University of Pennsylvania
ScholarlyCommons

Neuroethics Publications

Center for Neuroscience & Society

9-1-2004

# DARPA On Your Mind

Jonathan Moreno
*University of Pennsylvania*, morenojd@mail.med.upenn.edu

© 2004. Permission from Dana Press. Reprinted from *Cerebrum*, Volume 6, Issue 4, Fall 2004, pages 92-100.
Publisher URL: http://www.dana.org/books/press/cerebrum/

This paper is posted at ScholarlyCommons. http://repository.upenn.edu/neuroethics_pubs/30
For more information, please contact repository@pobox.upenn.edu.

# DARPA On Your Mind

**Abstract**
Think your brain is being controlled or disrupted by the Pentagon? You risk being called a nut, but the notion is not so far-fetched. Current research at the intersection of neuroscience and national security might one day produce weapons that literally boggle (or, if desired, enhance) the mind. This would give us unprecedented war-fighting superiority as well as a set of ethical dilemmas that could make genetically-modified-organism issues pale in comparison.

**Disciplines**
Neuroscience and Neurobiology

**Comments**
© 2004. Permission from Dana Press. Reprinted from *Cerebrum*, Volume 6, Issue 4, Fall 2004, pages 92-100.
Publisher URL: http://www.dana.org/books/press/cerebrum/

This journal article is available at ScholarlyCommons: http://repository.upenn.edu/neuroethics_pubs/30

# Cerebrum

## The Dana Forum on Brain Science

Volume 6 ■ Number 4 ■ Fall 2004

ARTICLE

## *DARPA on Your Mind*

Jonathan D. Moreno

Think your brain is being controlled or disrupted by the Pentagon? You risk being called a nut, but the notion is not so far-fetched. Current research at the intersection of neuroscience and national security might one day produce weapons that literally boggle (or, if desired, enhance) the mind. This would give us unprecedented war-fighting superiority as well as a set of ethical dilemmas that could make genetically-modified-organism issues pale in comparison.

*About the Author:*

Jonathan D. Moreno, Ph.D., is Emily Davie and Joseph S. Kornfeld Professor of Biomedical Ethics at the University of Virginia. He is a bioethics advisor to several organizations including the Howard Hughes Medical Institute and the U.S. Department of Health and Human Services. Dr. Moreno is the author of several books including *In the Wake of Terror: Medicine and Morality in a Time of Crisis* (MIT Press, 2003), and *Undue Risk: Secret State Experiments on Humans* (Routledge, 2001). He has published more than 200 professional and general articles and is an ethics commentator for ABCNews.com.

DANA PRESS

©2004 Dana Press
The Dana Foundation
www.dana.org

*by Jonathan D. Moreno*

# *DARPA on Your Mind*

*Applied science may once again play a decisive role in changing the face of armed conflict, and the rest of human affairs, by shifting the battlefield to our very brains. The national-security establishment—and particularly the Pentagon's Defense Advanced Research Projects Agency (DARPA)—supports research at the intersection of neuroscience and national security that could u ltimately enable authorities to do things like enhance (or muddle, or erase) memory, monitor crowds for individuals whose brain patterns correlate with aggressive behaviors, or control weapons from afar merely with thoughts. What are the dangers of such information falling into "the wrong hands," and are there any "right hands" for this kind of knowledge? Is any extension of human abilities justified by the need for government to protect its society?*

*The long-term Defense implications of finding ways to turn* thoughts into acts, *if it [*sic*] can be developed, are enormous: Imagine U.S. warfighters that only need use the power of their thoughts to do things at great distances (*emphasis in original*).*

—Strategic Plan, Defense Advanced Research Projects Agency, February 2003

A few years ago on a bucolic drive from Charlottesville, Virginia, to Washington, DC, my cell phone rang. Like any good citizen, I pulled over before I took the call.

"Dr. Moreno?" a female voice said.

"Yes?" I said.

"I need to talk to you about a matter—actually, it's…a national security matter."

"Uh, yes?"

"I read your book. I have been the victim of a government experiment, and I need to talk to you."

As I have done many times, I tried to assure the caller that I am not a physician or a lawyer, only a bioethics professor who wrote a book about human experiments and national security. I expressed my sympathy but told her I was unable to give her relief. Nonetheless, like others who have called or e-mailed me in the past six years, she was sure I could somehow help her. Mercifully, I lost the cell signal and the call.

I believe that people who think they have been victimized by government mind--control experiments are misguided, yet I am also impressed that there are thousands of such persons. I have worked for two presidential advisory commissions and have heard

many of these people provide perfectly lucid testimony about scenarios I find fantastic. Some of them are courageous and resolute in the struggle they perceive as having been foisted on them; others are distraught and terrified of what horrors the next day may bring.

## JUST BECAUSE YOU'RE PARANOID DOESN'T MEAN SOMEONE ISN'T FOLLOWING YOU

Despite the vast distance between their worldviews and mine, I have long been impressed at the irreducible kernel of truth behind these people's bizarre obsessions: The scientific community, in fact, has had a great deal of interest in "mind control," particularly those scientists in the United States and elsewhere who have been supported by the national security establishment. The history of this activity has been rich and rather odd, an offbeat slice of our cultural history. But the future is far more suggestive; it adds fuel to the fire that inflames those fearful minds most of us find hard to understand.

One might well wonder what "things" the Defense Advanced Research Projects Agency (DARPA) has in mind to do "at great distances," and what else might thereby be made possible. The epigraph that opens this article comes at the end of a discussion, headed Enhanced Human Performance, in a Defense Department paper in which the authors declare, "The goal is to exploit the life sciences to make the individual warfighter stronger, more alert, more endurant, and better able to heal." DARPA's Continuous Assisted Performance (CAP) program, the document continues, "is investigating ways to prevent fatigue and enable soldiers to stay awake, alert, and effective for up to seven days straight without suffering any deleterious mental or physical effects and without using any of the current generation of stimulants." Experiments are cited in which a monkey has been trained to manipulate a computer mouse or a telerobotic arm "simply by thinking about it."

These remarkable objectives would be easier to dismiss if the agency could not boast such an impressive track record. Its overall mission is to bring discoveries from fundamental research to bear on the mission requirements of today's warfighters, to accelerate the pace of applicable discoveries. Among DARPA's accomplishments in its continuous effort to "fill the gap" between basic research and military use are the Saturn rocket, ground radar, the Stealth Fighter, and the Predator missile. DARPA-developed Unmanned Aerial Vehicles have been used in Afghanistan and elsewhere. And then, of course, there is the one innovation that might prove to be the most socially transforming of them all: the Internet.

These mechanical and electronic innovations required extraordinary resources, foresight, intelligence, and patience. Unlike other areas of government, decades of development are acceptable in the DARPA framework. Today the agency is turning its considerable ingenuity and generous funding ($3 billion in fiscal year 2005) to the potentialities of biology, including, as we have seen, the enhancing of human performance.

The onrush of discoveries about the brain and the concomitant technological advancements suggest at least a few areas of interest. Two of these—improving

intellectual endurance and achieving mental control at a distance—are mentioned in DARPA's Strategic Plan. Others, such as memory enhancement and distant brain scanning (by means of a device that could detect telltale blood flow in certain neural systems from a distance), also suggest interesting possibilities at the intersection of neuroscience and national security. In addition, they present formidable ethical questions that our society has barely articulated, let alone carefully addressed. Are there places that science just should not go when it comes to what Woody Allen once called his second favorite organ?

### WAKE UP!

Longtime Minneapolis residents tell stories about the woozy, skinny young men seen about town during World War II. They were conscientious objectors involved in sleep- and nutrition-deprivation experiments. Problems of endurance and alertness are endemic to soldiers on the march. Infantry troops often subsist for a year at a time on four hours of sleep a night and modest rations. Any advantage that can be achieved in sheer concentration and physical stamina has long been prized, and biological innovations have been applied to this goal. As early as 1883, Bavarian soldiers on maneuvers were given cocaine to see if the drug would help overcome fatigue.

Paradoxically, some of the most infamous examples of drug experiments by the military have had as their purpose the inducing of confusion and panic, rather than clarity and cogency. Notoriously, American officials suspected the North Koreans and "Red" Chinese of using hallucinogens to "brainwash" POWs during the Korean conflict. During the 1950s, interest in determining the psychological effects of psychotropic drugs was rampant, especially in the CIA and the U.S. Army. One of the CIA's activities under the code name MKULTRA was the dosing of unsuspecting individuals with LSD, including army anthrax expert Frank Olson, who fell to his death from a New York City hotel in 1953 under circumstances that have led some to conclude that the drugging was part of an assassination. That same year, a New York City tennis pro named Harold Blaur died following a mescaline overdose in an involuntary experiment at New York State's Psychiatric Institute. Blaur, who had been admitted to the institute following a diagnosis of clinical depression, was an unwitting subject under a secret contract between the state and the Army Chemical Corps. In the 1960s, thousands of soldiers were given LSD in tests to which their consent was questionnable. Many at least seem to have known they were going to be exposed to an hallucinogen, but not where or how.

These incidents, it should be noted, came in the wake of the trial of Nazi doctors in Nuremberg, Germany, after World War II, and the famous code written by the judges. The first line of the Nuremberg Code is, "The voluntary consent of the human subject is absolutely essential." Less than two months after Harold Blaur's death, the secretary of defense issued a top-secret memorandum that made the code the Pentagon's policy for atomic, biological, and chemical warfare experiments. Yet the U.S. government funded a number of both covert and unclassified

psychological experiment programs through the 1950s without adequate consent. Some of them did not involve drugs, such as studies intended to incite emotional disturbance in postpartum women at a lying-in hospital in Montreal. Institutionalized people have historically been popular experimental subjects. Academicians were intensely interested in personality structure in those days.

*But these days DARPA seems more concerned with enhancing soldiers' capacity to go without food or sleep, and even to heal their own injuries, than it is with psychic deconstruction or reprogramming.*

A Harvard study pursued psychic deconstruction by humiliating undergraduates. As described in Alston Chase's *Harvard and the Unabomber*[1], one of the subjects was a young student named Ted Kaczynski.

But these days DARPA seems more concerned with enhancing soldiers' capacity to go without food or sleep, and even to heal their own injuries, than it is with psychic deconstruction or reprogramming. As reported by the journalist Noah Shachtman[2] and described in DARPA's website, a project called "Metabolic Dominance" aims to develop a "nutraceutical" that would vastly improve soldiers' endurance. The agency has also invested in sleep-reduction experiments, and in examining whether the body's core temperature can be altered depending on weather conditions. Seriously injured soldiers might be able to go into a sort of hibernation while they healed, perhaps after self-administering advanced wound-healing medication. "The ultimate goal," DARPA says, "is to enable superior physical and physiological performance by controlling energy metabolism on demand."

The ethical issues suggested by such work should be flying off this page by now. How will individuals be recruited to try what will obviously be very dangerous experiments? If such experiments are done in secret, how will they be ethically reviewed? What are the dangers of such information falling into "the wrong hands," and are there any "right hands" for this kind of knowledge? Is any extension of human abilities justified by the need for the state to protect a society that is free and democratic? Or is nature itself at hazard for distortions that make the ingestion of genetically modified organisms pale in comparison?

## DO YOU REMEMBER WHEN?

One aspect of cognitive capacity that would be of immense value to combat personnel is an improved memory. Battle assignments can be complex and easily misremembered when fast-moving events unfold. Fighter pilots in target-rich environments, for example, have to store a vast quantity of information.

Both biology and artificial intelligence offer possibilities here. Neuroscientists have found a gene that codes for NMDA receptors in the brain. When they gave mice extra copies of the gene for a type of NMDA receptor, the mice showed superior learning skills. Genomic and proteomic medicine may make this form of enhancement

possible. But would individuals then be overloaded with memories, storing vast quantities of detail that would normally be ignored because we have evolved to filter out or delete useless bits of information? Such an innovation could literally be maddening, let alone counterevolutionary, unless the effects were short-lived. And who would want to volunteer for the first trial?

*The idea was to create a database with every communication an individual has written, all pictures taken of them, and every bit of information about them.*

The artificial-intelligence approach would be more straightforward: engineer a direct connection between your brain and your Palm Pilot. Information could be not only uploaded to the brain but also downloaded to your Palm. DARPA's now-cancelled LifeLog program was a step away: The idea was to create a database with every communication an individual has written, all pictures taken of them, and every bit of information about them. Then use the Global Positioning System to track all their movements and sensors to record what they say, see, and hear and add that to the database. The unfolding events in a potential terrorist's life could be reconstructed in all their dimensionality. But so could yours or mine, and a civil-liberties outcry after DARPA disclosed the project led to its demise.

Learning about the mechanism of remembering also involves learning about the mechanism of forgetting. In the film, *Eternal Sunshine of the Spotless Mind*, ex-lovers undergo a high-tech brain erasing procedure to forget about the pain of breakup. In a literally touching moment in *Star Trek*, Mr. Spock engages in a Vulcan mind-meld with Captain Kirk, without his consent, to help him forget a tragic love affair. Less romantically, undercover agents would benefit from the ability to lose their memories upon capture. Neuropsychologists have already found that deliberate memory loss among victims of parental abuse is both a demonstrable mechanism (they are not "lying" when they say they don't recall) and a very effective method of defense.

But mucking around with memory raises significant questions about personal identity. As far back as David Hume in the eighteenth century, philosophers have noted that our idea of ourselves is intimately bound up with our remembered experiences, including previous ideas about ourselves that have entered the stream of consciousness. Anyone who believes that there are certain boundaries that should not be crossed must be concerned about the modification of the ability to remember and to forget.

## BENT SPOONS

Uri Geller gained fame decades ago for his ostensible ability to bend spoons using only mental energy. Then magicians did the same thing. Although Geller still has his advocates, agencies like DARPA seem reluctant to throw in their strategic lot with mentalists. Instead, in its effort to help warfighters "do things at great distances," DARPA initiated its brain-machine Interfaces

Program, which has shown that a monkey can control a robot arm using only neural impulses. In a 2002 report to Congress, DARPA insisted that these are not merely the impulses that normally control the monkey's arm, but the very thoughts about arm movement themselves, transmitted to a robot limb in another room. Similarly, in recent work at Duke University, scientists have shown that monkeys can be trained to engage in complicated movements, with neural processes alone, by means of devices that involve both reaching for and grasping an object. At the 2003 meeting of the Society for Neuroscience, researchers from Duke noted that they had proved the same principle in humans undergoing neurosurgery (who could cooperate because brain surgery anesthesia is local, not general) and that they could safely identify the cells that initiate actions. Ultimately it should be possible for paralyzed people to control limbs through computer implants.

*Those who suspect innovative national security agencies like DARPA of malicious intentions believe it will continue to probe all the possibilities presented by neuroscientific advances, including mind control.*

Once this can be done, those same impulses, digitized by a computer, can be sent as encrypted messages over the Internet to do things at any distance the electrons will travel, including maneuvering aircraft, inspecting a target, releasing weapons, and so forth, at very close range. A soldier could stay at a safe distance while controlling a drone; an operator far from the battlefield could do the same thing. Clearly we've come a long way from arguing whether Uri Geller actually bent that spoon.

General Patton is said to have lost his command after World War II when he told a journalist he regretted a world in which distant aircraft could determine the course of combat. But in fact the opportunity provided by ground warfare to engage in heroic acts at close range has never carried much weight in comparison with tactical advantage. Is any kind of tactical advantage acceptable, or at any point are some advantages so profound as to be unfair? (Probably not.) Defenders of these development efforts will surely observe that they are likely to alleviate one of the most vexing problems of modern war, the unintended effects of lethal weapons on unarmed civilians.

## BAD VIBES

Since the 1970s, reports have circulated about Soviet and Chinese interest in "psychotronic" weapons intended to influence psychological and physiological processes at a distance, perhaps through electromagnetic radiation. Those who suspect innovative national security agencies like DARPA of malicious intentions believe it will continue to probe all the possibilities presented by neuroscientific advances, including mind control. As evidence, human rights advocates claim that references to mind control or psychotronic weapons, including summaries of information about Russian and Chinese efforts, remain classified.

According to U.S. experts, although psychotronic warfare has been seized upon by those who believe a security agency is controlling or disrupting their brains, its goal as information warfare would be to attack communications systems, thus causing a catastrophic infrastructure failure. Jamming transmissions by Saddam Hussein's radar installations in the run-up to the Iraq war was an elementary example of such tactics.

*If the basic mechanism could be improved to detect blood flow at some distance from the target brain—something like the MRI systems within which surgery can be conducted—it would be possible to install surveillance systems in sensitive public spaces like airports.*

Similar principles might be applied to the mental energy of the warfighters themselves, perhaps by "pulse-wave weapons," which would disrupt motor signals from the central cortex. Once again, though, reports about Russian possession of such weapons are highly disputed—as are claims that such technical capabilities exist.

Perhaps more within reach are developments in functional magnetic resonance imaging (fMRI) technology. The advent of fMRI has been a boon to neuroscientists interested in correlating blood flow with just about every imaginable human experience. If the basic mechanism could be improved to detect blood flow at some distance from the target brain—something like the MRI systems within which surgery can be conducted—it would be possible to install surveillance systems in sensitive public spaces like airports. Individuals with increased blood flow in neural systems associated with aggressive behaviors could be singled out and stopped for questioning. Whether this approach would provide a security benefit or not might be beside the point for authorities anxious to appear to be doing all they can to protect the public, as air travelers have noticed in the past few years.

## ETHICS ON DARPA'S MIND?

In the largest sense, what seems to be at hazard are our most basic ideas about personal identity and liberty. What sorts of ground rules can be set for science and for states? Are there regions of forbidden knowledge? Or, because the prospects appear too attractive for governments to ignore (and too important to concede to their adversaries), how should democratic societies prepare themselves to manage these immensely powerful capabilities? We seem to be left with the ironic conclusion that the more tools the neurosciences present for national security purposes, the less secure each of us will be.

Discussions about ethics require the oxygen of transparency, precisely the item in short supply in national security matters. Yet the failure to engage in some prospective analysis of moral issues during the course of technological innovations can have vexing consequences for future generations. Aware of the experience of the atomic physicists, for example, geneticists resolved early on to open themselves up to public scrutiny.

The U.S. government's main funding program for genetics research has from the beginning set aside substantial funds to sponsor projects on ethics. The vigorous public discourse on ethics in genetics is partly owed to that program.

Two complementary options are available to stimulate a similar public debate about the pursuit of these novel technologies that may be applied to national security objectives. One option is to create a funded research program in which proposals can be submitted for examining the kinds of problems raised in this paper. Even if the detailed mechanisms cannot be shared, the issues at stake are clear enough and should be debated in scholarly journals and on op-ed pages. A second option is to create an "ethical, legal and social implications" advisory panel within agencies like DARPA, composed of individuals with a range of expertise and who have appropriate security clearances but are not employees of the federal government.

*If only a small fraction of these war fighting innovations bear fruit, applied science will once again have played a decisive role in changing the face of armed conflict.*

Whatever the means used for harnessing the knowledge that is forthcoming to acceptable public ends, our society will need to understand and debate the security options made possible by the new neuroscience. If only a small fraction of these war fighting innovations bear fruit, applied science will once again have played a decisive role in changing the face of armed conflict. In this case, science will have shifted the battlefield to our very brains. ■

## References

1. Chase, A. *Harvard and the Unabomber.* New York: W.W. Norton & Company, 2003.
2. Shachtman, N. "*Wired* News," Wired.com. February 17, 2004.