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**T**HIS IS YOUR BRAIN AS SEEN BY YOU: that familiar seat of ideas, notions, images, and dreams—the locus of your ordinary sense of self.

This is your brain as seen by someone with common sense: the physical location of intuition, reason, imagination, and will.

This is your brain according to the U.S. Constitution: the sacrosanct site of thought and choice—the inviolable domain of the personal discovery of truth and the private pursuit of happiness.

And this is your brain in the hands of those with dubious agendas: a nexus for conducting warfare; a target for mind control in times of political turmoil; a bull’s-eye for manipulation by Big Media, Big Business, and Big Pharma.

*Neuroethics: Mapping the Field* (Dana Press, 2004). The conference sparked a surge in academic papers, and the Neuroethics Society was established in 2006 ([www.neuroethicssociety.org](http://www.neuroethicssociety.org)).

But more than mere academic debate is needed within the paradigm of mainstream science. Keeping powerful new neurotechnologies out of the wrong hands will, first of all, require careful journalistic scrutiny. Increased public awareness will hopefully lead to improved democratic oversight, especially of the far-reaching military and law-enforcement applications of neurotechnology noted later in this article. Just as important will be the pursuit of a more holistic model of the brain and its relationship to consciousness and the mind.

# NEUROTECHNOLOGY’S SHADOW

BYRON BELITSOS

Hidden dangers lurk among the otherwise exciting advances in neuroscience, perils that may grow without a broader awareness of their social and political implications. “While genetics has spawned a robust watchdog industry, neuroscience has received far less scrutiny,”

writes Kathryn Schulz in a major review article in *The Nation*.<sup>1</sup> An editorial in *Scientific American* quipped: “The list of moral and social issues attached to neurotechnologies is long enough to position ethicists . . . on a list of hot jobs that appears in the *U.S. News and World Report* annual career guide.”<sup>2</sup>

In 1990 President George H. W. Bush declared the nineties to be “the decade of the brain,” and yet until a few years ago the National Institute of Mental Health had established no budget for the study of neuroethics, and few universities had pursued the subject. The discipline’s true inauguration may have been in 2002 when Stanford University cosponsored a pioneering conference with the Dana Foundation, which published the proceedings in the book

**GENETICS MAY YET THREATEN  
PRIVACY, KILL AUTONOMY, MAKE  
SOCIETY HOMOGENOUS, AND GUT  
THE CONCEPT OF HUMAN NATURE.**

**BUT NEUROSCIENCE COULD DO  
ALL OF THESE THINGS FIRST.**

— *THE ECONOMIST*, MAY 23, 2002

**GAINING KNOWLEDGE  
OF THE BRAIN, DID WE  
LOSE OUR SOUL?**

Finally, this is your brain according to the study of consciousness and informed by the world’s wisdom traditions: the physical vehicle of the mysterious endow-

ments of consciousness and cognition; the temporary biological partner of each person’s uniqueness and creativity; the locus of one’s soul and essential self.

The seventeenth-century scientist-philosopher René Descartes once thought that the pineal gland was the seat of the soul, a notion that neuroscientists today may find rather quaint. Indeed, a scan of the vast literature of neuroscience reveals that the field has swung to the opposite extreme, dispensing with any mention of the soul and rarely referring to the independent existence of the mind or psyche. It is in fact *de rigueur* among the majority of neuroscientists to believe that the brain *is* the mind. And someday, no doubt, we will think this belief to be quaint.

To its (and Descartes’) credit, current science has shown that the pineal gland probably produces DMT, a chemical

agent linked to mystical states, and a subset of neuroscience research has been accumulating evidence that the brain is somehow wired for “God experience.” But contemporary mainstream science was born through a violent break with such metaphysical visions of human potential and God-given faculties, and the well-meaning quest for scientific objectivity has turned the human subject into an object. At the same time, radical reductionism applied to neuroscience has become a pretext for denying the very existence of human—or any—consciousness outside of the physical brain.

## BEHOLD THE NEUROMACHINES

Today’s practical uses of neuroscience can be roughly divided into technologies that seek to map the brain and those that seek to alter it.

For more than a century, brain research was hamstrung by ethical restraints on experimenting with living human subjects. Not so in the past decade, when relatively noninvasive machines for measuring brain activity began to change all that. Among the most important is functional magnetic resonance imaging (fMRI), which employs magnetic fields to monitor changes in blood flow associated with specific neural activity.

For example, an fMRI can illustrate how the amygdalae of depressed people behave differently from non-depressed people. (The amygdala is a center of emotion in the brain, especially as related to memories.) When read a list of words that convey sadness, for example, the amygdalae of depressives showed more than three times the duration of increased blood flow than those of their nondepressed counterparts. In other words, depressed folks ruminate on sadness while well-adjusted others simply move on.

Significantly, the brain locations for the cognitive difference between truth-telling and lying are now well known. A proper scan can quickly reveal someone pretending to have impaired memories under police interrogation (or during an appearance before a Congressional committee!). Such scans are a distinct improvement over standard lie-detector tests and are leading to the development of new detection devices that monitor telltale involuntary electrical activity in the brain when a suspect is being shown images relating to a crime.<sup>3</sup>

Other scientists have identified the neurocorrelates of traits such as forgetfulness, empathy, extroversion, and aggression. Revealing an aggressive tendency in someone,

for example, could help identify a better CEO or salesman or screen out employees likely to engage in violent acts.

In fact, one can imagine all sorts of useful applications like these, but one can expect that all sorts of disquieting issues will also arise:

- ❖ *How far should authority figures, such as police, psychiatrists, or judges, be permitted to go in screening people’s brains?*
- ❖ *Once such data have been mined, who should have access to it? College admissions committees? Human resources departments? Health insurers? The FBI?*
- ❖ *Where do the rights of corporations and the state begin and our cognitive liberties end? Shall we permit brain scans to violate our Fifth Amendment right against self-incrimination or to gut our right to privacy?*

As Jonathan D. Moreno, PhD, puts it in his book *Mind Wars* (Dana Press, 2005), “Activity in a certain neural pathway cannot be deliberately controlled by a subject; thus, nonvoluntary disclosure is possible. In this respect, even physical coercion could be less invasive (although more frightening and injurious) than a valid fMRI scan.”

The newest applications of neuromachines can now outsmart even the most sophisticated brains. From the brave new world of neuromarketing, we learn that the taste of Coke “lit up” a section of the frontal cortex that controls higher thinking in subjects, revealing that even though these consumers said they preferred Pepsi, their brain actually liked Coke.<sup>4</sup> (The researcher concluded that they were unduly influenced by the effectiveness of the brand marketing of Pepsi.) Another researcher imaged brains of voters before the 2004 presidential election and learned that some held fast to a candidate against their brain’s better judgment. The scans showed that they suppressed their own cognitive dissonance in the face of facts contrary to their conscious preferences.<sup>5</sup>

It is evident in such examples that brain scans screen out subjectivity, rendering real persons into less-than-human objects. But will such “objective measures” of who we are—as opposed to what we or our peers *say* we are—become the new standard of personal identity? Will “brain fingerprints” become the new markers of individuality, setting



aside one's own personally discovered claims of intimate personal facts? In the future will our children no longer dip deeply within their minds and hearts to discover who they are but rather let scientists discover their real selves by "objective" means? In short, will our subjective inner worlds become increasingly marginalized?

The peril rises when the stakes rise: When national security is threatened, or a large insurance payment is hanging in the balance, or a murder charge is being contested, who's to deny authorities access to our brain states? If, after all, the brain really *is* the mind, wouldn't it be better to go straight to the "facts"?

But then, what if future discoveries reveal just how complex and subtle our brains (and thus our minds) really are, with the result that previous interpretations of brain scans are shown to have been little more than Rorschach tests of the neuromachines' operators?

In addition to mapping the brain, neurotechnology is making strides in the area of brain *alteration*. Here we find techniques such as repetitive transcranial magnetic stimulation (rTMS), a noninvasive method of exciting neurons in the brain that shows promise for the treatment of mental disorders. Amazingly, treating depression with rTMS entails simply holding a magnetic coil over someone's skull in just the right place (be sure to calibrate properly!). The procedure is painless. In more severe cases, the direct insertion (into the same spot) of a neural implant also does the trick—and has been repeatedly shown to work.<sup>6</sup>

Once a person has been "cured" by rTMS sessions, though, what now happens to their unique or even heroic story of struggle in the face of an arguably crazy society, largely not one of their own making? (Michael Moore's polemic *Sicko*, for example, demonstrates that the system itself—in this case, the medical system and its byzantine insurance structure—may be helping to produce neurologically treatable conditions in the first place.) What about the unseen habiliments of the patient's private world, in and through which the patient is evolving and growing? The inexorable "objectivity" of neurological treatments is exacerbating the current trend—already ingrained by pharmaceuticals like Ritalin and Prozac—toward rendering us as passive objects, and no longer conscious subjects, of our own healing and growth.

Other obvious ethical questions arise: Will neurointerventions reduce the ways it is acceptable to be a person? If ordinary maladies such as forgetfulness, aggression, or

## Who Controls the Controllers?

Consider how far this could go: In a few decades, writes famed futurist Ray Kurzweil, author of *Spiritual Machines* (World Future Society, 2005), we should be able to digitally scan a blueprint of every axon, dendrite, and neuron we possess—to create a software-based facsimile of our brain. But who, then, would be in control of this digitized rendition of the soul?

In Kurzweil's vision, man and machine will have fused; cyborgs will become a reality. Kurzweil really means it: "Our immortality," he says, "will be a matter of being sufficiently careful to make frequent backups."

In a more dystopian vein, the film *Minority Report* presents another stark image of where hyper-advanced neuroscience may take us. The movie is set in the year 2054, when genetically engineered telepaths who can see the future scan the population looking for citizens whose brains harbor plans for imminent murder. The telepaths then relay this information to "pre-crime cops," whose job it is to stop each murder before it happens. Meanwhile, on urban streets, people are constantly monitored to provide real-time brain scans and personal identity data to massive computers. Big business is linked to each brain fingerprint, enabling marketers to personalize animated public advertising displays for each individual as they pass by. High-tech drugs and virtual reality machines provide escape for those who find this new world order intolerable.

Is this the direction in which we are headed? Human rights groups critical of the perils of the coming neurosociety are standing up for what is now being called "cognitive liberty." For example, Mindfreedom ([www.mindfreedom.org](http://www.mindfreedom.org)) is a coalition of groups from 14 countries speaking out against such practices as forced medication and neural implants. The Center for Cognitive Liberty & Ethics ([www.cognitiveliberty.org](http://www.cognitiveliberty.org)) is a network of scholars focused on freedom of speech and thought, neurotechnology, "neuropolicy," and the war on drugs. And finally, Mind Justice ([www.mindjustice.org](http://www.mindjustice.org)) is a leading human rights group addressing the creation of new weapons that target the mind and nervous system.

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depression become optional traits because treatments to remove them are one day made possible by advances in neurotechnology, will people be inclined to discriminate against the bearers of those traits? And if only the wealthy are able to afford such treatments, the dawning era of brain transformation will only increase the gap between rich and poor, privileged and not.

**“WHAT KINDS OF PRIVACY SAFEGUARDS ARE NEEDED IF A MACHINE CAN READ YOUR THOUGHTS? WILL COGNITION ENHANCERS EXACERBATE DIFFERENCES BETWEEN RICH AND POOR? OR, INSTEAD, WILL THEY RELEGATE SOCIAL DIVERSITY TO THE STATUS OF HISTORICAL ARTIFACT?”**

**WHAT HAPPENS IF WE DEDUCE THROUGH NEUROIMAGING THE PHYSIOLOGICAL BASIS FOR MORALITY? OH, AND BY THE WAY, WHAT HAPPENS TO FREE WILL?”**

**—“A VOTE FOR NEUROETHICS,”  
SCIENTIFICAMERICAN.COM (AUGUST II, 2003)**

Yet another front contributing its share to the debate is the new field of “neurolaw.” To convict a suspect, criminal law traditionally requires that evidence of commission of the crime be linked to facts pointing to the specific mental (or brain) state of the suspect. This is known in legal parlance as *mens rea*, or literally, “the guilty mind.” Did the suspects act in self-defense or under external coercion? Did they do the deed of their own free will? Neuroscientific reductionism answers as follows: Brain states *cannot* be controlled; on the contrary, they control us. Strictly speaking, then, there are no free-will acts; thus there are no corrupted souls and no guilty minds.

## THE MILITARIZATION OF NEUROSCIENCE

The bizarre years of Cold War mind-control research between the 1950s and 1970s were epitomized by the CIA’s notorious MK-ULTRA program, an attempt to narrow the gap against the Soviet’s sophisticated psychtronics research. Now well documented, this and other programs laid the foundation over the next four decades for generous and largely covert federal funding of neuroscience research managed by the Defense Advanced Research Projects Agency (DARPA). Supported by this infusion, the

long-term trend toward the weaponization of brain research recently culminated in breakthrough discoveries on how to create and deploy EM (electro-magnetic) weapons targeted at the human nervous system.<sup>8</sup> Here is some of the evidence:

### Neuroscience-Based EM Weapons Debut in Iraq

According to reliable reports, GIs faced with restive Iraqi neighborhoods are sometimes directed to install hidden transmitters that saturate areas with pacifying or disorienting EM frequencies.<sup>9</sup> For more targeted crowd control, less sophisticated weapons mounted on Humvees are now being used to beam microwaves that flash-burn exposed flesh.<sup>10</sup>

### Israelis Use Acoustic Weapon to Disorient Protesters

As reported by the Associated Press and in the *Toronto Star*, demonstrators in a West Bank village were subjected to periodic blasts of sound emanating from a white Israeli military vehicle, causing them to fall to their knees, unable to maintain their balance. A professor of neurobiology at Israel’s Technion Institute likened the effect to seasickness: “The combination of low frequencies at high intensities can create discrepancies in the inputs to the brain.”<sup>11</sup> A variety of such exotic weapons were also widely reported to have been used by the Israelis in the 2006 Lebanon war.<sup>12</sup>

### Air Force Tests Weapons on U.S. Civilians

Air Force Secretary Michael Wynne stated that “nonlethal weapons should be tested on U.S. civilians before being used on the battlefield,” referring to the use of EM weapons in crowd-control situations. “The object is basically public relations,” said Wynne. “Domestic use would make it easier to avoid questions from others about possible safety considerations.”<sup>13</sup>

Department of Defense spending on this category of technology, generically known as directed-energy weapons (DEWs), has reached half-a-billion dollars a year, according to former Pentagon analyst William Arkin, now with the *Washington Post*.<sup>14</sup> Although rarely reported to Americans, the field is large and growing. DEWs are now a routine part of defense establishment strategy. The website for a recent trade show held near the Pentagon in Arlington,

Virginia, touted the show's "unparalleled speaker faculty" and its dozens of displays of the newest technologies. A new book entitled *The E-Bomb* by Doug Beason (Da Capo Press, 2005) argues in favor of these technologies and states that directed energy will "revolutionize warfare."

According to researcher Nick Begich, PhD, executive director of the Lay Institute on Technology, Inc., and author of *Controlling the Human Mind: The Technologies of Political Control or Tools for Peak Performance* (Earthpulse Press, 2006), painstaking efforts in recent years at forcing public disclosure of these programs have revealed that, "the new weapons are unlike anything ever contemplated by mankind. These are weapon systems which pierce the very integrity of the human being . . . [and] are frightening in their implications." Begich's research has uncovered such chilling statements as the following, excerpted from a document released in 1996 by the U.S. Air Force:

*One can envision the development of electromagnetic energy sources, the output of which can be pulsed, shaped, and focused, that can couple with the human body in a fashion that will allow one to prevent voluntary muscular movements, control emotions (and thus actions), produce sleep, transmit suggestions, interfere with both short-term and long-term memory, produce an experience set, and delete an experience set.<sup>15</sup>*

## PREPARING FOR THE FUTURE

The various perils noted in this article make neurotechnology appear to be the captive of today's materialistic, warlike, profit-driven culture, and indeed an almost pathological hubris does seem to hold sway with some neuroscientists and their corporate, government, and military sponsors. But if the will is there, this state of affairs should be just a passing phase in the evolution of neuroscience. To this end, much wider study of neuroethics is going to be crucial in the coming years. More important will be gaining greater public oversight at the national and global levels of these technologies and their applications. But perhaps most critical will be our common work of creating a great cultural shift, one that involves replacing brain-science reductionism with an expanded and holistic picture of human consciousness. 🌐

## Endnotes

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