Daniel Moore über human enhancement

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Interview mit Daniel Moore, Advisory Board Member der Nanoethics Group an der California Polytechnic State University über human enhancement.

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Interview with Dr. Daniel Moore, Ph.D. in Materials Science and Engineering from Georgia Tech, who works on nanoscale solutions for semiconductor development for IBM. He has written several articles on new technologies and their ethical challenges and is Advisory Board Member of The Nanoethics Group at the California Polytechnic State University.

Let us start with some background and context, if I may. How and why did you get interested in the field of human enhancement and nanotechnology?

As a Ph.D. student I was working on nanoscale materials and nanotechnology development, so I was mired in the developments of nanotechnology. I think that it's important, from time to time, to take a step back and look at the bigger development picture. As an undergraduate student at University of Chicago, I was exposed to a lot of the ideas that Prof. Leon Kass discussed with regards to bioethics. This led me to getting interested in the long term applications and the consequences of developing new technology and, in particular, how technologies are used to enhance individuals.

Could you define what qualifies as a human enhancement and where the connections to nanotechnology lie?

It's a tricky thing to define specifically. It's tempting to make too broad or too narrow of a definition. You could make an argument that all technology, in some way or another, enhances humans. Technology exists in order to augment what we naturally do. This, however, would be too broad of a definition. If everything is human enhancement, then the term doesn't have much meaning. However, we can be too narrow in our definition as well and say that only those technologies that make us more like a cyborg or The Incredible Hulk are human enhancement. This definition doesn't gel with our every day human experience. There's more of a scale when it comes to human enhancement. All technologies enhance our humanity in some way. However, some are more permanent and internal to our personal cognitive systems. Nanotechnology makes this internality and permanence easier to achieve. By its nature of being small, nanotechnology can develop technologies that interact with our natural selves in radical ways. By the types of materials that it enables, it enables the development of technology that change the way we experience the world in a natural-seeming way.

Do you think that enhancement of the human body will be integrated into the human self-image and so become commonplace in the near future?

Of course, for when nanotechnology based human enhancement becoming "commonplace", this depends on what is meant by the "near future." In one sense we already see this happening with other technologies and enhancements. Skin "enhancement" in the form of tattoos are becoming more and more commonplace (and more integrated into the person's self-image). But I think that this trend will continue and with nanotechnology allowing for technologies that are more integrated in our cognitive system and enhance our own capabilities its likelihood of becoming part of our self-image seems great.

As the question of nanorobotics seems to be largely hypothetical at the time being, the effects of creating machines or robots of microscopic nanoscale may be difficult to assess. Thinking of approaches like the DNA machine(1), what can we expect from this so very complex and vast field? What potential benefits but also risks are we looking forward to?

We are pretty far from creating a machine that has is run based on DNA, but we are starting to use DNA today to form other devices and architectures - I'm thinking, in particular, of Paul Rothemund's work on DNA origami, but there is a lot of research going on using DNA as the scaffolding for ordering other nanostructures. But what we really mean by a DNA machine is one in which the actual code of the DNA is read by some RNA-like molecule or machine that uses that code to perform certain actions. This is the way that all life on earth is created, so the possibilities seem huge and nearly limitless. However, I think that there are many engineering challenges in the near term towards developing this type of technology. The benefits could be great – specialized drugs could be developed, etc.

Recent projects on Brain Machine Interfaces like "BrainGate" have gained considerable media coverage. With William Gibson's books, this idea has spread through Science Fiction literature and to some part has inspired ideas like the

“Network Enabled Telepathy”, though most of these projects are being in early stages of development and with unknown results. What can we expect in reality in a foreseeable future?
I’m not a neuroscientist, but from what I know, anticipate, and have seen, I think that we can expect in the foreseeable future devices that allow basic communication and basic action through direct interaction with the brain. The main obstacle that I see to this is that we do not understand individual brains all that well right now.

Projects by the US Military on “augmented cognition”, “mind reading binoculars” and “computer-mediated telepathy” – as labelled by the media – sound like from a science fiction novel but in fact are a reality. Are these developments really to be reckoned with in foreseeable future?
I think that these developments are something to be reckoned with. Especially in military applications we tend to require very specified tasks to be performed and enhancing certain parts of the body (brain, nerve cells) for specific functions for short periods of time is very much a fully developing technology trend. It isn’t hard to think about how it can be done – especially for something like visualization abilities. Not only could we enhance the resolution of individual site with a small implant, but we could also convert other forms of sensory information so that an individual could see UV light or night vision contact lenses or something else of the sort. Further, it will allow for overcoming attention limitations, provide for enhanced memory capabilities, etc.

In the last couple of years there have been improvements in prosthetics for sports and everyday life, efforts in building exoskeletons and significant progress in gen-, neuro- and nanotechnologies. How are these technologies to impact on the military? How could we imagine this, as you called it, “nano enhanced army”?
I like to think of technology as solving problems that we have. So, in order to examine what impact technologies will have in a given area, we have to look at what problems need to be solved. To give one example, a problem in the military is that threats to soldiers can come unexpectedly, suddenly, and can cause injuries that cannot be healed quickly, like the explosion of an IED. Having an exoskeleton, nano-enabled body armor that can materially (that is, in the material of the body armor) react to these threats by stiffening automatically and allowing the blast to be absorbed (or stopping the shrapnel, etc.), would allow for mitigating the injury to the soldier. Accessing nanoscale materials can allow for this body armor to be flexible when not actively in use, but allow it to harden nearly instantaneously when necessary. This can be done by using certain polymers that have an electrorheological response – that is, when activated electrically, these polymers can transform from flexible and pliant to nonpliant and armor-like.

How do you see the future of Nanotechnology and its interconnection with other technologies, what are the developments you are looking forward to? What will we have to expect and also what are the potential future issues?

I think that there are a few developments that I am most looking forward to. The first is improved energy generations – and not just in the form of solar and fuel cells. There has been some interesting work done with piezoelectric ZnO nanowires being turned into a device that could be woven into clothing and generate electricity through basic movement. I’m also excited about medical technologies. For example, enhanced drug delivery systems that can target specific cells hold the key to better treating a lot of diseases, defects, and ailments. Some have also suggested that they will be able to “treat” aging. I think that these sorts of nanotechnologies are exciting, but also have some interesting issues. If we can “treat” aging and individuals routinely live productive lives significantly longer does this alter the general timeline of our lives? In what way does it inform our conception of what it means to be human?

What would be the societal and ethical challenges regarding future developments in human enhancement, not only for the military but also for the society as a whole? And how can we distinguish ethically between the various fields and settings where human enhancements are applied.

One of the biggest challenges that this produces, when it comes to the use of the military, is that it creates less losses when the military is used. This could make using the military politically easier (because the cost becomes lower), but we’ve also seen in recent years that tolerances for even historically low numbers of casualties have dropped dramatically for advanced societies. Making casualties even rarer may make this tolerance even lower.
Also, this means that many more soldiers will be returning home after prolonged combat operations. This makes reintegration into a non-military society a big challenge.
Finally, military technology tends to beget civilian technologies based on it (the great example is the internet being developed out of military networks, but we can also look at GPS and many other technologies that are now commonplace in society). It would be hard to imagine enhancements being implemented in the military without having them eventually used in the civilian sphere as well. This slippery slope, along with the blurred distinction between therapy and enhancement, makes it difficult to ethically distinguish between applications of human enhancement. It’s tempting to say that we know an unethical enhancement when we see it or to take an extreme position and say that all enhancement must be allowed (if it can be afforded) or that no enhancement above “natural human abilities” is allowed. I think that these are the easy answers.

What is the legal framework for these new technologies, especially if used in military contexts? There may have been some trend-setting developments in this field, like the Court of Arbitration for Sport’s verdict on Oscar Pistorius’ plea(2). From your perspective, what may be the main legal challenges in the foreseeable future?
I am not a legal scholar, but I suspect that the greatest legal challenges will be in resolving the question of equitable

access and in the blurring of the line between therapy and enhancement. My guess is that much of this discussion will be informed by the discussions that you see ongoing in athletics today with regards to performance enhancement drugs. The difficulty comes when the therapy gives enhanced capabilities, as opposed to returning capabilities to a “normal” human level, as some argued occurred with Pistorius’s carbon fibre limbs.

Notes
(1) A DNA machine is a molecular machine constructed from DNA.
(2) Oscar Pistorius is a South African Paralympic runner who has lost both legs as a child and runs with the aid of carbon fibre artificial limbs. In 2007 Pistorius took part in an international able-bodied competition. However it was decided that his artificial lower legs gave him an unfair advantage over able-bodied runners. Initially he was therefore bared from the Olympic Games by the International Association of Athletics Federations, but this decision was reversed by the Court of Arbitration for Sport. Although eligible to compete in the 2008 Summer Olympic Games in Beijing, Pistorius did not qualify for the South African team.