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Brain Implants and Memory

Heather M. Roff and Peter W. Singer (1) strikingly identify a problem for the next American president in the form of a decision on policy for autonomous (a form of robotic) weapon systems. In an important passage about the difference between semi-autonomous versus fully-autonomous weapon systems,[1] Roff and Singer note the difference between a system where there is a human in the loop versus a system where there is no human in the loop. They explain with examples, some of the problems that currently exist with regard to how lethal force could be applied in both kinds of systems and what the implications are for humanity over time with regard to not only morality, but to outcomes for, perhaps, the species. Important in this logic is an assumption by the authors that there remains a distinction between humans and machines.

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Permit me to make this distinction fuzzy, and therefore part of their analysis even more problematic based upon some of my recent research (3), where cybernetics evolve in such a system. Here, the distinction between humans and machines is difficult to parse in both design and very importantly, in effect. If implant technology evolves apace to where humans evolve into a more advanced type of cybernetic form, certain permutations in decision-making and signal processing may also evolve for kinetic weapon events in combat types of operations. In such events, the human operator may utilize what is currently referred to as artificial intelligence — digital (AI) and intelligence augmentation — analog (IA) types of technologies[2] to process information and to make decisions about lethal force. But also a possibility is the ability to perceive such a cyborg soldier as a form of *platform* in which both AI and IA technologies are utilized in signals processing by independent entities. In such a scenario, it is entirely possible and plausible that all decisions about lethal force and other decisions involving a particular combat event are made independent of the immediate human operator, or *individual person* at remote locations via the cloud. The decision-makers in this kind of event would be merely utilizing what we refer to as the human information appliance (HIA) (3), which also happens to be a human soldier/individual. This view is based entirely upon capability prior to any

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[1]See (2). The authors refer to three stages of autonomy: 1) machines that wait for human input or "human in the loop," 2) machines that are monitored by a human or "human on the loop," and 3) machines that function without the ability of humans to intervene or "human out of the loop."

[2]See Moreno (2), where he discusses philosopher Peter Skagestad's article in *Semiotica* (5) on Turing(digital/AI) versus Bush (analog/IA) science and technology — suggesting the latter may be on the rise as a better expression system of the workings of the human mind.

necessary and difficult investigation into the problem of design for both hardware and software attributes on the one hand, and importantly the civil/human rights of the soldier on the other.

But, let us consider the other possibility and the equally vexing problems that arise from a soldier where AI and IA implant technology render an enhanced soldier. Again, citing Roff's and Singer's article [1], we can now posit something well beyond a robot problem, and this evolves in important different ways. Consider that a chief concern to Roff and Singer is that in a lethal combat scenario with an autonomous weapons system (no human in the loop), human target selection would be a function of the machine (AI), and this is a problem of morality as well as a problem in that it threatens to send us down a path of automated killing of humans by machines that is potentially open to problems of control, authority, responsibility, and outcomes.

If we remove the autonomous weapon system from this scenario and replace it with a machine-enhanced human operator (IA/cyborg), other types of scenarios and conundrums present to us as analysts and evaluators of such systems. Let us assume that such a cyborg soldier is able to process information faster and with more precision. This may solve part of the problem resulting from an autonomous weapon system in that the cyborg soldier acquires more of the speed of the machine, but retains more of the human element for chain of authority, responsibility, and civilian input. Since this is merely a thought experiment with little to no empirical research to date to inform our thinking, we cannot know how much machine and how much human will result in various kinetic events. Neither can we know how such entities will evolve over time: which characteristics, machine or human, will become dominate in various events and for what reasons? How can we impact this sort of *personality* evolution either through individual psychological prophylactics or through social policy? An interesting problem may result where some systems in an HIA may be inaccessible to the human, or under certain event parameters, whereas sub-systems could become *superordained* to remote operators as interpreted by U.S. code or other legal instruments in either deliberative or ad hoc situations. We raise the last issues as extreme examples to fully illustrate some of the potential conundrums that could arise with these sorts of implantable technologies that might evolve with this kind of human enhancement.

In sum, the element of implants is a technology that may enhance capabilities that are attractive to a variety of users including the military. Certainly we would find great demand for such uses in the civilian and corporate worlds as well. However, it is also a technology that complicates our society in numerous other dimensions.

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