like the World Wide Web or the system of transcontinental air travel, great powers like the U.S. have already found themselves pushed to mirror the capabilities and approach of superempowered individuals. While today's superempowered individuals are such by virtue of wealth or networks or personal skills, the superempowered individual of tomorrow may be transhuman or posthuman. Technologies will amplify the power of individuals to the point that a single person could conceive of taking on the world – and winning.

Again, what we would have is a classic security dilemma: each group or individual that could modify itself, uncertain of the intention of other groups to take advantage of NBIC technologies for unilateral gain, would have reason to act as if the worst might happen. Each might see some value in selecting for greater cooperation, or greater empathy, or reduced aggressiveness. But unless everyone can be trusted to make such modifications, those who choose another path would have a competitive advantage. In a world of sheep, the wolves rule. The wolves who already exist are unlikely to volunteer to join the sheep.

Some may take it upon themselves to "tame" humanity. But this effort to tame the human animal, besides being morally repugnant, would fail to achieve its goal. The "zookeepers," however enhanced, will remain imperfect, and will likely be in competition with one another. Who or what will restrain the elites? The situation is analogous to the competition among sovereign states today, only far less orderly.

5. Security after a singularity

Some optimistic transhumanists take solace in the prospect that new kinds of actors, far beyond human, will emerge to save the day. Others see it as essential. The possibilities inherent in NBIC technologies have led transhumanist philosopher Nick Bostrom (2007b) to conclude there are four general futures for humanity: extinction, recurrent collapse, plateau, and posthumanity. The rate and direction of change points to what John von Neumann speculated would be "some essential singularity in the history of the race beyond which human affairs, as we know them, could not continue" (cited Bostrom 2007b). Today, futurists refer to "the singularity" as the "conjecture that there will be a point in the future when the rate of technological development becomes so rapid that the progress-curve becomes nearly vertical."

> Within a very brief time (months, days, or even just hours), the world might be transformed almost beyond recognition. This hypothetical point is referred to as the singularity. The most likely cause of a singularity would be the creation of some form of rapidly self-enhancing greater-than-human intelligence. (WTA 2008c)

This prospect has sometimes been referred to as "the rapture of the nerds." In 1965, statistician I.J. Good argued:

> Let an ultraintelligent machine be defined as a machine that can far surpass all the intellectual activities of any man however clever. Since the design of machines is one of these intellectual activities, an ultraintelligent machine could design even better machines; there would then unquestionably be an "intelligence explosion," and the intelligence of man would be left far behind. Thus the first ultraintelligent machine is the *last* invention that man need ever make… (Cited Bostrom 2007)

Good expected this machine to be built before the end of the twentieth century. Needless to say, ultraintelligence has proven more difficult than he imagined. Yet progress, however slow, has been made. Author and mathematician Vernor Vinge estimated in 1993 (cited by Bostrom 2007) that "[w]ithin thirty years, we will have the technological means to create superhuman intelligence. Shortly thereafter, the human era will be ended."

The world after a singularity event, if it were to occur, would almost certainly "be geo-politically destabilized" (Evans 2007, 162). With innovation building on innovation, first-adopters would have a significant advantage over others – so long as they could maintain some semblance of control over their machines and progeny. If they can not maintain that control, the new actors will accrue the advantage.

What would a post-singularity security competition look like? One way to look at it is as a logical extension of the evolving "generations" of war. In this analysis, as popularized by a rising generation of strategic analysts, first-generation war involved line-and-column tactics between soldiers of the state. The second generation applied machines and indirect fire, third-generation war involved industrialized mass armies, and the fourth generation involves political-economic struggles among networks. If past war has centered on an enemy's physical strength, and fourth-generation war on his moral strength, a fifth generation of war might focus on breaking his intellectual strength. It would require even more deception, and out-thinking of an opponent, than has been seen before. It would be most successful, in fact, if the target did not even realize it was taking place.

Third generation war, as seen in World War II, relied on industrial and political mobilization. In fourth generation war, the sort that involved Mao or Ho, political mobilization was critical. In fifth generation war, if political mobilization tips off your enemy, it is worse than useless. In the fifth generation, (1) "the people do not have to want to be on the fighter's side," (2) "the forces the fighter is using do not have to want to be on the fighter's side," and (3) "your enemy must not feel that he is not on your side" (Abbot 2005b).

It would be a kind of struggle that in many ways transcends our normal conceptions of conflict. In a post-singularity, fifth-generation world, there would always be the possibility that the economic collapse or natural disaster was not the result of chance, but of design. There would always be the possibility that internal social changes are being manipulated by an adversary who can plan several moves ahead, using your own systems against you. The systems themselves, in the form of intelligences more advanced than we can match, could be the enemy. Or it might be nothing more than paranoid fantasies. The greatest problem that individuals and authorities might have to deal with may be that one will never be sure that war is not already under way. Just as some intelligence analysts cited the rule that “nothing is found that is successfully hidden” – leading to reports of missile gaps and Iraqi WMD – a successful fifth generation war would one that an opponent never even realized he lost.

Is it the end of politics if some or all actors are not human? Is it the end of the “international” politics when “nations” make and remake themselves? In theory, transhuman agents may be less of a problem than they first appear to be. Humans are already unequal in many respects. In fact, a liberal society does not require identical power or other attributes, only equality before the law. One proponent of “liberation biology” argues that

> political equality has never rested on the facts of human biology. In prior centuries, when humans were all "naturals," tyranny, slavery, and purdah were common social and political arrangements. In fact, political liberalism is already the answer to Fukuyama's question about human and posthuman rights. In liberal societies the law is meant to apply equally to all, no matter how rich or poor, powerful or powerless, brilliant or stupid, enhanced or unenhanced.
>
> The crowning achievement of the Enlightenment is the principle of tolerance, of putting up with people who look differently, talk differently, worship differently, and live differently than we do. In the future, our descendants may not all be natural homo sapiens, but they will still be moral beings who can be held accountable for their actions.There is no reason to think that the same liberal political and moral principles that apply to diverse human beings today wouldn't apply to relations among future humans and posthumans. (Bailey 2004)

Bostrom, the philosophical dean of contemporary transhumanism, emphasizes that enhanced humans would retain their moral agency (2005a). This parallels his belief that individuals “should have broad discretion over which of these technologies to apply to themselves” (Bostrom 2005b, 202). But even if this were to be true within a liberal community, the world is not yet such a community. Although “NBIC enhancements in human performance will take us closer to abilities reserved for gods in most of our traditional stories” (Gorman 2005), the gods of myth were not without conflict, and often it was the humans who paid the price.

Perhaps it will be possible to establish superordinate goals that promote the development and diffusion of transhuman and NBIC technologies without the threat of a common enemy or the grasping for temporary advantage. Perhaps exploration, or a threat of catastrophic climate change, will encourage the development of a just and sustainable global civilization. Perhaps the benefits of local nanotechnology can be spread far enough, fast enough, to make competition over resources a waste of effort. Perhaps we will evolve past the point of violence and zero-sum games.

Perhaps, but not likely. Just as we now carry within the traces of our animal ancestors, posthumans – whether biological, or electronic, or some mix of the two – will carry traces of us within them. The international system as it is will shape the ways in which NBIC technologies are developed and applied, even as they will reshape that system. There is no reason to assume an end to politics, or to concerns with security. Instead, the threats will be more subtle, strategies more complex, and outcomes less definitive.

5. Human security and the posthuman future

Human security is, at its core, the shift in perspective from the state to the individual as the proper subject to secure. The United Nations Development Program's *Human Development Report* (1994) subdivided human security into seven threat areas: economic security, food security, health security, environmental security, personal security, community security, and political security. Advances in NBIC technologies will have a substantial impact in each of these areas. In addition, these technologies raise the prospect of a new dimension to human security: the protection of human identity and dignity in a posthuman world.

In the short run, economic security is threatened by the continued advance of NBIC technologies. Inequities of class and region and race may well be made worse by the uneven distribution of these tools. Since the powerful and wealthy will have first access, competitive and hedonistic pressures can be expected to increase the gap between haves and have-nots.

In the long run, a wider distribution of these technologies raises the prospect of mass political action to "raise the floor" of human potential, and this could also be encouraged by competition among states, firms, and other groups who see in the improvement of their "human capital" the potential for enhanced power. Here the risk is that elites may wish to maintain their position by keeping the best enhancements for themselves. Another is that competition among groups will encourage the powerful to impose a "tracking" of persons into differentiated and over-specialized "species" within groups. Physical and social division of labor would be matched by, and reinforced by, a genetic division of labor.

Food security may well be improved by breakthroughs in NBIC technologies. Not only will the application of genetic engineering and nanotechnology raise crop yields, rations developed for the battlefield will have applications after natural disasters and for communities suffering from malnutrition. Modifications of the human body, based in "supersoldier" technology may, if extended to others, permit individuals to do more with less.

Health security is transformed by the potential of NBIC technologies. Rather than aiming for "wellness" the new goal could be to be "better than well." This would be a constantly rising standard for achievement, and given the differences among cultures it might not be the same standard for all. Arguments about how much, and what kinds, of enhancement are enough – and what kinds are a "right" of personhood – will further complicate efforts to provide "adequate" health care for all.

Environmental security is threatened directly by the ability of NBIC technologies, especially those involving self-replication, to flood the environment with nanomachines and new organisms. While the "gray goo" scenario is unlikely, it is likely that the next generation will produce viruses and bio-machines that will infect humans and the environment in which they operate, much as computer viruses do today.

Widespread application of NBIC technologies will have a direct effect on community security, but the direction of the effect depends on the choices made. Widespread modification of humans by humans would lead to blurring traditional lines of ethnicity, both for good and for ill. On the other hand, the ability of cultures to recreate themselves to achieve their local conception of "better," coupled with competitive pressures and the potential for speciation, open new horizons for conflict among groups who might not recognize one another as human.

Personal and political security are at risk from the potential for abuse of NBIC technologies by States and other organizations. Left in the control of elites, these technologies could be used to create dystopian societies to rival anything in science fiction. In fact, the entire notion of personhood could be at risk. If these technologies can be distributed and regulated for the good of the community, however, they hold the promise of making a far better world. The diversity of humanity could be recognized as a value to be protected, even as people learn to see beyond external forms to the humanity within. Yet even under the best regulatory regime, the pressures of competition and the desire of each individual to improve set up the potential for a dilemma that affects not merely the interaction and security of states, but the lives and liberty of each person. This is not a danger that can be edited out of the human genome, for it is inherent in the nature of competitive interaction, coupled with the expected comparative advantage of those who choose to take advantage of the new technologies.

Here, then, is the conundrum: in our attempt to remake ourselves, we will not entirely leave our old selves behind, any more than we have escaped our animal past, and nor will we escape the pressures inherent in social and political systems. The balance of factors argues that change is coming. Evolution never ends, even when it is to some extent self-directed. Yet like so many other technologies, the tools of evolution-by-design will not solve the most basic problems of human or global security. There are things we cannot or will not leave behind. Trapped by the dilemmas inherent in security and economic competition, political and security issues will continue to challenge our descendants, no matter what forms or enhancements they possess.

Appendix: A sample of applications of NBIC technology for warfighting, with projections for when each will be achieved[2]

2010 Virtual-reality battlefields and war-gaming simulations are sufficiently realistic to revolutionize combat training.

2015 Human biochemistry will be modified to allow soldiers and pilots greater endurance for sleep deprivation, enhanced survivability from injury, and enhanced physical and psychological performance.

2020 Uninhabited combat vehicles. Adaptable smart materials. Microfabricated sensors to warn of chemical, biological, radiological, or explosive devices. Effective measures against biological, chemical, radiological, and nuclear attack.

2025 The human body will be more durable, more energetic, easier to repair, and more resistant to stress, biological weapons, and aging.

2035 Nano-enabled sensors will be implanted inside the body to monitor health.

2045 Warfighters will be able to control weapons and combat vehicles through thought, perhaps including the ability to react before the thought is fully formed.

Notes

1. Wilson 1998, 302-303.

2. These estimates are based on the median of the judgments of participants and authors in the first three National Science Foundation conferences on NBIC technologies. They are extracted from a list of 76 applications found in Appendix 1 of Bainbridge (2005).

References

Abbott, Dan. 2005. Dreaming the fifth generation war. *Txdap* (**http://tdaxp.blogspirit.com/archive/2005/07/20/dreaming-5th-generation-war.html**) 20 July 2005, accessed 9 March 2008.

Adams IV, Nathan A. 2004. Creating clones, kids and chimera: Liberal democratic compromise at the crossroads. *Issues in Law and Medicine* 20:3 (Summer): 2-69.

Agar, Nicholas. 2007. Whereto transhumanism? *Hastings Center Report* 37 (May): 12-17.

Anderson, Brian C. 2002. Identity crisis. *National Review* 54, 10 (3 June): 41-45.

Auer, Catherine. 2004. Super snacks for super soldiers. *Bulletin of the Atomic Scientists* 60, 3 (May-June): 8.

Bailey, Ronald. 2004. Transhumanism: The most dangerous idea? *Reason Online* (http://www.reason.com/news/show/34867.html) (24 August), accessed 26 February 2008.

Bainbridge, William Simms, and Mihail C. Roco, ed. 2005. *Managing nano-bio-info-cogno innovations: Converging technologies in society*. Washington, D.C: Springer.

Baylis, John, James J. Wirtz and Colin S. Gray, ed. 2010. *Strategy in the contemporary world* Oxford: Oxford University Press.

Bendle, Mervyn F. 2002. Teleportation, cyborgs, and posthuman ideology. *Social Semantics* 12, 1 (April): 45-62.

Bigelow, R. S. 1970. *The dawn warriors: Man's evolution toward peace*. London: Hutchinson.

Bostrom, Nick. 2005. In defense of posthuman dignity. *Bioethics* 19, 3 (June): 202-214.

Bostrom, Nick. 2005. The transhumanist dream (letter to the editor). *Foreign Policy* (January): 4.

Canton, James. 2005. NBIC convergent technologies and the innovation economy: Challenges and opportunities for the 21st century. In Bainbridge and Roco 2005.

Cebrowski, Arthur K., and Thomas P. M. Barnett. 2003. The American way of war. *Proceedings* (January): 42-43.

Cohen, Eliot. 2010. Technology and warfare. In Baylis, Wirtz, and Grey 2010: 141-60.

Dacey, Austin. 2004. The new perfectionism. *Free Inquiry* 24, 4 (June): 24-26.

Darnovsky, Marcy. 2010. "Moral questions of an altogether different kind": Progressive politics in the biotech age. *Harvard Law and Policy Review* 99, 4 (Winter): 99-119.

Dvorsky, George. 2004. Better living through transhumanism. *Humanist* 64, 3 (May): 7-10.

Eibl-Eibesfeldt, Iraneus. 1977. Evolution of destructive aggression. *Aggressive Behavior* 3, 2: 127-44.

Elliott, Carl. 2003. Humanity 2.0 *Wilson Quarterly* 27, 4 (Autumn): 13-21.

Evans, Woody. 2007. Singularity warfare: A bibliometric survey of militarized transhumanism. *Journal of Evolution and Technology* 16, 1 (June): 161-65.
http://www.jetpress.org/v16/evans.html

Fox, Dov. 2007. Silver spoons and golden genes: Genetic engineering and the egalitarian ethos. *American Journal of Law and Medicine* 33: 567-622.

Fransman, Martin. 1994. Biotechnology: Generation, diffusion and policy. In *Technology and Innovation in the International Economy*, ed. Charles Cooper, 41-147. Brookfield, VT: Edward Elgar.

Friedman, Thomas L. 2002. Excerpt from the author s *Longitudes and latitudes*.
(http://www.thomaslfriedman.com/longitudesprologue.htm) Accessed 9 March 2008.

Fukuyama, Francis. 2002. *Our posthuman future: Consequences of the biotechnology revolution*. New York: Farrar, Straus and Giroux.

Fukuyama, Francis. 2004. Transhumanism. *Foreign Policy* 144 (September): 42-43.

Garreau, Joel. 2005. Perfecting the human. *Fortune* 151, 11 (30 May): 101-108.

Gibson, William. 1999. The Science of science fiction. *Talk of the Nation* radio program (30 November).

Girifalco, Louis A. 1991. *Dynamics of technological change*. New York: van Nostrand Reinhold.

Goldblatt, Michael. 2002. DARPA's programs in enhancing human performance. In Roco and Bainbridge 2002: 297-300.

Hudson, Valerie M., and Andrea M. Den Boer. 2005. *Bare branches: The security implications of Asia's surplusmMale population*. Boston: MIT Press.

Habermas, Jurgen. 2003. *The future of human nature*. Trans. Hella Beister and William Rehg. Cambridge, UK: Polity Press. (First published in German 2001.)

Jervis, Robert. 1986. Cooperation under the security dilemma. *World Politics* 30, 4 : 167-214.

Kass, Leon R. 1997. The wisdom of repugnance: Why we should ban the cloning of humans. *The New Republic*. 216: 17-27.

Kurzweil, Raymond. 1999. *The age of spiritual machines: When computers exceed human intelligence*. New York: Penguin.

Lee, Martin A., and Bruce Shlain. 1985. *Acid dreams: The complete social history of LSD*. New York: Grove.

McKibben, B. 2003. *Enough: Staying human in an engineered age*. New York: Times Books.

Michelson, Evan S. 2005. Measuring the merger: Examining the onset of emerging technologies. In Bainbridge 2005.

Pattinson, Shaun D., and Timothy Caulfied. 2004. Variations and voids: the regulation of human cloning around the world. *BMC Medical Ethics* 5:9.

President's Council on Bioethics. 2003. *Beyond therapy: biotechnology and the pursuit of happiness*. Available at www.bioethics.gov/reports. New York: Regan.

Robb, John. 2007. *Brave new war: The next stage of terrorism and the end of globalization*. Hoboken, NJ: Wiley.

Robinett, Warren. 2002. The Consequences of fully understanding the brain. In Roco and Bainbridge 2002.

Roco, Mihail C., and William Sims Bainbridge, ed. 2002. *Converging technologies for improving human performance*. NSF: Arlington, VA.

Schumpeter, Joseph A. 2006. *Capitalism, socialism, and democracy* London, Routledge.

Sententia, Wyre. 2005. Cognitive enhancement and the neuroethics of memory drugs. In Bainbridge and Roco 2005.

United Nations Development Program. 1994. *Human Development Report*.

Verdoux, Phillipe. 2009. Transhumanism, progress, and the future *Journal of evolution and technology* 20, 2 (December): 49-69.
http://jetpress.org/v20/verdoux.htm

Waltz, Kenneth N. 1979. *Theory of international politics*. New York: Random House.

Wilson. Edward O. 1998. *Consilience: The unity of knowledge*. New York: Vintage.

World Transhumanist Association. 2008a. Transhumanist FAQ
http://www.transhumanism.org/index.php/WTA/faq21/46/ accessed February 16, 2008.

World Transhumanist Association. 2008b. Transhumanist FAQ 1.2
http://www.transhumanism.org/index.php/WTA/faq21/56/, accessed February 16, 2008.

World Transhumanist Association. 2008c. Transhumanist FAQ 2.7
http://www.transhumanism.org/index.php/WTA/faq21/64/, accessed February 16, 2008.