

Technology has had more advancement in the past few years than ever before, this advancement is known as Moore's Law. In 1965 Gordon E. Moore wrote a paper about his prediction on technology. His prediction stated that the number of transistors in a dense integrated circuit doubles approximately every two years. His prediction turned out to be true and even today industries use his law to guide long-term planning and to set targets for research and development. We have come so far in the past couple years and each year we make enhancements to our previous devices, take the iPhone for example. Each year Apple finds a way to make these phones run faster, slimmer, and provide new upgrades to draw the customer in. It's like this for almost all of the technology we have now. When I was growing up my parent's had flip-phones and they hardly worked. As I grew up, this phone made so much progress and even now the amount of time it takes to improve the device shrinks. We make so much progress in such a short period of time it's almost scary. Of course I'm not worried about the phone's progression, because it's separate from the body from the mind. Even if some people have their phone glued to their head most of the time, it's separate from the individual. What worries me is the technology we are creating to enhance the human being. We now have devices that are connected to the human body, and mind. For the body, there are devices to enhance the human's physical abilities. Transhumanism is a term used to define technological attributes to enhance the human being. When my parent's were children they wouldn't even dream of transhumanism; the theory that the human race can evolve beyond its current physical and mental limitations seemed to be a long way into the future, but it came sooner than we thought. It's now so probable to enhance our physical capabilities; college students are inventing them. I'm not so concerned about these physical enhancements, but more of the mental attributes. We can now improve the brain by using technology. This distresses me greatly, how is this right? Do people really approve the idea of unnaturally enhancing our bodies and minds? Personally, I believe that technology and the human being should remain separate from each other.

Is it right to unnaturally enhance our bodies physically? Our physical capabilities are limited to our physique. We can improve ourselves by working out, eating right, and this will amplify our strength, speed, agility, and health, but we have to work for it. It doesn't happen over night; it's not an easy thing to do. Of course you can always take the easy way out. There now are contraptions to immediately to improve these attributes. DARPA the (Defense Advanced Research Projects Agency) is a main contributor to these devices, and they make these gadgets for the military. The United States seems to be a big fan of the new technology and not a lot of other countries seem to take a great interest in it, besides Japan. Coincidentally a majority of these inventions are created by the military and if it's a project made outside of the military they usually catch word of it and acquire the technology. For example, DARPA created a device, which they call Raytheon XOS 2, a robotic exoskeleton: "The wearable robotic suit increases the human strength, agility and endurance capabilities of the soldier inside it. The XOS 2 uses high-pressure hydraulics to allow the wearer to lift heavy objects at a ratio of 17:1 (actual weight to perceived weight). This allows repeated lifting of the load without exhaustion or injury" (Raytheon, 2014.) This cybernetic technology research is wide spread. Jason Kerestes; a college student, invented a speed enhancing jetpack. "A student at Arizona State University, has developed the 4 Minute Mile: a jetpack that helps soldiers move faster, without requiring them to physically exert more. While jetpacks are usually associated

with flying around, this one just gives the runner a boost, helping them to shave off time while also decreasing the amount of effort put into the activity. Initial testing has shown that even while loaded up with the jetpack equipment, the runner was able to complete a 200-meter run faster and with decreased metabolic cost than when he ran on his own.” An interesting idea turned into reality, with help from the military. As I looked into Jason’s project, it turns out it was made possible with the help of DARPA. “This project was completed in ASU’s iProjects program, which hooks students up with faculty and partners in the industry to help solve real design problems. Kerestes’s project was completed in cooperation with professor Thomas Sugar of ASU’s Human Machine Integration Lab and Defense Advanced Research Projects Agency (DARPA)” (Winter, 2014) There are some robotic exoskeletons that aren’t being used for military purpose. Instead, they are being used to assist handicapped patients with walking and to relieve stress on the joints. This is where I draw the line between assistance and enhancement. I see no problem with robotic limb assistance because it’s assisting the weak and helping them out with their day-to-day tasks. This stabilizes them and makes them normal; enhancement goes beyond normal, which is why I say “no” to robotic enhancements. An example of an assistive robot is The Hybrid Assistive Limb (HAL): “Used as an extension of the body structure, HAL5 is used to support movement and to lift weights. In medical purposes the suit is used by patients with disabilities to rise from a chair, to walk or to lift various weights. In constructions can be used in common activities, especially for carrying or picking up heavy loads that can’t be removed without assistance.” Priced at \$17,000 it doesn’t seem like the average person could get their hands on one of these. The company has enhanced the robot as well, as I was saying earlier we keep improving our technology. “Since 1992, when the project was launched, Cyberdyne released several versions starting with HAL 1, HAL 3, and ending with HAL 5. Each version has brought improvements in mobility, lower weight and greater autonomy” (George, 2014). If we keep improving our technology year by year, robotics will overcome us. I can’t give an estimate on how many years this will happen but it will be sooner than we realize. It sounds ridiculous in our present time but I predict it will happen soon; not in my lifetime but hundreds, maybe thousands of years from now technology will physically overwhelm us and possibly intellectually. This is where the mind comes into play.

We now have the technology to enhance and possibly manipulate the human brain. I first got word of this through a Radiolab podcast entitled “9-Volt Nirvana.” The device in which I’m speaking of is the tDCS (Transcranial direct current stimulation) device. The device creates an electric current in your brain and it’s shown to increase learning abilities. In the Radiolab the hosts interview an editor, Sally Adee, at *New Scientist* and she explains her experience with the tDCS. Sally describes her encounter with DARPA as an interesting and fascinating experience. She first was instructed to interact with a shooter videogame. The first round she didn’t do well at all; she got 3/20 targets in the game. They proceeded to attach the tDCS to Sally and she got another shot at the virtual stimulation. The changes were remarkable; she hit 20/20 targets. One hundred percent is an incredible improvement from less than a quarter accurate. What’s even more impressive is when she took the device off and tried the game for a third time; she also got one hundred percent accuracy. They say the effects of the tDCS last to about

an hour. “Effects seen after the electricity is shut off can last for an hour or so and seem to arise from a second mechanism. Pharmacological evidence suggests that the current increases the expression of proteins called NMDA receptors at the synapses, the connections between neurons. This heightens the plasticity of brain tissue — leaving it in a temporary state somewhat like wet clay, in which it is more apt to reshape its synaptic connections in response to stimuli, such as when learning a video game” (Fox, 2011). It’s also been noted that tDCS is being used as a therapeutic device:

“Several studies suggest it may be a valuable tool for the treatment of neuropsychiatric conditions such as depression, anxiety, Parkinson’s disease, and chronic pain. Research has also demonstrated cognitive improvement in some patients undergoing tDCS. Currently, tDCS is not an FDA-approved treatment (The Johns Hopkins University, 2014.) What is truly even more fascinating is that the tDCS was used temporarily arouse patients who were in a vegetative state. Scientist at the University of Liège in Belgium led the study. “The team worked with 55 people who had experienced a traumatic brain injury or lack of oxygen to the brain and were in a minimally conscious or vegetative state. They placed electrodes over their left dorsolateral prefrontal cortex – an area involved in memory, decision-making and awareness. Then they delivered twenty minutes of stimulation to some of the people and a sham treatment to the others. The next day, the two groups received the opposite therapy. During brain stimulation, thirteen people with minimal consciousness and two people in a vegetative state showed signs of awareness that were observed neither before the stimulation nor after the sham treatment. For most of these people the changes were moderate, but some recovered the ability to communicate, says Laureys. "Two patients emerged from a minimally conscious state altogether." When asked questions such as ‘Am I touching my nose?’ they were able to answer by nodding their head or making specific eye movements” (Thompson, 2014). I see this as the top reason to continue research on the tDCS. If we can temporarily awake some comatose patients, then maybe we could permanently awaken them. I find myself so fascinated by this device. Can we really momentarily change our brains for the better or worse? There is large Internet community devoted to making these devices and I find it worrying that anybody can construct a mind-altering device. The military are using these devices to train soldiers to learn how to pilot drones faster. Remember, it can also make an ordinary civilian with no military experience a sniper in a matter of seconds.

It still isn’t right; we shouldn’t be able to unnaturally enhance our minds. I admit that it’s truly fascinating how we can even do this and the technology we have for this invention now is not that dangerous, but I know we won’t just stop here. We will keep experimenting with this device and enhancing it until we will have a permanently brain-altering tool. This terrifies me. I predict that, in the future we will be able to go into a person’s brain and change what we wish. The human mind should not co-exist or thrive off of technology. At that point this will no longer be titled “science fiction” and it will be a “science reality”. What worries me the most is that if somebody is interested in building a tDCS they can, and if we do get to this point of brain-hacking what’s stopping an average person from building one? Since I have such a fascination with this technology, I decided I must experience this device for myself. So I found the highest-rated, cheap, tDCS device; it’s called the “*Brain Stimulator*”. I will then document my experience with

this device by conducting a variety of tests on myself. I have to say this is the furthest I've gone with any research paper. I'm so concerned with tDCS because I value the mind over the body. If you have a full robotic body, but an intact mind, you are still in control; you're still not technically a robot. If your mind is robotic and your body is intact, you might as well call yourself a robot.

As soon as I received the device in the mail, I was eager to test it out. The first test I would run would be the "mood-boosting test." Previously I had done some research on where to place the electrodes on my head to achieve the desired effect. I found that if you placed the sponges on F3 and Fp2, (which are coordinates for the top of your head), it would relieve depression in patients. Granted, I don't consider myself to be depressed but some users had achieved relaxation and anxiety relief from the same position. I decided it would be a good start, so I gave it a try. I immediately felt it when I turned the device on; it's a slight tingling sensation that continues until you shut it off. I left it on for about twenty-five minutes and then proceeded to go throughout my day. I couldn't tell if I had felt relaxed because I wasn't particularly anxious before. I didn't feel the same as when I was about to put the tDCS on though. I found it was a lot easier to converse with people. Usually I stumble across my words and I think faster than I talk, but this time my speech flowed freely, in sync with one-another. I was so excited and felt so good about my discovery that I wanted to experiment more. I put the electrodes in the same place and left it on for the same amount of time. As I took it off I discovered I didn't get the same effect; I was slightly agitated and nervous. I had overdone it and had now the reverse effect. I tried the motor control and pain reducing placement and it ended up giving me the same agitated effects. I conclusively don't have enough experience with the device to come up with any concrete results for whether it helped me for better or worse.

These human enhancements are a new addition for technology and it has advantages that outweigh the disadvantages, for now. We will keep experimenting with these devices and finding ways to improve them. It's unsettling enough that they can change how you feel, or enhance your learning ability, make you stronger, faster, or increase your motor-function skills. Imagine the future of this device and what it holds. You can't stop people from doing what they wish with this device and you will have people with bad intentions in there. I fear that robotics will no longer be used for the good of humanity, but as a tool to destroy one another. You can't prevent robotics or humans controlling the robotics to have a moral code, because they aren't capable of telling what's right or wrong. Our physical capabilities can be enhanced beyond our body's breaking point. Robotics might be an interesting invention for our time, but I fear it won't be beneficial to the future.

