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## H-Diplo | ISSF Roundtable on “Biology and Security”

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“Unlocking the Secrets of Human Biology: Implications for Diplomacy, Security, and War.”

The role of biology in human conflict has been a perennial concern for those who reflect on the causes and nature of war. Now, revolutionary advances in the biomedical sciences are reorienting how we think about these issues, as well as providing new tools to deal with them. The implications for security studies will undoubtedly be widespread. However, the sheer quantity and scope of novel biological research confronts us with the challenge of understanding where its true promises lie. From a theoretical perspective we need to ask whether new research fundamentally changes important paradigms in the field. From a practical perspective, finite resources force us to make bets on which research is likely to be most useful to pursue. Thus it is worth taking a bird’s eye view to survey and appraise the promises and limits of biological research as it relates to security issues across the board.

Connections drawn between biology and conflict are indeed old. The greatest war epic of the ancient world begins with the "wrath of Achilles" and the devastation it wrought. Throughout *The Iliad*, the actions of Achilles and other heroes such as Agamemnon, Odysseus, and Hektor are described in animal terms, likened to the fury of a lioness trying to regain her cubs, the rampage of hounds against a savage boar, and the desperation of two beasts vying for control of a little spring of water.<sup>1</sup>

These comparisons are more than mere literary device. The association of war with animality in the history of political thought, of which Homer is but one originaive example, points to deep concern about the foundations of aggression in human biology. As “rational animals” humans appear truly exceptional. However, in the face of conflict human rationality is often focused and transformed by what is characteristically described as destructive, animalistic passion. *Homo homini lupus* — man is a wolf to man — as the ancient saying goes. Moreover, there is a strong tradition of associating human “passions” with baser animal instincts, as something to be mastered and controlled by higher capacities of reason and judgment.

Thucydides described the tremendous destruction and social upheaval of the Corcyrean Revolution, spun out of control through the intrigues of a few political elites, in terms that raised basic questions about human nature: “the sufferings which revolution entailed upon the cities were many and terrible, such as have occurred and always will occur, as long as the nature of mankind remains the same...In peace and prosperity states and individuals have better sentiments, because they do not find themselves suddenly confronted with imperious necessities; but war takes away the easy supply of the daily wants, and so proves

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<sup>1</sup> Homer. *The Iliad* trans. Richmond Lattimore (Chicago: University of Chicago Press, 1951) Bk. 18.318; 11.292; 16.825.

a rough master that brings most men's characters to a level with their fortunes." In the midst of violent revolution Thucydides claimed "revenge was held of more account than self-preservation" and observed that "human nature gladly showed itself ungoverned in passion."<sup>2</sup>

Thucydides diagnosis of the causes and effects of human conflict is suggestive on many fronts. Not only does he share the classic perspective that sees ungoverned passions as a source of conflict, but he also draws attention to the permanence of conflict, due to its roots in human nature, as well as the liability of that nature to be vexed by both daily wants and more complex concepts like honor and revenge.

Our understanding of human nature has changed dramatically since ancient times, due in large part to advances in the bio-medical sciences. The dichotomies we draw between passions and interests, emotions and rationality, dispositions and habits have been reconfigured and complicated in various ways. However, the basic insight — that decisions about, and conduct within, war alerts us to the animality of the human animal — remains a profound one. What is dramatically new is the possibility of understanding and manipulating biological dimensions of human behavior in ways that can be useful for security, victory, and peace. In the past we could do little more than describe and lament the limitations and complexities of human nature. However, over the last few decades developments in genomics, neuroscience, and molecular biology have granted unprecedented insights into our biological constitution, many of which hold significant implications for security, broadly construed.

The pace of these discoveries is fast and their implications widespread. The modest purpose of this essay is to offer a brief introduction to the technologies that are currently revolutionizing biological research, followed by a quick-moving overview of the actual and possible security applications of our emerging knowledge. In particular, I will consider the implications for security under three main categories: elite decision-making and diplomacy, domestic security and counter-terrorism, and the conduct of war. However, in illustrating the relevance of biological research to a broad range of security questions, I also mean to draw attention to potential limits of this research for many larger, theoretical debates in the field. Advances in biology will fundamentally change the way we think about many security dilemmas and the resources we have to deal with them. However, there are also perennial questions that cannot be addressed by this research — understanding that will be an important part of using biological insights to our greatest benefit.

## **A New Universe of Biological Research**

Gene sequencing and brain imaging technologies have been the driving motor of the current revolution in biological knowledge. Each has opened up new areas of biological

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<sup>2</sup> Thucydides. *The Peloponnesian War* trans. Richard Crawley (New York: Random House, 1962). Bk 3.82-85.

inquiry that were unthinkable only a generation ago and dramatically contributed to advances in molecular biology.

The human genome contains some three billion nucleotide base pairs comprising over 20,000 genes, which together form the blueprints of human life. The genetic architecture we inherit from our parents is ground zero of human nature. Although our genetic endowment interacts with and is modified by the “environment” in countless ways throughout our lifespan, it is an obvious place to start looking for explanations of disease and behavior. Indeed there are a many diseases that are well characterized by their genetic causes and inherited in classic Mendelian fashion — sickle cell, Huntington’s disease, cystic fibrosis — and others that appear to be strongly influenced by particular gene mutations — breast cancer, colon cancer, Alzheimer’s. Also, various genetic conditions are known to cause or contribute to certain psychological and behavioral deficits, such as Down syndrome, fragile X, and Lesch Nyhan syndrome. When it first became clear that advances in gene sequencing techniques would enable researchers to map the entire human genome there was considerable excitement in the hope that we would discover simple genetic explanations for a wide range of diseases and that the explanatory power of genetics could extend to patterns of human behavior, psychological dispositions, and character traits.

Unfortunately, progress in disease genomics has been slower going than many envisioned. Although our genetic architecture must necessarily be part of the story of how diseases arise in conjunction with environmental interactions, the degrees of complexity involved are increasingly understood to be far greater than previously imagined. The classic model of Mendelian inheritance, in which a single trait (or phenotype) is caused by a single gene (or gene variant, called an allele), is the exception rather than the rule when it comes to understanding the origins of most diseases. These may depend on multiple gene interactions combined with extensive environmental influences, not to mention complicated dynamics at the level of epigenomics and ongoing mutations. To take but one example, schizophrenia is highly heritable and thus should presumably be an ideal candidate for genetic analysis. However, studies have repeatedly failed to identify any particular genetic variations significantly associated with the disease.<sup>3</sup> More recently, researchers have suggested that there may be many small, random mutations that occur on dozens of various genes involved in brain function, any of which can produce symptoms classified as schizophrenia.<sup>4</sup> If true, this tremendously complicates attempts to pharmacologically ameliorate the genetic sources of “schizophrenia,” as there may be hundreds of different, particular mutations that lead to the disease — or, to be more accurate, hundreds of discrete diseases.

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<sup>3</sup> B. Riley and K. Kendler, “Molecular Genetics of Schizophrenia” in *Neurobiology of Mental Illness* (Charney and Nestle eds.) pp. 247-262, Oxford: 2005. (<http://books.google.com/books?id=5Cr7ABelO1EC>)

<sup>4</sup> Duke Medicine News and Communications, “Schizophrenia Genetics: Evidence Fingers Emerging Class of Culprit” ([http://www.dukehealth.org/health\\_library/news/schizophrenia\\_genetics\\_evidence\\_fingers\\_emerging\\_class\\_of\\_culprits](http://www.dukehealth.org/health_library/news/schizophrenia_genetics_evidence_fingers_emerging_class_of_culprits))

If understanding the genetic sources of disease is complicated, investigating the genetic sources of human behavior promise to be even more complex — although there have been notable discoveries (discussed below). To statistically enable the kind of studies that could hope to tease out higher orders of complexity requires massive amounts of data. It is possible to sequence targeted areas of interest in the genome (examining particular “single nucleotide polymorphisms,” i.e. genetic variations) for a low cost. Already there is a flood of genetic data coming down the research pipeline, and we will increasingly have access to an expanding universe of genetic information matched to varieties of survey and behavioral data. However, only time will tell if more complex and informative genetic relationships can be discovered through statistical innovations utilizing larger and more refined data sets.

A few immediate consequence of the genomic revolution for the social sciences are worth noting. First, it has refocused debates about human nature on the phenomenon of variation. There have always been significant controversies in the anthropology, sociology, psychology, and philosophy concerning whether human nature should be understood as something fundamentally universal (and, if so, the basis for that universality) or segregated into meaningfully different types (ranging from caste hierarchies to neutral, complementary diversities). Positions in these debates fall along a spectrum, but our increasing recognition of the amount of genetic variation present (or possible) in the human species has led many to re-conceive of human nature as itself fundamentally diverse. This has in turn led to a renewed interest in identifying “character types” with an eye towards establishing their roots in human genetic variations. Also, this perspective has led many to suspect that explanations of abnormal/deviant behavior are to be found at the genetic level (or in physiological states derivative of particular gene-environment interactions).

Second, increasing recognition of the complexity involved in our genetic architecture has also illuminated the limits of “purely” genetic explanations of the human organism. Genes are always part of the story, but they are seldom the full story. Our genetic architecture puts in motion biological systems that recursively interact with and are modified by their environments and which reflect many stochastic influences as well. This is particularly the case with the most complex and plastic of genetically engineered organs, the human brain.

Research at the intersection of “Mind, Brain, and Behavior” has also been subject to radical advances in recent years driven by technological developments. Various imaging and measurement techniques such as electroencephalograms (EEG), positron emission tomography (PET), and functional magnetic resonance imaging (fMRI) have granted a window of sorts into the brain. They promise to shed new light, not only on various brain pathologies, but also on the very nature of human perception, decision-making, and consciousness. These technologies bring us much closer to understanding the biological dynamics immediately underlying human behavior and, like genomic technologies, they have spurred an enormous quantity of new research. According to one estimate, in 2007

about eight peer-reviewed articles employing fMRI were published per day.<sup>5</sup> Neurological research has also greatly expanded our understanding of chemical pathways and systems in the brain, illuminating the influence of neurotransmitters (e.g. dopamine, norepinephrine, and serotonin), hormones (e.g. cortisol, testosterone, oxytocin) and other chemicals on brain function and human behavior.<sup>6</sup>

The human brain is in some sense the final frontier of biological research. Going forward, deep debates about the relationship between the mind and the brain will undoubtedly persist and become richer, but many of the findings in neuroscience will prove useful regardless of how these deeper debates develop.

### **Implications for Elite Decision -Making and Diplomacy**

Perhaps no concept in the social sciences has been more heavily influenced by biological research in recent decades than rationality. The history of this concept is complex, but to a large extent the social sciences in the 20th century treated rationality as a normative ideal. Rationality could mean consistency in preferences (reflexivity, transitivity, and completeness), the use of probability theory to deal with risk, Bayesian updating from past experiences, or even scientific induction more generally. Rationality, thus construed, had to do with whether people chose the best means to instrumentally achieve their goals and the logical consistency of those goals. Irrationality was something that should not persist because it is suboptimal from an agent's perspective and enables exploitation by others. Thus, "rational behavior," subjectively defined, could be expected from most people, and on the basis of such expectations social scientists could make useful predictions.

However, behavioral research of the last few decades increasingly demonstrated that people often do not adhere to normative ideals of rationality. Rather, people exhibit inconsistent preferences, perceptual biases, inefficient strategies, and so on. This led to the development of more sophisticated accounts of rationality that attempted to explain apparent irrationality by deeper rational considerations. These included accounts such as rational ignorance, bounded rationality, satisficing (accepting suboptimal outcomes in light of the disproportionate costs of achieving optimal ones), and minimaxing (minimizing the maximal potential for loss). Although there does appear to be some method to the apparent madness of many human behaviors — which is to say we are often "predictably irrational" to use Daniel Ariely's term — biological research has shown why it is likely a mistake to think there is a universal, single, underlying unity to human decision-making. Although there may be some conceptual unity to an agent's beliefs, goals, and strategies, our physiology also makes us liable to various deviations from intellectual coherence. The traditional catalog of vices — lust, gluttony, sloth, anger, envy, greed, pride, etc — is not a

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<sup>5</sup> "Jonah Lehrer, "Picture Our Thoughts: We're Looking for Too Much in Brain Scans," The Boston Globe (August 17, 2008). Cited by Selim Berker, "The Normative Insignificance of Neuroscience"

<sup>6</sup> For a good overview see J. Blaustein and A. Lajtha, *Handbook of Neurochemistry and Molecular Neurobiology: Behavioral Neurochemistry and Neuroendocrinology* 3<sup>rd</sup> Edition, (Springer: 2006).

bad place to start looking for manifestations of our biological liabilities. Moreover, many of these liabilities have a good biological rationale. We need biases, heuristics, and dispositions in order to cognitively manage our world. The question for those interested in diplomacy is whether these liabilities adversely influence elite decision-making and, in the likely event they do, how to predict and manage these influences.

To approach this as a central question for security studies is to already to adopt, or at least entertain, Kenneth Waltz's so-called "first image" of international relations, according to which, "the locus of the important causes of war is found in the nature and behavior of man."<sup>7</sup> War, on this account, can result simply "from selfishness, from misdirected aggressive impulses, from stupidity." This explains why studying the psychology of leaders could be such a valuable enterprise, unless it turned out everyone's psychology is either unpredictable or identical. Writing in the 1950s Waltz noted, "the assumption of a fixed human nature, in terms of which all else must be understood, itself helps to shift away from human nature — because human nature, by terms of the assumption, cannot be changed, whereas social-political institutions can be."<sup>8</sup> However, contemporary biological knowledge challenges Walt's assumption that human nature is homogenous. If, instead, there are significant variations in the biological factors that underlie human behavior and these are things we can understand and control, this would provide new hope for addressing some of the fundamental causes of war.

The range of research investigating the neurobiology of decision-making and brain genomics is vast. Many neuroscientists have presented evidence for modular theories of the brain, according to which certain functions are localized in different brain regions. Antonio Damasio has popularized much of his own work that highlights the ways in which emotional centers of the brain are engaged in different cognitive tasks.<sup>9</sup> He argues that "rationality" often depends on significant emotional contributions, which provides a key to understanding many behavioral abnormalities and paradoxes of reason. Others, such as William Uttal, have cautioned against the temptation to reduce brain processes to specific regions and modules, arguing that cognition is always a process that involves the whole brain.<sup>10</sup> His defense of distributed processing places a greater emphasis on the complexity and plasticity of the brain. However, many of the most interesting and robust findings in neuro-chemistry hold regardless of one's theory of brain organization. These

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<sup>7</sup> Kenneth Waltz, *Man, the State, and War: a theoretical analysis*. (New York: Columbia University Press, 1954), 16

<sup>8</sup> *Ibid*, 41.

<sup>9</sup> Antonio Damasio, *Descartes' Error: Emotion, Reason, and the Human Brain*. (New York: Penguin, 2005).

<sup>10</sup> William Uttal, *The New Phrenology: The Limits of Localizing Cognitive Processes in the Brain*. (Boston: MIT Press, 2003).

include associations between sex hormones (testosterone, estrogen) and aggression<sup>11</sup>, neurotransmitters (dopamine, serotonin) and depression<sup>12</sup>, oxytocin and trust<sup>13</sup>, cortisol and stress<sup>14</sup> -to name some of the more prominent discoveries.

The biology of decision-making has a special relevance to international relations and diplomacy because decisions to go to war have provided social scientists with the greatest paradoxes of rationality. According to a prominent line of thinking in the tradition of rational choice analysis, war doesn't make sense. Since war imposes tremendous costs, and one side generally loses, both parties (but particularly the weaker) should be able to negotiate a better outcome *ex ante*. James Fearon's classic article, "Rationalist Explanations for War," forcefully explored this paradox, suggesting that few mechanisms can account for war on strictly rationalist terms and those that can depend in various ways on incomplete information.<sup>15</sup> While there may be rational reasons that complete information is difficult to obtain, there are also plenty of "irrational" factors that might obstruct information as well. Thus, for both rationalist and non-rationalist theories of international relations, one way of explaining why war happens is to point to information asymmetries and misperceptions. In retrospect, it is often quite clear that at least one party made a miscalculation about the enemy's strengths or interests. History also suggests that personalities, tempers, and shifting sentiments of honor and vengeance can fuel misperceptions and short-sighted decisions in strategic contexts.

Robert Jervis famously investigated the sources and nature of misperception in international politics while demonstrating their profound impact on the course of world events in his 1976 book, *Perception and Misperception in International Politics*.<sup>16</sup> We now have good reasons to believe that biological research will further illuminate the systematic cognitive and perceptual biases that Jervis documents. The genetic and neurological foundations of such biases should become clearer, and with this understanding many hope we can better guard against their detrimental influences.

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<sup>11</sup> R. McDermott, et al, "Testosterone and Aggression in a simulated Crisis Game" in *The ANNALS of the American Academy of Political and Social Science* (2007): 614 (<http://ann.sagepub.com/cgi/reprint/614/1/15>)

<sup>12</sup> P. Willner, "Dopamine and Depression" in *Dopamine in the CNS Vol 2* (DiChiara ed.): 387-416 Springer: 2002.

<sup>13</sup> P. Zak, et al. "Oxytocin is associated with human trustworthiness" in *Hormones and Behavior*, 48:5 (2005): 522-527.

<sup>14</sup> K. Vedhara, "An Investigation into the relationship salivary cortisol, stress, anxiety, and depression" in *Biological Psychology* 62:2, (2003): 89-96.

<sup>15</sup> J. Fearon, "Rationalist Explanations for War" *International Organization*. 49:3 (Summer 1995): 379-414

<sup>16</sup> R. Jervis, *Perception and Misperception in International Politics*. (Princeton: 1976).

In the introduction to *Perception and Misperception* Jervis noted that psychologists were already working on similar issues surrounding the nature of perception. However, he identified five major faults in the psychological literature that made its findings of questionable use for problems of elite decision-making and diplomacy. I believe at least four of these apply with almost equal force to much of the current research in neuro-decision theory and behavioral genomics.

The first of Jervis's complaints was that more attention is paid to “emotional rather than cognitive factors” in explaining human behavior. Research such as Damasio’s complicates this accusation — if emotion and cognition are two sides of the same coin, then it would be hard to neglect the study of the latter in favor of the former. However, I believe the majority of biological-behavioral research today focuses on what we might generally describe as “semi-cognitive” factors — factors that may influence decisions and reasoning but do not have any appreciable connection with larger belief systems or conceptual frameworks. This is only a slight concern, as I expect there is much to learn from the nature of sub-cognitive influences, but one of the challenges for bio-behavioral research going forward will be its ability to say something meaningful about the “ideational” sources of human action.

Jervis’s second charge was that data are derived from laboratory experiments that are extremely remote from processes of interest in the real world. Indeed, experimental protocols typically deal with very small stakes and use highly artificial simulations that bear only the slightest analogy to the phenomena researchers would ultimately like to explain (consider the research on the “dictator gene” discussed below). The external validity of laboratory findings is a concern across the board in social science experiments, but the problem is particularly pronounced when dealing with the unique circumstances of diplomatic crises.

Jervis’s fourth concern (setting aside his third concern with policy bias), is that research often disregards the institutional settings and particular dangers/opportunities of political circumstances, and thus threatens to “over psychologize” (we might say over-biologize) people’s decisions when there are much simpler explanations at hand in terms of beliefs, interests, and political realities. This concern expands upon the previous one questioning the portability of findings, but also explains why seemingly robust findings may not be portable. There are many instructive illustrations of this problem in behavioral finance.

Systematic biases in economic behavior found in the general population (overbidding in certain types of auctions) are often not found in seasoned traders, who are subject to strong arbitrage pressures to rationalize their decisions and thus have learned not to pursue low probability bets.<sup>17</sup> Although behavioral economics has shed a great deal of light

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<sup>17</sup> See P. Burns, “Experience in Decision Making: A comparison of students and businessmen in a simulated progressive auction” in *Research in Experimental Economics* (Smith ed.) JAI: 1985- as well as M. Haigh and J. List, “Do Professional Traders Exhibit Myopic Loss Aversion? An Experimental Analysis” in *The Journal of Finance*. 60(1), 2005. pp. 523-534. Interestingly, the habitual risk aversion of traders often leads them to make less in laboratory settings than naïve participants.

on the nature of animal spirits in financial markets, it is less likely to be useful for predicting the unique, high stakes economic decisions of business leaders. Likewise, when an eminent primate biologist recently suggested in a talk that George W. Bush's invasion of Iraq was nothing more than an "in-group out-group" reaction of an alpha male, his perhaps tongue in cheek comment exemplified Jervis's concern that overly psychologized (biologized) explanations could exclude important dimensions of reality.

Jervis's fifth and most serious challenge to the psychology literature of the day was that most theories of behavior "did not account for the ways that highly intelligent people think about problems that are crucial to them." In some sense this criticism does not transfer well to biological research. Biological influences on thought and behavior may not be apparent to individual agents or reflected in prior beliefs about how they reason. Biological research is likely to help clarify the role of dispositions in ways we could not have explored without recent advances in bio-metrics and statistical analysis. Moreover, decisions concerning conflict likely do engage deep emotions such as anger, fear, and vengeance. Thus, even highly intelligent people may exhibit sensibilities that present themselves as matters for further biological inquiry.

Yet, Jervis's challenge does raise most directly the lurking question of how insights into biological influences and dispositions relate to intelligent thought. It is one thing to know that certain hormones make people more aggressive, but quite another to assert that such hormones are the reason that Adolf Hitler sought territorial expansion or Neville Chamberlain sought appeasement. Of course, findings about the biological bases of aggression are highly suggestive of such links, but connecting those dots straight away is likely overly reductive. Although it is reasonable to conjecture that, lacking a certain physiological/genetic makeup, Hitler would never have sought territorial expansion in the first place, this does not necessarily tell us why Hitler sought territorial expansion. Was his ostensible "reasoning" irrelevant to his decision? Somehow our understanding of biological influences and dispositions must also include space for the influence of more complex conceptual judgments when such judgments clearly play a supporting role as well.

Take, for example, the extensive research done on the hormone oxytocin. Known to be involved in "pair bonding" in mammals, a number of research teams have found that in economic trust experiments, people who exhibited more trusting behavior also had higher levels of oxytocin circulating in their blood.<sup>18</sup> Moreover, in separate trials researchers were able to induce higher levels of trusting behavior in subjects by administering them oxytocin beforehand. The differences were not enormous, but they were significant and reproduced in a number of studies. Many have interpreted these findings as proof that trust is to be explained in terms of a-rational biological forces. Interestingly, many of the behavioral effects of oxytocin (increased risk taking, gregariousness, sociability) are similar to those of

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<sup>18</sup> M. Kosfeld, et al. "Oxytocin increases trust in humans" in *Nature*, 2 June, 2005. pp. 673-676.

Zak, "Oxytocin is associated with human trustworthiness". P. Zak, et al. "Oxytocin increases generosity in humans.: *PLoS One*, 2(11) 2007.

alcohol (with the exception of intoxication), and recognizing such influences can obviously have strategic advantages — it is no mystery why casinos serve free drinks. Yet it would be premature to conclude that the behavioral manifestations of elevated levels of oxytocin or ethanol equate to what we commonly mean by “trust.”

First, with regard to hypothetical utility of pharmacological manipulation, I would venture to guess that neither of these chemicals would, if administered to rival factions, be successful in securing trust in cases where differences in interest are profound and well known, such as the Israeli-Palestinian conflict or hostilities between Al-Qaeda and the United States. At a deeper level, there is the basic question of how brain chemicals themselves not only drive but also respond to cognitive judgments. We are apt to think of oxytocin in terms of its causal influence on trust rather than as a mediating variable between cognitive judgment and biological affect. However, research has also shown that the *experience of being trusted* apparently raises oxytocin levels on its own. Thus, cognitive judgments appear to retain some influence over components of what otherwise seems a reductionist account of the nature of trust. Much current research is focused on identifying relationships between biology and behavior at a very general level, but for these findings to be of use we will have to explore the details of these relationships with much more nuance and detail. Disentangling the interplay between “mechanistic” biological influences and higher capacities of the human intellect promises to be a very complex enterprise.

I do not wish to downplay the depths to which biological factors influence our attitudes and behaviors. Because we are biological beings, it is of course a truism that our biology matters, and in colloquial terms there are reasons to believe that “strong” biological factors are involved in decisions and behaviors relating to violence and conflict. The simple fact that a high proportion of crime in developed countries (~50% by the estimation of some studies<sup>19</sup>) is committed under the influence of drugs or alcohol is highly suggestive of this, as is the fact that the vast majority of crime worldwide is committed by males between the ages of 15-35.<sup>20</sup> Moreover, attitudes and behaviors that appear unusual or unintelligible seem ripe for biological explanations. However, conceptual judgments also shape human behavior and these are extremely difficult to account for in reductive biological terms.

The ability to conduct genetic association studies, along with an increasing recognition of the degree of human genetic diversity, has resurrected old paradigms in psychology that sought to classify people into various “personality types.” Perhaps the most classic construct of this sort, the “authoritarian personality,” was criticized for its conceptual imprecision, which in retrospect seemed a way to pathologize the attitudes of certain ideological positions. Contemporary research in behavioral genomics has access to larger

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<sup>19</sup> For example, see this report by the Australian government (<http://www.health.gov.au/internet/drugstrategy/publishing.nsf/Content/mono64-l~mono64-l-ch5>)

<sup>20</sup>The UK’s statistics are representative of many countries’ (<http://www.statistics.gov.uk/CCI/nugget.asp?ID=1661>)

and more precise data sets, although conceptual precision in defining “phenotypes” continues to be a challenge.

It is, *prima facie*, reasonable to ask whether people are biologically disposed to be aggressive or passive, violent or peaceful, risk loving or risk-averse, realist or idealist, sadists or saints. However, it is important to recognize how much conceptual baggage comes with trying to define and measure these “types.” Upon scrutiny it is hard to imagine how some of these terms could be meaningfully understood biologically. What counts as aggression or realism will reflect judgments about which there may be substantial disagreements. Also, there is an inherent trade-off between generality and particularity in studying these concepts. From an evolutionary perspective there are reasons we might expect some people to be quicker to anger than others. But is undoubtedly a mistake to treat anger as if it were a simple property that will be manifested in the same or similar ways in all possible contexts. Precisely how such a disposition manifests itself will likely be highly sensitive to social mores, childhood upbringing, legal institutions, and cathartic outlets — not to mention intermediate biological influences from diet or drugs. For such reasons, it is *prima facie* unlikely that we’ll find special biological dispositions underlying ever more discrete categories of attitudes/behavior — the anger of Americans after 9-11, the anger of peace activists over the Iraq invasion, the anger of North Carolinians over the decision to relocate Guantanamo detainees to Illinois. Attempting to find a particular biological disposition behind every human behavior resembles the old scholastic mistake of multiply universals, inventing a new generalization for every special case we encounter.

Consider, as illustrative of many of the concerns expressed above, the case of the “ruthlessness gene” reported by *Nature* in April of 2008.<sup>21</sup> Science writer Michael Hopkin authored this news release, entitled “‘Ruthlessness gene’ discovered: dictatorial behavior may be partly genetic, study suggests,” which was accompanied by photos of Adolf Hitler, Robert Mugabe, Saddam Hussein, and Benito Mussolini. It reported the main findings of a then forthcoming article in the journal *Genes, Brains, and Behavior*.<sup>22</sup> According to Hopkin, “The study might help to explain the money-grabbing tendencies of those with a Machiavellian streak — from national dictators down to ‘little Hitlers’ found in workplaces the world over.” Hopkin interprets the experimental protocol of the study- the “dictator game” — as giving participants two basic options: “behave selflessly, or like money-grabbing dictators such as former Zaire President Mobutu, who plundered the mineral wealth of his country to become one of the world’s richest men while its citizens suffered in poverty.” Indeed the study did employ the “dictator game,” but the relationship of this game to dictatorship consists of nothing more than a linguistic coincidence. Hopkins interpretation was profoundly unwarranted. What exactly did the study find?

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<sup>21</sup> M. Hopkin, “‘Ruthlessness gene’ discovered: Dictatorial behaviour may be partly genetic, study suggests” *Nature News*. 4 April, 2008.

(<http://www.nature.com/news/2008/080404/full/news.2008.738.html>)

<sup>22</sup> A. Knafo, et al. “Individual differences in allocation of funds in the dictator game associated with length of the argininevasopressin 1a receptor RS3 promoter region and correlation between RS3 length and hippocampal mRNA” in *Gene, Brains, and Behavior* (7) 2008. pp. 266-275.

Genetic samples were taken from some two hundred student volunteers at the Hebrew University who played a simple economic game. Students were randomly divided into two groups and those in the first group were given 50 shekels (~\$14). Each of these students could then decide whether to give away some of this money to a student from the second group with whom they were randomly and anonymously paired through a computer screen. In this exercise, which could more accurately be called the “generosity game,” researchers found that those who transferred the most money were more likely to have longer versions of the gene AVPR1a. This gene is related to the hormone vasopressin, which is known to influence mammalian sociability. Students also filled out questionnaires measuring attitudes of “altruism” and “benevolence,” which likewise showed some association with the AVPR1a allele. To their credit, the study's authors were much more careful and reserved in the language of their paper, phrasing the differences they found in terms of “altruism” and “benevolence.” However, the unwarranted extrapolations drawn by the *Nature News* editor — drawing a line from the less generous participants in this game to mass murders -were profoundly misleading. From the perspective of fundamental biological research this study is, on its merits, genuinely interesting for a number of reasons, but those searching for an explanation of Stalin or Hitler would be well advised to look elsewhere.

We should also note in passing the large amount of current research examining the relationship between “aggression” and the gene encoding monoamine oxidase A (MAOA). MAOA is an enzyme that helps metabolize neurotransmitters, and different versions of the gene are found in the population at large. At least one experimental study has suggested that variations of this gene influence levels of retaliation in response to discrete provocations.<sup>23</sup> A number of longitudinal studies have found associations between shorter MAOA alleles and various measures of “addiction” and “anti-social behavior;” and the prevalence of this allele in the Maori population, where many of these studies first took place, led to its being characterized as the “warrior gene.”<sup>24</sup> However, examining the details of these studies suggests that this moniker exaggerates the biological reality. Many studies have failed to find any significant, direct relationship between MAOA and various measures of criminal behavior, violence, and aggression.<sup>25</sup> Rather, this gene has been the poster child for GxE (gene environment interaction) studies. Avshalom Caspi and Terrie Moffitt pioneered this field with a study that found that low MAOA was associated with “anti-social behavior” in people who were abused as children, but showed no effect on those without a

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<sup>23</sup> R. McDermott, et al. “Monoamine oxidase A gene (MAOA) predicts behavioral aggression following provocation.” in *Proceedings of the National Academy of Sciences* 106(7) 17 February, 2009. (<http://www.pnas.org/content/106/7/2118>)

<sup>24</sup> R. Lea and G. Chambers, “Monoamine oxidase, addiction, and the ‘warrior gene’ hypothesis” in *The New Zealand Medical Journal*. 120(1250) 2 March, 2007. (<http://www.nzma.org.nz/journal/120-1250/2441/>)

<sup>25</sup> J. Buckholtz and A. Meyer-Lindenberg, “MAOA and the neurogenetic architecture of human aggression” in *Trends in Neuroscience* 31(3) 6 February 2008.

history of abuse.<sup>26</sup> Replication studies of this GxE interaction have had mixed results, but some have suggested that low MAOA is associated with *lower* aggression in those who have not been abused (compared with the general population).<sup>27</sup> This may explain why so much variation persists in this allele, if it can grant benefits or liabilities depending on certain environmental triggers (protective in one case, but detrimental in the other). In any case, the title of “warrior gene” is a significant over dramatization of existing results.

To return to the question of elite decision-making and diplomacy, one of the greatest problems with “strong” biological urges or genuine brain illnesses is that they can make individuals impervious to reason, conventionally construed. Much of the IR and security studies literature is premised on a (minimal) rational actor model that understands people as having goals they reason instrumentally to achieve. Indeed, our understanding of human action generally depends on its being intelligible on some level in terms of ends and means, purposes and strategy. It is for this reason that “mad men” at the helm of power are so dangerous in principle, as they can be unpredictable or impervious to negotiation even when it would suit their ostensible interests. Much of the stability of the international world order depends on the use of incentives to structure and align interests. If one's ability to understand and respond to incentives and compelling arguments is compromised by biological urges or an enfeebled mind, this poses a challenge for diplomacy.

Consider Thomas Schelling's rather colorful, but nonetheless tragic, account of Anglo-American dealings with Iran mid-century:

Recall the trouble we had persuading Mossadegh in the early 1950s that he might do his country irreparable damage if he did not become more reasonable with respect to his country and the Anglo-Iranian Oil Company. Threats did not get through to him very well. He wore pajamas, and, according to reports, he wept. And when British or American diplomats tried to explain what would happen to his country if he continued to be obstinate, and why the West would not bail him out of his difficulties, it was apparently uncertain whether he even comprehended what was being said to him. It must have been a little like trying to persuade a new puppy that you will beat him to death if he wets on the floor. If he cannot hear you, or cannot understand you, or cannot control himself, the threat cannot work and you very likely will not even make it.<sup>28</sup>

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<sup>26</sup> A.Caspi, T. Moffitt, et al. Role of genotype in the cycle of violence in maltreated children. *Science*. (297) 2002. pp.851-4. (<http://www.sciencemag.org/cgi/content/abstract/297/5582/851>)

<sup>27</sup> J. Kim-Cohen, “MAOA, Maltreatment, and Gene-Environment Interaction Predicting Children's Mental Health: New Evidence and a Meta-Analysis” *Molecular Psychiatry*. (11) 2006 pp. 903-913  
(<http://pn.psychiatryonline.org/content/41/23/26.full>)

<sup>28</sup> T. Schelling, *Arms and Influence* (Yale: 2008), p.38  
(<http://books.google.com/books?id=V25WWXMgte8C>) I am grateful to my colleague Eric Lorber for drawing my attention to this passage.

This concern is a valid one, even if the example is extreme. The debacles of that era of US foreign policy continue to have ramifications into the present day. A better appreciation of the “irrationality” of Mossadegh might have led diplomats to deal very differently with the situation.

Reflecting on the broad nature of biological influences that can operate on judgment at any given moment may lead to a kind of fatalism regarding our ability to understand or predict the behavior of others. Pascal averred that world history might be different but for the length of Cleopatra's nose. Would Mark Antony have fallen for her and out of favor with Rome otherwise? Hitler forbade anyone to smoke in his presence. Did that make Chamberlain, a smoker, nervous and impatient at Munich? Many historically momentous incidents are ripe for speculation of this sort in hindsight. However, can an understanding of biology meaningfully inform strategy *ex ante*?

Here I argue that we need to distinguish between different kinds of biological influences. Although it is true that all thinking is dependent on our biology at some level, it is still meaningful to distinguish between: 1) a generally “healthy brain” that can support capacities of consideration and judgment characteristically associated with human rationality and 2) a brain with serious biological deficits, which diminish or destroy capacities crucial for rationality. This idealized distinction can admit of a spectrum of intermediate types and tough cases. However, at the extreme end, biological deficits — and I think here of various brain diseases — have clear, and often predictable, debilitating effects. They call for medical interventions, not arguments. Moreover, advances in neuroscience and genomics are likely to shed a great deal of light on the many ways in which the brain can break down, as well as enable new therapeutic interventions.

At the other end (of “normal” rational capacities), it will still be the case that people are affected by biological dispositions and influences. However, part of becoming a mature human being is learning to be aware of and to deal with such drives and urges. Considerations and judgments of reason must be possible within the gamut of biological forces that weigh on a “healthy” brain, if reason is to be possible at all. And with regard to those ways in which the average person is often “predictably irrational” — loss aversion, wishful thinking, perceptual biases, etc — these are likely to come under increasing scrutiny as the stakes of any decision become higher. Finally, we should recognize that one of the important functions of social institutions is to help order and control biological passions. The story of Ulysses strapped to the mast while sailing past the Sirens is instructive. By understanding our biological weaknesses we can often mitigate their effects when they threaten our deeper or more long-term interests.

Of course there will be many tough cases in the middle, instructive for thinking about what we mean by rationality: the idiot savant capable of mathematical genius but unable to recognize faces, the psychopath with cunning analytic abilities but devoid of empathy. Still, psychopaths and savants are rare, as are those with brain damage and mental illness. Psychopaths can obviously be dangerous, and if your opponent is one that is important to

know. Moreover, one of the most important tasks for political institutions is to keep “mad men” (and women) out of power.

Although it makes sense to look for explanations of particularly crazy or unintelligible behavior at the biological level, it would be a mistake to think that conflict and violence are caused only by biological deviants. In his book *Moral Minds: How Nature Designed Our Universal Sense of Right and Wrong*, the Harvard biologists Marc Hauser, help popularize the notion that normal humans come hardwired with innate moral convictions, which according to Hauser roughly correspond to the ideals of Rawlsian justice.<sup>29</sup> Anyone familiar with history is likely to be incredulous of such a claim, and indeed it has come under sustained critique (e.g. see Jesse Prinz<sup>30</sup>). However, this thesis reflects a certain optimism about human nature, eager to believe that aggressiveness/violence is something rare, which requires explanation via some biological anomaly. Living in the relative tranquility of a rich, western, liberal democracy, it is understandable why someone might mistake the habits of fellow citizens for universal features of human nature. However, those in developing countries that lack extensive institutions to constrain violence are likely to see things differently.

To take one minor example, consider an incident from 2001 in the Nigerian town of Jos. A Christian woman walking home through a commercial district on a Friday afternoon became involved in an argument with a security guard stationed outside of a prominent mosque. The details of the dispute are unclear, but apparently the woman was commanded to take a different route home out of sight of the crowded mosque. The argument turned to shouting and the rumor quickly spread that a Christian woman had been slapped by a Muslim man. Within minutes a street fight erupted. Soon, the town, which had never experienced a riot, was engulfed in bloodshed. In the three days following, over 1000 people were killed in close quarter combat, and dozens of churches and mosques were burned, as previous peaceful neighbors turned against each other in a desperate escalation of violence.<sup>31</sup> The well documented phenomenon of mass violence should caution against the assumption that a minority of biological deviants make up the quarrelsome and contentious.

The biological foundations of violence likely run wide and deep in human nature. They may be more pronounced in certain populations — it is no accident that most of the rioters in Jos were men. However, our capacities for violence clearly engage, and are mediated by, conceptual judgments that are not similarly instinctive — judgments about what

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<sup>29</sup> M. Hauser, *Moral Minds: How Nature Designed Our Universal Sense of Right and Wrong*. Abacus: 2008. (<http://books.google.com/books?id=pQ1zAAAACAAJ>)

<sup>30</sup> Prinz criticizes Hauser’s work in three related papers (<http://www.unc.edu/~prinz/research.html>)

<sup>31</sup> This example is taken from the dissertation research of Alexandra Scacco. ([http://www.columbia.edu/~als2110/files/Scacco\\_Who\\_Riots.pdf](http://www.columbia.edu/~als2110/files/Scacco_Who_Riots.pdf))

constitutes an offense or interest in the first place. Had the woman in Jos been slapped by a mere thief in a botched robbery, the reactions would likely have been very different. Those who work on the biological foundations of behavior are right to call our attention to the place of emotions in human life. Many political theorists have argued this point as well. For example, Harvey Mansfield suggests, “Politics is about what makes you angry, not so much about what you want. Your wants do matter, but mainly because you feel you are entitled to have them satisfied and get angry when they are not.”<sup>32</sup> We are, in Mansfield's view, fundamentally “thumotic” creatures, and our political theories, particularly our accounts of human rationality, need to recognize this. However, it is likely a mistake to think our emotions come hardwired. Our biological dispositions towards anger and violence combine to make us thumotic by nature, but their specific exercise is often mediated by concepts that are historically developed and learned, such as the nature of honor.

Thus, in surveying the emerging literature in neuroscience and genomics related to “mind, brain, and behavior” my own suspicion is that the most remarkable discoveries will likely concern ways in which the brain breaks down. Such knowledge promises to enable dramatic new therapeutic options for those afflicted with these conditions. By extension, this knowledge may help us diagnose and understand the deviant behavior of certain elements of society, and perhaps even certain elites. However, for the vast majority — those with “healthy brains” — conventional analysis of ideology, interests, and beliefs is likely to hold the key to the most important decisions and behavior.<sup>33</sup> Granted, even “healthy brains” will be beset with various different biological dispositions, including perceptual biases, emotional liabilities, systematic “irrationalities,” but these generally tell only part of the story, which must also be informed by concepts, ideas, purposes. Perhaps research on healthy brains will require us to develop a more subtle language to identify and differentiate the influence of biological forces. It is unlikely, though, that this research will require us to abandon traditional considerations of interests and ideology, power and institutions, etc.

In fact, there are additional reasons to believe that elites will be under particular pressures that guard against dramatic biological irrationalities. The filtering mechanisms through which elites come into power, the high stakes of their decisions, and strong demands of rationalization they face all make it less likely that their decisions will reflect “knee-jerk” reactions. More interesting questions can be raised about the rationality and decisions of democratic masses. Animal spirits may play a greater role here, and a number of interesting theses have been advanced on this front. For example, the diets and lifestyles of wealthy nations tend to lower testosterone (a hormone linked to aggression) across the population, which perhaps plays some role in the (comparative) reluctance of these nations

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<sup>32</sup> H. Mansfield, “How to Understand Politics: What the Humanities Can Say to Science” NEH Jefferson Lecture, 2007. (<http://www.neh.gov/whoware/mansfield/HMlecture.html>)

<sup>33</sup> Some studies have claimed that ideological beliefs are themselves genetically hardwired, but these suffer from many of Jervis's concerns, as well as other methodological shortcomings.

to go to war — a kind of biological boost to the democratic peace thesis. On another front, some have looked to evolutionary psychology for an explanation of why territorial disputes are much more likely to lead to violent conflict than other disputes.<sup>34</sup> There are good evolutionary reasons that territory might have a natural grip on the human imagination and many provocative analogues of territorial jealousy in the animal kingdom. However, such associations are speculative, and, in any case, the relationship between biology, public opinion, and democracy is a matter for another article.

Although biological discoveries will continue to shed light on the nature of human decision-making across the board, for reasons explored above I expect the most powerful discoveries will mainly apply to issues at the margins of elite decision-making and diplomacy. This assessment relies on a deeper judgment that the reductionist hope of understanding the human mind in terms of its biological components is likely to elude us — or is, at least, a very long way off. It is no secret that biological reduction is appealing to some social scientists who hope to make the study of human behavior completely “scientific,” but this aspiration is fraught with well known objections — and its possibility will have to be demonstrated rather than assumed. In the meantime we will continue to have to negotiate the conceptual, and thus historical, dimensions of human beliefs and behavior as we have done in the past, albeit with a greater understanding of distinctly biological influences.

While the contributions that biological research stands to make to our understanding of elite decision-making and diplomacy are, on this estimation, fairly modest, the contributions of biological research to other areas relevant to security and war are likely to be much more profound.

### **Implications for Domestic Security and Counter Terrorism**

Preventing terrorist attacks is one of the most pressing concerns for governments in the post 9-11 era. Technological advances and biological knowledge have combined to provide a number of new tools in this battle. Some of the applications have been obvious, such as the forensic uses of DNA sequencing. Other advances have created new opportunities for terrorists — many pathogens that could serve as biological weapons are now relative easy to synthesize using recombinant DNA. On the whole, however, new technologies are likely to disproportionately benefit those who provide security rather than those to aim to disrupt it.

The strategic advantages of terrorism are well known and the challenges of counter terrorism widely discussed in contemporary security studies. Terrorists are often aided by their ability to blend in to crowds and approach their targets undetected. Various

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<sup>34</sup>That they are more likely to lead to conflict has been persuasively argued in the literature, see: J. Vasquez and M. Henehan, “Territorial Disputes and the Probability of War 1816-1992.” *Journal of Peace Research*. 38:2 (March 2001): 123-138. I am indebted to my colleague Sean Zeigler for many stimulating discussions regarding evolutionary psychology and its links to theoretical perspectives in security studies.

surveillance technologies currently help officials search for material components of terrorist attacks- bombs, chemicals, communiqués, etc. However, terrorists have developed sophisticated techniques for concealing these components.

### Biological Profiling

Some of the most promising surveillance and detection technologies on the horizon leverage biological knowledge to search directly for the terrorists themselves. These systems rely on various form of “biological profiling” to identify abnormal biological states that could be cause for suspicion. The body, it turns out, reveals many secrets that one might otherwise wish to conceal. As one commentator succinctly explained, “It may be true that hiding emotions is actually harder than hiding a bomb.”<sup>35</sup> Humans are adept at reading body language, particularly facial micro-gestures, although our intuitions are often hard to explain or defend. However, there are also objectively measurable bio-correlates of fear, anxiety, stress, etc. Some of the telltale signs are familiar ones — heart rate, eye motions, temperature, breathing — but others involve more sophisticated physiological correlates. Moreover, a remarkable number of biological measurements can be obtained non-invasively by passive biometric sensors.

In their simplest configurations, these technologies are an extension of methods long used by polygraph tests to detect deception. These rely on the premise that conscious deception elicits physiological reactions that stand out when compared to “normal” baseline states of straight-forward honesty. However, this simple detection paradigm is famously open to countermeasures. There are various was to manipulate one's vital signs — through mental exercises, muscle contractions, or even biting one's tongue — that can reliably confound polygraph results. Thus, the use of these tests in courts or for employee screening has been controversial. A National Academy of Science report on “The Polygraph and Lie Detection” issued in 2003 concluded that, when used on naive populations, polygraphs could detect lies significantly better than chance, but they are not accurate enough to justify their use for large scale security screening.<sup>36</sup>

Nevertheless, “better than chance” may be useful odds for targeted screening applications. The United States military has been interested in using polygraph technology in the field to enable quick screening of suspicious persons, for example in the vicinity of a fresh IED. Two years ago a handful of troops in Afghanistan were supplied with polygraph handsets — officially called the “Preliminary Credibility Assessment Screening System”- which employ three biometric sensors that attach to a suspect’s hand.<sup>37</sup>

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<sup>35</sup>A. North, “Step to the Right and Open your Brain: Will Mind Reading Improve Airport Security?” in *Jezebel*. 8 January, 2010. (<http://jezebel.com/5443891/step-to-the-right-and-open-your-brain-will-mind+reading-improve-airport-security#comments>)

<sup>36</sup> “The Polygraph and Lie Detection” National Academies Press: 2003 ([http://www.nap.edu/openbook.php?record\\_id=10420&page=6](http://www.nap.edu/openbook.php?record_id=10420&page=6))

<sup>37</sup> ([http://www.newlaunches.com/archives/us\\_troops\\_to\\_get\\_portable\\_lie\\_detector.php](http://www.newlaunches.com/archives/us_troops_to_get_portable_lie_detector.php))

A number of companies are currently in the process of bringing related technologies to market. Suspects Detection Systems Ltd. has developed modules that collect and analyze “psycho-physiological” data from persons of interests, meant to identify those who merit further investigation. The company claims its results are highly accurate with a false positive rate of less than 4%.<sup>38</sup> Although these technologies are ostensibly employed for profiling purposes prior to actual investigations of guilt, false positive are a major concern. There are many innocent reasons that someone could display abnormal biological signs. Reliable methods of biological profiling will depend on using multi-factorial assessments that go beyond the simple and common bio-markers of stress.

Another company, WeCU Technologies Ltd., claims its methods can overcome many of the traditional limits of biological profiling: “The system is based on a unique probing method which uses knowledge from the behavioural sciences in combination with advanced biometric sensors. The system is effective for the detection of individuals who are manipulative, calm, do not have guilty knowledge, and are not being deceptive at the time of the detection. At the same time, it eliminates false results...”<sup>39</sup> One of the innovations of their approach is the use of small cues that elicit different autonomic responses from individuals familiar with them. For example, by flashing an obscure terrorist code word on a screen and using optical temperature and heart rate sensors to monitor people walking past, this technology is apparently successful in detecting those with special knowledge of the code word. As our understanding of such autonomic responses increases, along with the sensitivity of biometric scanners, biological profiling will perhaps prove useful a useful tool, making it more difficult for terrorists to blend in.

### Mind Reading and Interrogation

The concept of biological profiling raises deeper questions about how the body can reveal things that the conscious mind would like to conceal. Those tasked with interrogation have an obvious interest in leveraging biological knowledge to elicit truthful information from those suspected of criminal activity. In the past, biological knowledge played a small and generally sinister role in interrogation- most conspicuously in service of torture. In more recent decades scientists have explored using various chemicals agents as truth serums. Rather than employing pain to make someone talk against their will, these chemicals aim to break down biological mechanism of inhibition and self-control. Indeed, drugs such as sodium amytal, sodium pentathol, and scopolamine do make people more talkative, although the truthfulness and usefulness of what they said is highly disputed.<sup>40</sup> Although chemically enhanced interrogation is perhaps ethically preferable to traditional torture it suffers from similar sorts of objections. There is also a spectrum of less dramatic ways to

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<sup>38</sup> (<http://www.suspectdetection.com/solution.html#>)

<sup>39</sup> ([http://www.epicos.com/epicos/extended/israel/wecu/wecu\\_home.html](http://www.epicos.com/epicos/extended/israel/wecu/wecu_home.html))

<sup>40</sup> J. Marks, “Interrogational Neuroimaging in Counterterrorism: A ‘No-Brainer’ or Human Rights Hazzard?” in the *American Journal of Law and Medicine* 33:2-3 (April 2007).

break down resistance, highlighted in recent debates about “enhanced interrogation techniques,” such as sleep deprivation, stress positions, and light control.

The acrimony of these debates helps to explain the considerable interest in “mind reading” technologies, which are fervently being explored by a number of research teams. The great hope is to employ brain imaging technologies to detect lies and guilty knowledge. When US Intelligence Director Dennis Blair recently announced that the government's newly created High-Value Detainee Interrogation Group will conduct “‘scientific research’ to find better ways of questioning top terrorist suspects” he would not discuss the nature of these research projects.<sup>41</sup> However, the search for a brain imaging lie detector is undoubtedly near the top of the list. A technology able to bypass the intransigence of terrorists and obtain high quality data about what they know would solve many legal and strategic needs.

There are currently at least five different approaches to “mind reading” being explored. One uses electroencephalography to detect signals that are supposedly emitted shortly after a brain recognizes something “familiar” to it, providing what some have called a “brain fingerprint.” Another uses laser spectroscopy to look for surface patterns of the brain correlated with deception. Yet another analyzes facial micro-gestures, and there are also experiments examining whether periorbital thermography (measurement of temperatures around the eye) can detect deception.<sup>42</sup> Perhaps the most promising research thus far has come from the use of functional magnetic resonance imaging (fMRI). This technology is able to monitor real-time changes in blood oxygenation levels within the brain based on the differences in their magnetic properties. Because active neurons elicit more oxygen from blood than inactive ones, it is believed that changes in blood oxygenation correspond to localized neuronal activity. Many believe fMRI holds the best chance of providing data detailed enough to discriminate different brain states associated with lying or guilty knowledge.

In 2005, the journal *Nature* ran a news article with the title “Brain imaging ready to detect terrorists, say neuroscientists.”<sup>43</sup> It reported the latest round of tests with an fMRI lie detector by a research team at the University of Pennsylvania. The team, lead by psychiatrist Daniel Langleben and neuropsychiatrist Ruben Gur, reported a 99% accuracy rate in its ability to distinguish whether participants in an experiment lied about which cards they drew at the outset of the study. According to Gur, “A lie is always more complicated than the truth...You think a bit more and fMRI picks that up.” Although fMRI studies have not reliably found any “lying centers” in the brain, Langleben and others have claimed that the distribution of brain activity looks different when subjects are engaged in

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([http://www.breitbart.com/article.php?id=CNG.64f93e3e5ec86eaffb1af7e7d2f5a565.2d1&show\\_article=1](http://www.breitbart.com/article.php?id=CNG.64f93e3e5ec86eaffb1af7e7d2f5a565.2d1&show_article=1))

<sup>42</sup> M. Greely, “Neuroscience Based Lie Detection: The Need for Regulation” in *Using Imaging to Detect Deception: Scientific and Ethical Questions*. American Academy of Arts and Sciences: 2009.

<sup>43</sup> J. Wild, “Brain imaging read to detect terrorists, say neuroscientists” in *Nature*. 437 (457) 22 September, 2005. (<http://www.nature.com/nature/journal/v437/n7058/full/437457a.html>)

deception. A company named “No Lie MRI” now uses algorithms derived from the Penn team's research to offer commercial lie detecting services to a wide range of customers.<sup>44</sup> Another company, Cephos, offers similar MRI lie detecting services and lists on its website over 30 scientific articles that support its technology, many published in top, peer-reviewed journals.<sup>45</sup>

The details of many laboratory studies of fMRI lie detection have, however, drawn extensive criticism. First, it is unclear whether providing false information under instruction in a laboratory even counts as lying. More generally, there is a concern that the low stakes and trivial tasks of most research protocols are not good models for investigating the nature of high stakes lies in the real world. Also, although most scientists are acutely aware that their findings are sensitive to specific parameters of a lying task, this caveat is often overlooked by those enthusiastic about fielding this technology. Discriminating a lie from a truth in a forced choice task is very different than detection of deception in more general statements; and guilty knowledge tests, which try to measure some memory/familiarity response to cues, are another challenge altogether. Some critics have also suggested that the most dramatic experimental successes in fMRI lie detection are driven by artifacts that have nothing to do with lying.

For example, in the card experiment used by the Penn research team subjects were presented an envelope with a seven of spades and five of clubs.<sup>46</sup> They were to tell the truth about having one of these cards but lie about the other, and if successful in their lie would receive \$20. In the scanner subjects were shown a number of cards in succession (including many control cards from the rest of the deck) and asked to identify only the card(s) they had received. Since subjects would only positively identify that one card which they had chosen to be the truth card, they spend most of their time in the scanner answering “no” to move through the deck, looking for that special card they had chosen as their truth card. Nancy Kanwisher, a prominent neuroscientist at MIT, has suggested that the “neural signature of the supposed 'truth' response is really just the neural signature of a target detection event,” which would mean this experiment is not tracking lying at all.<sup>47</sup> Moreover, she argues that the statistical algorithms employed by Langleben and colleagues to boost their detection rates are highly sensitive to the peculiarities of the experimental protocol.

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<sup>44</sup> (<http://noliemri.com/pressNPubs/Publications.htm>)

<sup>45</sup> (<http://www.cephoscorp.com/lie-detection/index.php#working>)

<sup>46</sup>Langleben, D. et al. 2005. Telling truth from lie in individual subjects with fast event-related fMRI. *Human Brain Mapping* 26 (2005): 262–272.

Davatzikos, C. et al. Classifying spatial patterns of brain activity with machine learning methods: Application to lie detection. *Neuroimage* 28 (2005): 663–668.

<sup>47</sup> N. Kanwisher, “The Use of fMRI in Lie Detection: What Has Been Shown and What Has Not” in *Using Imaging to Detect Deception: Scientific and Ethical Questions*. (American Academy of Arts and Sciences: 2009).

Debates about the merits of particular experiments will continue and likely lead to more robust and interesting investigations. However, a serious challenge awaits those who would like to successfully apply any fMRI lie detection technology to terrorists, namely the existence of simple and effective countermeasures. These are summarized by Kanwisher:

Functional MRI data are useless if the subject is moving more than a few millimeters. Even when we have cooperative subjects trying their best to help us and give us good data, we still throw out one of every five, maybe ten, subjects because they move too much. If they're not motivated to hold still, it will be much worse. This is not just a matter of moving your head— you can completely mess up the imaging data just by moving your tongue in your mouth, or by closing your eyes and not being able to read the questions. Of course, these things will be detectable, so the experimenter would know that the subject was using countermeasures. But there are also countermeasures subjects could use that would not be detectable, like performing mental arithmetic. You can probably activate all of those putative lie regions just by subtracting seven iteratively in your head.<sup>48</sup>

The vulnerability of such interventions along with extensive concerns about the generalizability of laboratory findings inform her ultimately dim view of the usefulness of this technology: “Because the published results are based on paradigms that share none of the properties of real-world lie detection, those data offer no compelling evidence that fMRI will work for lie detection in the real world. No published evidence shows lie detection with fMRI under anything even remotely resembling a real-world situation. Furthermore, it is not obvious how the use of MRI in lie detection could even be tested under anything resembling a real-world situation.”<sup>49</sup>

Others, however, see a great deal of promise in the results thus far and expect future innovations can overcome current hurdles to confidently employing mind reading technologies in the investigation of terrorists. I am told a number of studies boasting lower error rates, better protocols, and cross subject regularities await publication. Time will tell if these can overcome the powerful objections of critics, with whom my own sympathies currently rest.<sup>50</sup>

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<sup>48</sup> Ibid. p. 12.

<sup>49</sup> Ibid.

<sup>50</sup> For further discussions of the promise and limits of using imaging technologies for deception see: D. Langleben, “Detection of Deception with fMRI: Are we there yet?” in *Legal and Criminal Psychology*. 13 (2008). pp. 1-9.; P. Rosenfeld, “‘Brain Fingerprinting’: A Critical Analysis” in *The Scientific Review of Mental Health Practice*. 4:1 (Spring/Summer 2005).; P. Wolpe, et al. “Emerging Neurotechnologies for Lie-Detection: Promises and Perils” in *American Journal of Bioethics*. 5(2) 2005. pp. 39-49

The quest for an fMRI mind reader is exemplary of the ambitious hopes placed on emerging biotechnologies that some believe can revolutionize the provision of security and justice. On the other hand, this quest has fueled the fears of those who worry both about the dangers posed to privacy if the technology works and the dangers of false convictions if it doesn't. In any case, it is likely that debates about the feasibility of these technologies will overshadow debates about their desirability. While the search for effective lie detectors continues, a number of the biological profiling methods discussed above do appear immediately useful for screening purposes. However, it is important that those who employ them not confuse the probabilistic “red flags” of biological profiling with dispositive evidence of guilt.

### **Implications for the Conduct of War**

Napoleon reportedly remarked that an army travels on its stomach. Indeed, one of the greatest logistical challenges of any military campaign is keeping troops healthy and well fed. However, the fitness of soldiers for work and battle depends on much more than caloric intake. The physiological demands made on soldiers are extensive. This is particularly true in combat situations where, in addition to immediate dangers of enemy fire, soldiers face extraordinary levels of stress and physical exhaustion that can affect performance and have long lasting consequences. Biological research has contributed significantly to our ability to understand, support, and respond to the many physiological needs and liabilities of soldiers.

#### Optimizing Performance

Professional athletes have long been interested in how science can help enhance their performance. Extensive biological research has aimed at developing training regimens and diets that optimize natural biological capacities, as well as towards identifying performance enhancing drugs. Such knowledge can be of obvious use for improving the fitness, stamina, and mental acuity of troops as well.

Up until the Second World War the daily rations of most European armies included modest portions of alcohol and tobacco, which undoubtedly improved morale. Although these are no longer government issued staples for most troops, simple stimulants such as caffeine and tobacco are used at very high rates by soldiers. The proportion of U.S. military personnel at large who use tobacco is at least 10% higher than the general population, and combat veterans are 50% more likely to use tobacco than soldiers who have not seen combat.<sup>51</sup> Amphetamines and other psycho-stimulants have a long history of combat use too. Some 72 million amphetamine tablets were issued to British troops in the Second World War; similar tablets were available to Special Forces units in Vietnam; and present day US military pilots use amphetamine based “go-pills” to fight fatigue in long term

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<sup>51</sup> Combating Tobacco in Military and Veteran Populations, Institute of Medicine Consensus Report: 26 June, 2009. (<http://www.iom.edu/Reports/2009/MilitarySmokingCessation.aspx>)

missions.<sup>52</sup> In at least one state (Maryland) law enforcement officers can be administered Modafinil (an amphetamine class stimulant) during extended security operations.<sup>53</sup> The benefits of these drugs on cognition and stamina are well documented, although they do have side effects, ranging from neurotoxicity from long term amphetamine abuse to dramatic “crashes” when discontinued.

Some have raised concerns about excessive reliance on performance enhancing drugs in security applications. Shortly after the United States established its military presence in Afghanistan, go-pills taken by a pilot on a 10 hour mission were implicated in his “friendly fire” mistake that resulted in the deaths of four coalition troops.<sup>54</sup> Also, the history of drug research for military applications has a checkered past. The CIA ran a secretive project named MKULTRA from 1953-64 that involved testing drugs such as LSD on unwitting US citizens. Senate hearings in 1977 concluded that drugs were covertly administered to “unwitting subjects in social situations... at all social levels, high and low, native Americans and foreign.”<sup>55</sup> Since then the larger biomedical research community has developed extensive protocols to help prevent unethical experimentation. Even with such protocols in place, pharmacological enhancements are likely to raise new and distinct ethical issues.

One of the lurking questions in enhancement research is the degree to which we will encounter inevitable trade-offs. Some have argued we should start from the presumption that evolution has been relatively efficient. If there were simple ways to enhance human biology these should have been selected for in the past. Thus, if evolution has already optimized our biology with regard to the most useful dimensions of human nature, then boosting certain capacities will likely come at the cost of diminishing others. These basic trade-offs may be elementary to our biological constitution: concentration vs. creativity, brawns vs. brains, stamina vs. strength. Perhaps with regard to a panoply of desirable traits, we cannot have our cake and eat it too. Granted, there may be much room for minor improvements, tweaking our capacities, and for repairing genetic abnormalities. However, as far as radical enhancement is concerned, this school of thought suspects that there are

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<sup>52</sup> See N. Rasmussen, “America’s First Amphetamine Epidemic 1929–1971: A Quantitative and Qualitative Retrospective With Implications for the Present” in *American Journal of Public Health*. 98:6 (June 2008): 947-985. (<http://ajph.aphapublications.org/cgi/content/full/98/6/974>); R. Cornum, R. et al. “Stimulant Use in Extended Flight Operations” in *Airpower Journal*. (Spring 1997). (<http://www.airpower.maxwell.af.mil/airchronicles/apj/apj97/spr97/cornum.html>); T. Dormandy, *The Worst of Evils: the fight against pain*. (Yale: 2006), pp. 416-417. (<http://books.google.com/books?id=lor1NiZNQ0gC>)

<sup>53</sup> The Maryland protocol is described at: (<https://www.miemss.org/home/LinkClick.aspx?fileticket=PcFzAVnOA4M%3D&tabid=106&mid=537>)

<sup>54</sup> M. Friscolanti, *Friendly Fire: The Untold Story of the U.S. bombing that Killed Four Canadian Soldiers in Afghanistan*. (Wiley: 2005).

<sup>55</sup> 1977 Senate Hearing on MKULTRA, 3 August, 1977. Accessible html copy at: ([http://www.governamerica.com/article\\_mkultra.html](http://www.governamerica.com/article_mkultra.html))

few “free lunches” waiting to be discovered. Often there will be a price to be paid for enhancements. Also, it may be the case that certain enhancements may be detrimental to an individual but useful for a society- one could imagine producing idiot savants adept at cracking codes but incapable of sustaining normal human relationships. The price of any enhancement may be worth it, but we will have to decide whether we want to sacrifice some of our capacities to achieve others, and this will raise increasingly difficult ethical questions if these decisions are not based on consent.

Others, however, have argued that such trade-offs are not fundamental to our biology or that they can be overcome with sufficient biological knowledge. They draw attention to the fact that the environments in which humans evolved were characterized by resource constraints that are no longer with us. The selection pressures that optimized our biology in the Pleistocene era produced an organism with features that may be less than desirable today. Moreover, our biological systems may have latent possibilities which were not realized in the past simply because they were optimized within harsher, but outdated constraints. Perhaps the most significant shock to human biology in the last few centuries has been the amount of calories available to the average first world citizen. The immediate effect has been that people have grown much larger (first in height, then in width), but various pathologies have increased as well, such as diabetes, heart disease, and certain cancers.

The incredible advances in medicine over the last century, give many reason to hope that when any pathology is understood well enough, modern science can provides ways to mitigate or resolve it. Perhaps the same will be true of enhancements. As we delve deeper into our understanding of the human organism, we may be able to circumvent the economy of traits that leads to apparent trade-offs, or control these trade-offs with extreme precision. Maybe soldiers of the future can have their cake and eat it too, when it comes to enhancements useful for the field: Designer moods, extended stamina, improved memory and mental clarity, and extraordinary strength. Such enhancements could provide significant strategic advantages, particularly in light of recent discussions of the importance of “force deployment.”<sup>56</sup> The ability of soldiers to reason tactically, adapt, and persevere in the field may be just as important as the increasingly high tech weapons they will have at their disposal. Ultimately, the proof will be in the pudding, as it were. However, at some point we will have to confront the question of what qualities should be enhanced and whether the qualities that make a better soldier also make a better citizen and person. In the meantime, there are many other areas where biological research has yielded clear and less controversial benefits for optimal performance. These include technologies that track health, such as the “Mobile Heat Stress Decision Aid” presently being fielded to help American troops avoid heat exhaustion in desert climates, as well as many that enable better hygiene, nutrition, and sleep.<sup>57</sup>

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<sup>56</sup> See S. Biddle, *Military Power: Explaining Victory and Defeat in Modern Battle*. (Princeton: 2006).

<sup>57</sup> The significant benefits of the Heat Decision Aid are discussed in the report: W. Santee, et al. “Comparison of USARIEM Heat Strain Decision Aid to Mobile Decision Aid and Standard Army Guidelines for

## Selection

Until we possess the ability to pharmacologically enhance or genetically engineer better soldiers, biological knowledge can also be employed to help select soldiers with desirable traits that have measurable physiological manifestations or correlates. This has already been done for some time with regard to medical conditions perceived as liabilities in military service. In addition to serious disabilities and diseases, common conditions such as “flat feet,” asthma, and allergies automatically disqualify Americans for military service. Certain military divisions have more restrictive standards on account of their particular missions, such as the vision requirements for pilots. Most of these traditional medical qualifications for service relate to observable qualities — conditions that have noticeable physiological manifestations and are likely to be known to the individuals they affect. However, research has increasingly identified biological markers that correlate with physiological capacities, and these relationships are not immediately obvious or known to individuals. Although such relationships are often probabilistic, they nonetheless provide valuable knowledge. One of the serious questions that will confront those who make personnel decisions and policies in the future will be whether and to what degree biological markers should inform the placement and professional opportunities of soldiers. For some this will likely conjure images from the classic film *Gattaca* along with concerns about oversold biological determinism. Others however will be quick to point out the undeniable utility of this knowledge.

Consider the findings of a recent study of the biological effects of uncontrollable stress in the military's Survival, Evasion, Resistance and Escape (SERE) training course. Researchers closely monitored the hormones and performance of over 200 students throughout the course, which involves prolonged exposure to high levels of stress.<sup>58</sup> The changes in cortisol (our primary stress hormone) they recorded were some of the highest ever documented in humans. Likewise, testosterone levels showed a dramatic drop, in some cases from normal levels to castration levels within a matter of hours. Moreover, the stress of the course causes significant biological deficits. Many participants experienced high levels of “dissociation” — disruptions in consciousness that alter perceptions of bodily identity and control — and these episodes were correlated with lower levels of performance. Twenty-four hours after the conclusion of the course, the hormones adrenaline and neuropeptide-Y, which the body release in response to stress and whose levels were correlated with better performance, remained depleted in most participants. However, there was a notable exception, namely the subgroup of Special Forces soldiers. Both of these hormones had returned to normal levels in the average SF soldier, and these soldiers had also experienced lower levels of dissociation and better overall performance during the course.

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Warm Weather Training” Army Research Institute of Environmental Medicine.  
(<http://www.stormingmedia.us/82/8273/A827384.html>)

<sup>58</sup> C.. Morgan, and G. Hazlett, “Assessment of Humans Experiencing Uncontrollable Stress: The SERE Course” in *Special Warfare*. Spring 2000. pp. 6-12.

The authors attributed the extraordinary performance of SF soldiers to two complementary factors: the selection effects of Special Forces training regimens, which weed out individuals who are overly sensitive to stress, as well as “stress inoculation” that occurs as part of training. The study observes, “The end product of the SF pipeline is a soldier who is biologically and psychologically different. These differences all point in the direction of higher stress tolerance and a greater capacity for functioning effectively under high stress.”<sup>59</sup> Given the relevance of operational stress to soldiers’ cognitive abilities, physical resilience, and immune system there are good reasons to want to promote or select “stress inoculated” individuals. The authors single out nutritional supplementation as one promising way to mitigate the biological effects of stress, but their research also suggests there may be individual genetic differences in the way people deal with stress that could be discovered through simple biological screening processes. If we can predict how well individuals are likely to respond to stress based on particular bio-markers, it is very possible that these will become part of the selection criteria for certain military units.

The way individuals respond to combat situations varies widely. Although many reactions can be strengthened or weakened by training, others have deeper, intransigent sources. Ernst Junger (*Storm of Steel*) found the First World War exhilarating and repeatedly threw himself into no man’s land with little fear. Erich Remarque (*All Quiet on the Western Front*) despised the same war, particularly its effects on soldiers. Perhaps an explanation of such difference is to be found at some biological level. As we learn more about individual biological variation, this knowledge is likely to inform new standards of selection for modern soldiers.

### Conclusion

We are in many respects fortunate not to live within the warrior culture of the ancient Mediterranean chronicled by Homer, Thucydides, and Livy. We are also privileged to enjoy the benefits of modern science and medicine. However, the ability of Western states to constrain violence and manage passions is indebted to more than mere technological advancement or biological superiority. The genetic endowment of humans has changed fairly little in the past few millennia, and, although changes in diet, exercise, and medicine have had a profound effect on our biology, they are still insufficient to explain variations in human institutions, culture, and history.

Many of the most historically successful strategies for containing violence did not depend on any significant biological insights. The recent book, *Violence and Social Orders*, by North, Wallis, and Weingast convincingly demonstrates this point.<sup>60</sup> Our continued search for ways to provide security and peace needs to remain cognizant of this fact. On the other

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<sup>59</sup> Ibid. p.11

<sup>60</sup> D. North, J. Wallis, and B. Weingast, *Violence and Social Order: A Conceptual Framework for Interpreting Recorded Human History*. (Cambridge: 2009).

More interestingly, the shared environmental component seems to capture a trivial amount of variance in the specific attitudes, suggesting the dominance of the biological component of the attitudes over the socialized component. The shared environmental variance shared between the twins' accounts for systematic attempts at socialization, within family similarity in environment, and common social background. Thus, if there was a concerted effort to teach people the "correct" attitude, this component would absorb the majority of the variance. Because this is clearly not the case, it is necessary to conclude that these attitudes do not seem to be influenced by common environmental factors; however, it is difficult to draw strong conclusions without knowledge about the variability around the estimate of the variance components. Central to the current argument, the specific attitude shared environment variance is less than the shared environment for the general ideology scale.

Finally, the unique environmental variance component captures the majority of the variance in every attitude. This is not overly surprising given that the unique environment (E) is the accumulation of unique, random, or unshared environmental influence which also includes error. This suggests that political attitudes are strongly influenced by the idiosyncratic features that make up a person's life. Thus, these military or defense related attitudes seem to decompose into additive genetic and unique environmental factors.

Verhulst, Hatemi & Eaves conducted a confirmatory factor analysis to retrieve factor scores for social, economic and military ideology dimensions with the same items, with the attitudes from the Alford, Funk and Hibbing paper presented in Table 1 comprising the military factor.<sup>24</sup> The univariate variance components results are presented in Table 2.<sup>25</sup> What is evident is that when the attitudes are aggregated into a single military factor, the results replicated very strongly. In fact, for both males and females this military dimension does not have a statistically reliable common environment effect while for both the economic and social ideology dimensions, the shared environment variance component is highly significant.

Verhulst, Hatemi and Martin (2010) further extend the robustness of these effects using a sample of Australian twins.<sup>26</sup> As can be seen in Table 3, Punishment attitudes have a relatively small shared environment component in males while in females the shared environmental component in females is decidedly not significant. Again, with a different set of twins, a different set of items comprising the same underlying attitudinal scale, in a different political climate, the basic result of punishment attitudes being driven by a strong additive genetic component and a variably significant shared environmental component

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<sup>24</sup> B. Verhulst, P.K. Hatemi, & L. Eaves, "Personality Traits and Political Ideologies" (submitted).

<sup>25</sup> For more information on variance components modeling in the classic twin design see S.E. Medland and P.K. Hatemi, "Political Science, Biometric Theory and Twin Studies: A Methodological Introduction," *Political Analysis*, 17:2 (2008): 191-214.

<sup>26</sup> Verhulst, Hatemi and Martin, "The nature of the relationship between personality traits and political attitudes".

hand, the biological sciences are developing extraordinary insights into the foundations of human behavior and unprecedented possibilities for medical interventions, all of which would be foolish to ignore. As the quantity of biological research continues to explode- and it will- it's important that those interested in cutting edge priorities within security studies understand the genuine insights of emerging biological knowledge as well as the limits of new research.

Upon examination, much of the hype touting the utility of basic research in neuroscience and genomics appears premature. Genetic explanations of behavior have shed little light on the decisions of those with healthy brains, and neuroscientists are nowhere close to being able to read complex thoughts with a scanner. However, certain aspects of the biological research explored above do promise to make significant contributions towards our ability to establish justice, insure domestic tranquility, provide for the common defense, promote the general welfare, and secure the blessings of liberty — to use the language of desirable social outcomes framed in the US Constitution. However, like all technologies, biological insights can be used for ill in the wrong hands, and indeed many worry that these could make new forms of tyranny possible. This concern runs deeper than standard worries about any arms race. These technologies could be used for more than conventional domination, they might be used to change the very sort of people we are. The specter of biological engineered dystopias, explored so powerfully in contemporary literature and film, raises genuine questions about whether biological discoveries will lead to a Brave New World.

If it is indeed the case that humans are naturally “thumotic,” and most biological research supports this classical perspective, then it is unlikely that we can completely secure peace and tranquility without radically changing, or indeed abolishing, human nature as we know it. This is the simple insight that feeds much of the unease with the radical possibilities of biotechnology. Freud's basic argument in *Civilization and Its Discontents*, that civilization will necessarily frustrate many aspects of human nature, raises the question as to whether it would be better to sacrifice aspects of human nature to achieve more stable and lasting social tranquility. The reality, Freud argued, is that it will not be easy to pacify human nature:

The element of truth behind all this, which people are so ready to disavow, is that men are not gentle creatures who want to be loved, and who at the most can defend themselves if they are attacked; they are, on the contrary, creatures among whose instinctual endowments is to be reckoned a powerful share of aggressiveness. As a result, their neighbor is for them not only a potential helper or sexual object, but also someone who tempts them to satisfy their aggressiveness on him, to exploit his capacity for work without compensation, to use him sexually without his consent, to seize his possessions, to humiliate him, to cause him pain, to torture and to kill him.<sup>61</sup> (68-69)

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<sup>61</sup> S. Freud, *Civilization and Its Discontents*. (Norton: 1961). pp. 61-69.

However, from the perspective of the post-Cold War world, concerns about biological dystopias and unmanageable aggression likely appear premature and overwrought. The great achievement of liberal democracies has been the use of institutions to channel *thumos* towards socially beneficial pursuits and to satisfy residual passions through cathartic spectacles of sport, art, and dramatic entertainment. Much violent crime appears readily explained by physiological abnormalities (mental illness), drugs and alcohol, or childhood upbringing. The decisions of elites are fairly well characterized by basic financial and ideological interests, and those in government are often sufficiently constrained by the political process and the democratic sounding board of the popular press. A minimal moral framework emphasizing rights of person/property and prohibiting assault and theft is widely accepted as legitimate.

To those who hope to preserve and extend the relative tranquility of liberal democratic societies, biological research seems to promise knowledge useful for shoring up many desirable aspects of our current civilization. For those afflicted by mental illness or chemical dependencies, biological knowledge promises to remedy these conditions and their effects. For those interested in understanding quirks of human behavior and designing more efficient institutions to deal with them, biological research hopes to provide a fuller account of human psychology. And biotechnology that enhances the performance of troops or the capacities of law enforcement is of one piece with the quest for technological superiority that ensures the hegemony of Western states, and by extension international stability. The only serious concern is whether any given biological research program is actually producing valid and applicable results.

There is much to recommend this view of the generally positive contributions biological research stands to make to the cause of peace and security. Whether the dystopian or Freudian fears prove to be warranted will depend both on the direction of future research and the ability of social scientists and decision makers to evaluate it wisely. Hopefully, rather than providing tools to abolish what is most distinctively human, new frontiers in biological research might help elevate the better angels of our nature.