Social and Behavioral Sciences for National Security: A Decadal Survey

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Introduction

The historical relationship between the brain and military spans many cultures, continents, and centuries. From the age-old use of stimulants, depressants, intoxicants, and hallucinogens—including cannabis, coca, cocaine, and others—to today's pharmaceuticals and sophisticated brain–machine interfaces (BMIs), humankind has long studied and altered neurological functions to enhance mental and physical performance in warfare. Some of the same pharmacological and electronic neuroengineering breakthroughs that are being developed for use in medicine, including military medicine to treat neurological and psychiatric wounds of war, can also be employed within dual-use initiatives to facilitate or augment warfighter capabilities, or both.

Despite numerous success stories and persistently high hopes for the ways that brain science can be used in national security and intelligence operations, fundamental tensions between the goals of science and security riddle the history of US military and intelligence neuroscience research with case studies in ethics, law, and policy. Whereas national security relies on secrecy to maximize strategic, technological surprise, science is an inherently public enterprise characterized by transparency and peer review. Security agencies, moreover, focus on the ever-present immediacy of security threats, while science slowly tests and aggregates truths over time. History shows that an unfortunate result of these conflicts of values can manifest as unethical experimentation on human subjects and the deployment of technologies before being scientifically and ethically validated as safe and effective. And yet, as described by the Collingridge dilemma, the practical and ethical consequences of technological innovation may be unpredictable until widely deployed; by then, however, it may be too late to put the proverbial genie back in the bottle (Collingridge 1980).

In the context of scientific research and the development and deployment of technology, scholars and policymakers use the term "dual-use" to refer to two separate, but interrelated, dichotomies. One meaning indicates that the research and/or use of a given technology may be intended to achieve either benevolent or malevolent ends, whereas the second refers to science and technology with both military and civilian uses (Evans 2014).

Historical Context

Since the mid-nineteenth century, government agencies and advisory bodies have been periodically created to assess and direct science and technology policy issues as they relate to military operations and national security. Ever since the outset of the Cold War, US national security policy has called for technological superiority over all adversaries, not merely parity. In 1950, the National Security Council officially recognized the importance of the science–security partnership, declaring: “it is mandatory that in building up our strength, we enlarge upon our technical superiority by an accelerated exploitation of the scientific potential of the Unites States and our allies” (Nitze 1950). Following this recognition of the importance of innovation and technological surprise, a full-fledged military–academic complex emerged and remains an essential element of today’s university funding portfolio.

Founded in 1958, DARPA’s mission was and remains that of “keeping the United States out front when it comes to cultivating breakthrough technologies for national security rather than in a position of catching up to strategically important innovations and achievements of others” (DARPA 2016). Its most celebrated achievement, the development of the Internet, is proving useful in various BMI projects and integrating head-mounted displays to web-access for augmented reality. Since at least the early 2000s, DARPA has contracted with many university- and medical school-based neuroscientists to pursue projects of interest. According to one estimate, by fiscal year 2011 DARPA was funding at least $240 million USD in cognitive neuroscience studies (Kosal, quoted in Moreno 2012, p.53).

Other US military agencies have also been, and are increasingly engaged in brain research. The Office of Naval Research (ONR) has sponsored a number of projects that have focused on enhancing warfighter performance. Through such work, ONR seeks, for example, to “[e]nhance individual and team decision-making and combat effectiveness” by optimizing biological efficiency and performance (Office of Naval Research: Science & Technology n.d. a). In addition, the US Department of Defense directly engages brain research through broad agency announcements and contracts that solicit university-based projects.

Warfighter Enhancement

Biotechnological neuro-enhancement may be the next frontier of warfighter optimization. Preliminary studies indicate the potential to safely modulate and stimulate neurological activity with electrical current, magnetism, and ultrasound. In 2009, the US National Research Council identified transcranial magnetic stimulation (TMS) as a wakefulness enhancement for the US Army (Committee on Opportunities in Neuroscience for Future Army Applications, National Research Council of the National Academies 2009). Similarly, DARPA and the US Army funded studies of wearable, helmet-borne devices to affect neurological function through the delivery of patterned ultrasound pulses (Tyler 2010).

Brain–machine interfaces (BMIs, also known as brain–computer interfaces or BCIs) constitute another major area of military neurological device research. BMIs either translate neurological signals into inputs for computers or machines, or vice versa. Scientists successfully trained monkeys, equipped with BMIs attached to robotic arms, to articulate and control the prostheses using only their neurological output (Lebedev 2006). Since then, BMIs have also facilitated human neurological control of a mouse cursor, which could allow paraplegic patients to regain control and physical autonomy in their lives (Simeral et al. 2011). Current DARPA research seeks to complete the feedback loop between the brain and prostheses, not only granting the brain direct control over a robotic limb but also returning tactile feedback, such as pressure and temperature, from sensors in the prosthesis to the user's brain (DARPA 2015).

An early twenty-first century DARPA program, AugCog (short for "augmented cognition"), sought to fully integrate, at the neurological level, a warfighter's cognitive capacities and sensory perceptions with his or her combat vehicle environment (Cummings 2010). As computers monitor working memory, attention, executive function, and sensory input, the warfighter would be prompted in real time with information about cognitive load. This kind of biofeedback could help a warfighter manage his or her neurological resources; it might even bring into conscious awareness one's own subconscious recognition of danger, prompting the warfighter's attention to threats before they would have been identified naturally (Szondy 2012).

Biotechnological enhancement, whether brain stimulation, neurological control of artificial limbs, or cognitive feedback about neurological process, raises a myriad of ethical concerns. The bioethics literature on optimizing human neurological function and performance tends to focus on cognitive enhancement via the use of drugs and devices and the implications for performance in school and in the workplace settings. Warfighter enhancement, however, can manifest more grave, if not lethal stakes and may entail additional enhancement modalities, including physical adaptions and modifications through wearable or implantable technologies, such as neurofeedback-equipped helmets and biointegrated BMIs, respectively. When approaching these ethical issues, it becomes important to evaluate the actual capabilities and limitations of the technique(s) or technologies at hand, to assess if, and how any augmentation of function is imparted, and to evaluate the impact that any such effects will have (Shook & Giordano 2014; Giordano 2015). On a fundamental level, human enhancement raises ethical questions in at least two domains: (1) Does enhancement inherently transgress fundamental moral boundaries? (2) Do the known and unknown risks of enhancement interventions render them unethical?

Transforming Ethical Analyses Into Actionable Policies

The 2014 report of the National Academies asserted that the research, development, and use of brain science in international military and security scenarios represent a significant and growing concern. In the United States and most Western nations, governmentally funded neuroscience programs adhere to dual-use research of concern (DURC) policies, in keeping with the general constructs of the Biological and Toxin Weapons Convention (BTWC) and Chemical Weapons Convention (CWC). But such control can also create a dilemma: on the one hand, it creates parameters for the conduct of brain science in participatory states; on the other, it can create opportunities for other nations or even nonstate actors to take advantage of these constraints to gain a competitive edge toward attaining power.

Casebeer has proposed a normative framework to address the neuroethical issues fostered by neuroscience research and its translation, which although primarily oriented toward military and civilian medicine, can be applied, and is nonetheless useful to national security, intelligence, and defense agendas (Casebeer 2014). This has been expanded to engage neuroethicolegal and social risk-assessment and mitigation paradigm, in which defined steps, queries, and framing constructs are employed to determine if and how specific uses of neuroscience and neurotechnologies give rise to ethical issues (Giordano 2015). Critical to this approach is consideration of contexts of application. An undergirding question is whether neuroethical issues of brain science in contexts of national security and defense are best addressed in accordance with military ethics, ethics relevant to enterprises in the public domain, or some other system or ethical toolkit.

The professional ethics of the military should define the focus, scope, and conduct of any and all its constituent scientific and technological enterprises. Just war theory, *jus ad bellum*, may substantiate using neuroscience and neurotechnology (or any science and technology) in national security, intelligence, and defense, in accordance with ethical precepts that define the need for aggressive actions. The premise is that war is a horror to be abhorred and avoided, but realistically may sometimes be necessary. Defined criteria attempt to discern if and how such conflict might be prevented, restrained, and made more humane.

In this latter regard, precepts for fair conduct of conflict (i.e., *jus in bello)* might define whether and ways that neuroscience and technologies may be employed within warfare, or to prevent warfare. But particular attention should be paid to the precept of *no means malum in se*, which proscribes the use of methods and weapons that violate some consensus construct of harm (e.g., chemical weapons), or that may be uncontrollable (e.g., biological and nuclear weapons), or both of these. This remains a gray zone: while some domains of brain science fall within the purview of the current BTWC, CWC, and DURC policy, others such as neurotechnologies do not.

In 2014, the US National Research Council report on *Emerging and Readily Available Technologies and National Security* addressed the ethical, legal, and social issues (ELSI) relative to government agencies' work in disruptive technologies of potential interest to both state and nonstate actors. The committee's recommendations included a five-step process: initial screening of proposed research and development; further review of proposals that raise ELSI concerns; project monitoring and midcourse corrections as needed; public engagement; and periodic review of ELSI processes within an agency (Chameau et al. 2014).

But which agency, agencies, or organizations should be charged with these duties, how will their constituencies be decided, and what level and extent of interagency and public discourse can and should be engaged? Differing groups may have distinct views and goals, and, as with any approach to national defense, issues of security, operational readiness, and power will need to be evaluated and weighed in light of global humanitarian concerns. We believe that it is vital to inform the public about the reality and growing potential for brain science to be used in security, intelligence, and defense operations, so as to foster broad social awareness.

Ethics must inform and lead to the formulation of policies and regulations that guide and govern what aspects of brain science are studied and employed in these contexts (Dando 2007; Moreno 2012). The growing potential for the use of novel drugs and devices of brain science will prompt re-examination and revision of current categorizations, caveats, and constraints. As we have stated in prior work, it is undeniable that neuroscience is, and will be, employed in security and defense agendas (Moreno 2012; Wurzman & Giordano 2014). Our hope is that the knowledge and capabilities it confers will be used to prevent or mitigate violence, reduce conflict, and foster peace.

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Disclaimer

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