



Foreword

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It is with great pleasure that I write the foreword to this Thematic Issue of *Synesis* edited by Drs. James Giordano and Chris Forsythe. The topic of neuroscience and neurotechnology in national security, intelligence and defense is both timely and important. In 2000, the Potomac Institute for Policy Studies, with the support of all 21 major US Government R&D agencies, conducted a study to evaluate the potential of emerging sciences and technologies to revolutionize the human condition and public life. At the time the world was still reeling from the effects of a digital technology revolution that was changing almost every aspect of the human experience. Our study identified several likely revolutionary technologies – progress in the biologic sciences, a continuation of the digital revolution, and reform production and use of energy. The study highlighted neurosciences and neurotechnologies as the fastest moving of all scientific pursuits, and to date we have observed only a small fraction of the ways that neurotechnology can change the quality and conduct of human affairs.

Later, in 2005, the Institute was commissioned by the Defense Advanced Research Projects Agency (DARPA) to focus solely on neurotechnologies, and evaluate the potential for what was rapidly being seen as a “neurotechnologic revolution”. This study more fully documented the speed of neuroscientific and neurotechnologic developments, and further illustrated the many effects these new technologies could, and probably will have on society. As was noted, while the agricultural revolution changed the way we feed ourselves, the manufacturing revolution changed the way we made tools, the digital revolution provided tools that were previously unimagined, it will be the neurotechnologic revolution that will change the way we use tools – including the “tool” that is the mind.

The potential of neurotechnology is staggering. We may well be looking at a near future when direct interface of our minds with machinery and automation is a reality. The implications of this advance are difficult to imagine must less quantify. Further, the pace of technology development is increasing. In fact, over 90% of all patents have been filed in the past 20 years! It took a number of generations for the manufacturing revolution to evoke worldwide effect(s) and vastly change the way humans lived. Yet, the digital revolution has almost totally altered the way we communicate, operate our business, and conduct daily life — and all of this has happened in less than one generation (i.e., about 40 years). Most will remember the magical handheld “Tricorder” on the TV show *Star Trek*. Forty years later the most popular phone in the world, the iPhone, can actually perform more functions than was ever envisioned for *Star Trek*’s “Tricorder”.

Developments in neurotechnology reflect a similar pace and scope. Barely a decade ago, researchers talked about experiments that would relate brain activity to behavior. Today neurotechnology not only facilitates this understanding, but may be used to depict the brain, assess the mind and predict and modify behaviors. How long can it be before such advances become radically manifest in a wide range of human affairs? Will we be prepared? Without doubt, neurotechnology has the potential to vastly change the conduct of human activities. Perhaps one of the greatest areas of impact is in the arena of intelligence collection and analysis. In fact, DARPA has already demonstrated the use of neurotechnology to increase the productivity and accuracy of image analysts. Furthermore, there is a growing interest in using neurotechnology to enhance other aspects of information access and analysis. Imagine what a device that allows truly objective lie-detection would mean for practices of interrogation and intelligence collection.

Yet, like all powerful new scientific developments, neurotechnology will provoke ethical, legal, and social issues that will test, try, and perhaps force re-examination and re-definition of moral and political values, regulations and practices. What are the ethical implications and effects of remotely sensing of the state of someone's brain? What laws and legal structures will address the ownership of one's mental processes and thoughts? How will we govern, regulate, or oversee mental enhancement? Or for that matter, the malicious induction of mental impairment?

These are difficult issues that will surely take time to resolve. It should be noted that even as the pace of scientific and technologic developments have increased, the processes for the development and implementation of ethical, legal, and social standards has, if anything, slowed down. We are therefore facing a future where new sciences and technologies will be empowering us in ways we may not yet be equipped to deal with as a functioning society. Discussion and scholarly research of the ethical, legal, and social issues should be a requirement when conducting and advancing science and technology. I would not advocate a version of the precautionary principle, but I most certainly encourage and endorse forums like this one that engage and sustain scholarly discourse upon these evolving technologies and their impacts on our society.

Disclaimer

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Conflict of interest

The author declares that he has no competing interests.