

The Rise of Cybernetic Beings: Neural Interfaces In The Age of AI

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Abstract- *Neural control/interfacing/interaction is a powerful means, which can develop a robust bridge between humans and machines. In this paper we emphasize on neural interfacing as an evolving trend in wireless communications by taking into account one of its important application i.e. cyborgs. A cyborg is a cybernetic organism (i.e. an organism that is a self-regulating integration of artificial and natural systems. Here we discuss the operational features of cyborgs. In an attempt to promote greater interaction between humans and computers, companies that develop (cybernetic) robotics technologies participate in a variety of seductive strategies that embody the cyborg discourse.*

Some of these strategies persuade individuals to concede to particular philosophies, such as the argument that technical artifacts and instrumental reasoning are necessary for effective social development. With the experiments conducted and proposed to be conducted in future and in the process give a brief description of the advantages and disadvantages of this technology.

Keywords- Cyborg, Central nervous system, nerves, interfacing, robot, silicon chip, science

I. INTRODUCTION

Attachments and interfaces mediate our interaction with the environment and usually are positioned on the surface of the body. Physical objects would be called tools or attachments, while information utilities would be called interfaces. In the same way a neural interface allows human brain communicate directly with a computer, without any other equipment. That kind of interface allows any illusions to be inputted to human nervous system. Neural interfacing fantasies have mainly grown out of science fiction.

The possibility exists to enhance human capabilities. To harness the ever increasing abilities of machine intelligence, to enable extra sensory input and to communicate in a much richer way, using thought alone. Kevin Warwick has taken the first steps on this path, using himself as a guinea pig test subject receiving, by surgical operation, technological implants connected to his central nervous system

A recent article on neural interfacing in the IEEE Transactions reports that "a Microelectrode array capable of recording from and stimulating peripheral nerves at Prolonged intervals after surgical implantation has been demonstrated." These tiny silicon-based arrays were implanted into the peroneal nerves of rats and remained operative for up to 13 months .The ingeniously designed chip is placed in the pathway of the surgically severed nerve.



Fig. 1 A human cyborg

The regenerating nerve grows through a matrix of holes in the chip, while the regenerating tissue surrounding it anchors the device in place. This chip receives the signals from the surrounding nerves and sends it to a computer through a wireless medium. Within several decades, active versions of these chips could provide a direct neural interface with prosthetic limbs, and by extension, a direct human-computer interface. This human computer interface may now lead to a revolutionary organism called as "cyborg", which was thought of as a science -fiction earlier.

II. WORKING

A cyborg is Part human and part machine(robot), a hybrid of neurons and wires or circuits. It is a human being artificially transformed into a machine by providing a proper interface between man and computer. And Cyborg means "Cyber Organism".

- Non-invasive communication with the neural tissue
- No harming side effects
- Spatial resolution in the range of micro- or nanometers in order to specifically target individual neuritis.

- Temporal resolution at the millisecond level in order to capture neural processes
- Real-time data acquisition and processing

An interesting concept that may ultimately unify the requirements listed is the communication with neural tissue by means of electromagnetic fields. An ideal NIF technology would enable the real-time visualization of thoughts.

cybernetics in the 1960's where Manfred Clynes and Nathan Kline helped coin the term as a concept that would "allow man to optimize his internal regulation to suit the environment he may seek" in outerspace (Clynes, 32).

On another side of history, the cyborg takes its origin from Mary Shelley's Frankenstein. Frankenstein's monster is often cited as the first cyborg and was not born of woman but assembled his monster on the operating table. Thus, two dominant types of cyborgs emerge in their history: the cyborg as a reconceptualized post-human body and the cyborg as machine- controlled monster. Cyborgs may even give birth according to Heims quote 'The psyche longs to perpetuate itself and to conceive offspring; and this it can do, in a transposed sense, by conceiving ideas and nurturing awareness in the minds of others as well as our own' and movies like Terminator and Judgement Day (1991).

The first real cyborg have been around for about 50 years. It was a white lab rat, part of an experimental program at New York's Rockland State Hospital in the late 1950s. The rat had implanted in its body a tiny osmotic pump that injected precisely controlled doses of chemicals, altering various of its physiological parameters. It was part animal, part machine. Cyborg was more than just another technical project; it was a kind of scientific and military daydream.



Fig. 2 Working of cyborg from eye

A related concept was employed in the movie "Minority Report" Scene from the movie "Minority Report":

Thoughts and thus neural activity is directly visualized by means of optic scanning of the brain. Depicted are three muses whose thoughts are directly visualized on a screen. (Please note, that NIF has nothing to do with predicting no future or action elements as entertained in the movie mentioned.

III. HISTORY

The word 'cyborg' is shortened 'cybernetic organism'. Cybernetic is the entire field of control and communications theory, whether in the machine or animal while organism is an organized body, consisting of mutually connecting and dependent parts constituted to share a common life.

Donna Haraway suggested that "the cyborg has no origin story in the Western sense" (151-52). However it can be said that the history of cyborgs originates from two lines of history. One, the character of the cyborg originated out of the emergent field of

IV. OPERATIONAL AND ARCHITECTURAL FEATURES OF CYBORG

A silicon chip is implanted into any part of the body especially the region where most of the nerves are interconnected, and send and receive the electronic impulses. This silicon chip is designed in such a way that it can receive the nerve signals, amplify them and encode the signal into digital format by which proper computer accessibility is provided. Since no wires are preferred to interconnect the cyborg and computer a wireless communication path is preferred. This implant is encased in a glass tube. One contains the power supply, a copper coil energized by respect to the signals from the "Cyborg". Radio waves to produce an electric current. In the other end, three mini printed circuit boards will transmit and receive signals. The implant is connected to the body through a band that wraps around the nerve fibers and is linked by a very thin wire to the glass capsule. The chips in the implant will receive signals from the nerve fibers and send them to a computer instantaneously. For example, when a finger is moved, an electronic signal travels from the brain to activate the muscles and tendons that operate the hand. These Nerve impulses will still reach the finger. The signal from the implant will be analog, so it is to be converted into digital in order to store it in the computer. Still, several studies on work, organizational culture, computerized information systems (CIS), networks, and human-machine dyads (such as the "symbolic value of the CIS" or the "organizational symbolism" of computer Culture) indicate the desire to explore, interpret, and reveal more than the efficiency of cyborgs and their supposed capability to undo the "problems" of late industrial society. There is a desire to

understand and to make meaning of the developing history of cyborgs, the development of their behavior and culture; the two interconnected through hands, wires and electronic mechanisms that bend the technological discourse towards cultural as well as digital ears.

V. IMPLANTATION PROCEDURE:

By using this technology not only blind people can be assisted but it may also be possible to capture signals responsible for happiness, pain, anesthesia etc. Experiments are also being conducted to establish wireless communication between two persons by placing similar chips, that are capable of using the energy in the body and can transmit and receive impulse signals between them. If this experiment is proved to be possible then “cyborg” which was assumed to be a science fiction is no more a distant dream. With this technique there would be no use of any speech to communicate, just the impulses in the human body can be used to convey the information between each other. Thought communication will place telephones firmly in the history books. Another important application of cyborgs would be in curing diseases. If this type of experiment works, we can foresee researchers learning to send antidepressant stimulation or even contraception or vaccines in a similar manner. With this we can gain a potential to alter the whole face of medicine, to abandon the concept of feeding people chemical treatments and cures and instead achieve the desired results electronically. Cyber drugs and cyber narcotics could very well cure cancer, relieve clinical depression, human health and safety. In this way cyborgs may lead many adverse consequences as predicted by the critics.

VI. TYPES OF CYBORGS

6.1 Robot:

A cyborg can literally be a robotic form which helps humans with everyday tasks. They can be used for medical purposes, military purposes, or personal use. Service robots assist humans by performing everyday tasks for them, including cleaning, doing laundry, and even cooking. Service robots are programmed to listen to a human's instructions, but those instructions must be precise in order for a service robot to fulfill that task. Robots come in many shapes and sizes. Many people believe a robot literally looks like a robot seen above in the picture. However, a computer is a robot. A vacuum is a robot. Robots do something for us, or help us do something with ease.

6.1.1 Robot implications:

1. Cyborgs create an ease of life for the people who own them, which can ultimately cause a dependence on technology deeper than the dependence we already have.
2. Robots and humans may have little distinction between them in the future.

“CYBORG: MYTH OR REALITY?”

-This article begins discussing the assumptions that cyborgs and humans have little distinction anymore, because people really believe we will rely solely on cyborgs in the future. The author of the article takes a different approach to this assumption by saying that it is not true, because relying on cyborgs goes against values, specifically those embedded in Christianity. Being that a cyborg is a “cybernetically controlled organism”, people begin to wonder if they will take over our planet in the future much like the “I, Robot” movie. The article discusses that we have become attached to technology so much that even we are acting like cyborgs. Still, the author does not agree with this, saying that even though cyborgs can be a medical advantage, they still will not take over the human race. While we do have and will have cyborgs, they will not take over and become a necessity for people to live.



Fig. 3 Cyborg implanted in the central nervous system

In an experiment conducted by a team at Emory University in Atlanta, which to great international interest has implanted a transmitting device into the brain of a stroke patient. After the motor neurons were linked to silicon, the patient was able to move a cursor on a computer monitor devices for their repair, recharge, and maintenance, thus placing them under the absolute control of the designers of the technology. Perhaps the most cogent arguments against this technology originate from people who foresee tremendous possible risks toward

3. If robots are used for medical use, will we rely on them more than doctors?

“Service Robots: Rise of the Machines (Again)”

-This discusses how robotics is taking off to be a multi-billion dollar industry. Currently, the united states are putting in more money than China towards the advancement of service robots. Specifically, money being spent on robots is geared towards a military gain. One robot is being designed to run at cheetah-like speed. This robot can also be used in emergency scenarios, like fire-fighting. There are also robots that help surgeons, causing surgeries to be less invasive with quicker recovery time. The united states are really trying to increase the productivity and use of service robots. We are competing with China and other countries at achieving this, but so far billions of dollars have been put to good use for these potential robots.

Service robots need precise instruction from their owners in order to fulfill any tasks correctly. If the owner does not know how to communicate clearly, the robot may malfunction. This causes issues with safety.

“False Alarm Metrics for Human–Robot Interactions in Service Robots”

-The idea of a service robot has become increasingly popular due to the potential that robots may have to fulfill our everyday tasks for us, like washing dishes or doing laundry. However, this is not a perfected idea yet. Service robots currently being used around the world still have issues. There are still complications that can go wrong with service robots, and the article points them out. One of the main issues is safety for the robots and humans that will use them in the future. When service robots were first invented, safety was an afterthought. Now, researchers are going back to develop an HRI metric for safety. This begins with false alarms in the robot due to indecisiveness from both the human and robot itself. The robot may “reject a correct interaction or fail to reject an incorrect interaction” (1844). In order for this to improve, the human giving the orders needs to be precise and know what they need done in order for the service robot to complete it properly.

6.2 Computer and human:

We’re closer to becoming real cyborgs than most people realize. In the New York Times the other day, there was a great story by Pagan Kennedy about experiments with brain-computer interfaces, which included the stuff you usually hear about, like people moving cursors with their minds. But it also included some new stuff, like Kennedy herself choosing a picture on her phone using just brainwaves — with no drilling into her skull required. And the novel idea

of creating a kind of "brain esperanto," or a universal language for people to speak to computers with their minds. Are we a lot closer than we think to becoming true cyborgs, with our brains connected to computers at a fundamental level?

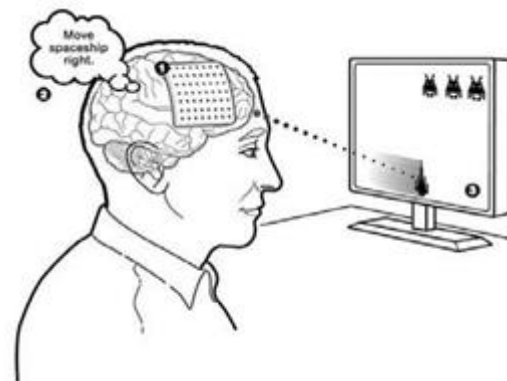


Fig. 4 Human cyborg with computer

Although new technologies are improving how we live as humans, some do not not agree with the direction our future is headed. Even with new social medias such as: Facebook, Twitter and Tumblr, technology is taking the place of human connection. People use websites now more than ever to share ideas and feelings. Using social media can be harming to one's self and their loved ones due to the lack of communication outside of the computer. For our Writing Research and Technology class, we were required to discuss multiple readings and progress regarding our assignments.

VII. CYBORG VS ROBOT

Robots and cyborgs seem like the stuff of science fiction and to some degree they are. But what most people do not know is that cyborgs and robots do exist just not in the form that they depict in the movies. The main difference between a cyborg and a robot is the presence of life. A robot is basically a machine that is very advanced. It is often automated and requires very little interaction with humans. In comparison, cyborgs are a combination of a living organism and a machine. It doesn't necessarily have to be human; it can be a dog, a bird, or any other living thing.



Fig. 5 Cyborg vs robot

The living component is what separates a cyborg from a robot. This basically means that a cyborg is alive while a robot isn't. Even though some robots can simulate certain aspects of living beings, it never truly is alive. A robot is only capable of doing what it was programmed to do while a cyborg, especially human cyborgs, exercise free will on their activities.

There are a number of good examples for robots. Among them are the robots working in factories that do the repetitive tasks. These robots are better than humans at these tasks as they are very quick and do not get tired. Cyborgs also walk among us, though you may think of them as ordinary people. People who have robotic prosthetics generally qualify as cyborgs. Even people with pacemakers qualify as their existence depends partly on the continuing function of the electronic device that keeps their heart's rhythm.

Another area where the robots and cyborgs vary is complexity. Robots can be fairly complex like the factory robots mentioned above. There are, however, also robots that are very simple. There are simple robotic kits made available to young children to spark their curiosity and show them the basic principles behind robotics. In comparison, the machine part of a cyborg is often very complex as it interfaces with the organic part in order to function. Some prosthetic arms can function pretty much like a real limb, and some people can even reach out and grab things.

VIII. ADVANTAGES AND DISADVANTAGES OF CYBORGS

ADVANTAGES:

There are many advantages of mixing organic with mechanical parts. The main advantage is to that of health. Many humans can now be classed as cyborgs because of surgical procedures for example a person with a pacemaker can be classed as a Cyborg because they are dependant on the mechanical part. Many improvements have been made within

the medical field for humans to be classed as cyborgs. Many parts of the body can be replaced:

- Hip replacement
- Knees
- Elbows
- Wrists
- Arteries
- Veins
- Heart valves

There are also brain implants based on neuromorphic modelling (this is the reverse engineering of the brain and nervous system)

A deaf man has had his inner ear replaced so he can now engage in telephone conversation. (this in time will be upgraded so that he can hear music)

PARKINSON DISEASE: there are brain implants that help reverse the most devastating symptoms of the disease.

CEREBAL PALSY: implants that help control tremors.

There have been many experiments with the technology classed as 'cyborg', which goes beyond humans and into animal experimentation. 'Ratbot' was an experiment that meant a rat underwent having a small electronic backpack strapped it's back which was then linked to electrodes in their brains. Simple commands were sent to them to manipulate their brains and into following a pre-programmed route/command. This was successful and now researchers are proposing to use them to search for land mines and buried victims of earthquakes as they can move more quickly than human rescuers or existing robots.

DISADVANTAGES:

There are also many disadvantages of mixing organic with mechanical parts. Below are some cons of cybernetic organisms.

- Robots can sense the world in ways that human's cannot-ultraviolet, x-rays, infrared and ultra sonic perception. So basically there is more dependence on cyber technology.
- They out perform humans intellectually in aspects of memory and mathematical processing .

- Cyborg have no problem thinking of the world around them in wider dimensions (multiple) where as human beings are more restricted in that sense.
- Cyborgs have physical limitations. Cyborgs do not heal Body damage normally, but instead must be repaired. For example, broken limbs and damaged armour plating must be replaced which can be expensive and time consuming.

IX. FUTURE

Cyborgs are gradually working their way into our lives. The general representation of a cyborg is that seen in science fiction films of a fusion between human and machine. A direct interface between the brain and the Internet, like the brain-machine interface (BMI) described in the science fiction manga *Ghost in the Shell*, has been successfully tested in laboratory experiments. That extreme level of human-machine fusion aside, people's lives would already be compromised by not having a mobile phone or smartphone, and in some cases, when we think about those who lead a life that is dependent on such devices, we can see that the fusion between human and machine is underway with a momentum that supersedes the pros and cons.

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Fig. 6 Cyborg face mask

However, the fusion of humans and machines is not confined to fusion with engineering machinery. Think of machinery as technology in a wider sense. One of the largest modern technological fields is biotechnology. People are helped by biotechnology in the form of medical treatment, but we could be heading toward a scenario in which people are composed of biotechnology. If that is the case, the question must be asked:

what are the people who have been integrated with technology in such a way? My background is in western philosophy, which since ancient times has continually asked the question, "What is humankind?" Traditional philosophy was founded on a distinction between human beings and machines (as well as animals), but nowadays technology is beginning to shake this distinction and cyborgs, which are the fusion of humans and machines, really have to be seen as a fundamental phenomenon in philosophical discussions. The question "What is humankind?" needs to be replaced by the question "What is a cyborg?"

Human beings composed of technology

Let's move from abstract theory to concrete considerations. I have discussed the above-mentioned BMI elsewhere¹, so here I want to focus on biotechnology, and especially iPS cells in regenerative medicine. Technology related to iPS cells has developed so quickly that in recent years hardly a day has gone by without it making the news. iPS cell technology is a field of regenerative medicine in which body cells are reprogrammed into a so-called pluripotent cell state, from which any organ can be created according to plan. Press coverage says that a number of significant breakthroughs will be needed before actual three-dimensional organs can be created, although attempts have already been made². If this creation of real organs does become possible in the future, it will increase the opportunities for human beings to be composed of transplanted organs. More and more people will accept being composed of such biotechnology.

"Enhancement" providing enhanced, extended life

Attempts have already been made to genetically modify iPS sequences, with some successful cases being reported³. This kind of genetic modification will inevitably raise the issue of enhancement in the future. Enhancement means increased performance: think about the simple example of doping among athletes. This is, of course, a very problematic topic. In terms of the above-mentioned genetic repair, it means not only restoring gene sequences that cause illness into normal gene sequences, but also going further and creating gene sequences in order to enhance performance as well as health.

At the extreme end of enhancement is the extension of the natural limits to our lifespan, or in other words, increasing longevity. A general feature of technology is that it extends or amplifies the natural state. The technology of the automobile, for example, enables us to move at speeds unattainable in our natural state of walking or running, so

basically it has extended and amplified our natural state of being on foot. Regenerative medicine can through organ transplantation, provide patients who are sick or dying with improved natural health or an extended lifespan. This being the case, people who have been helped by biotechnology such as regenerative medicine, and who are consequently composed of biotechnology, are enhanced by this technology which basically prolongs their life, and are filled cells and to restore "sick" genetic sequences to normal genetic with the strength to try to defy death.

Western philosophy assumes that all people die one day. Of course it may be impossible to avoid death by regenerative medicine. But technology (or biotechnology) has set itself the target of shaking this assumption, a fact that needs to be included in philosophical discussions. People composed of biotechnology are cyborgs, an amalgam of human being and technology. Cyborgs are truly a fundamental phenomenon in philosophical discussions.

X. CONCLUSION

Though bioelectronics has many advantages it may lead to negative arguments with the Invention of biological machines called "Cyborgs". As many scientists have eloquently argued, once a technology is out there, you cannot make it go away. There never was a technology that the human race ever abandoned wholesale, even the hydrogen bomb or other weapons of mass destruction with the power to wipe out all life on Earth. When human beings are offered the chance to utilize computers and electronic technologies within their bodies to achieve the same results, it is almost certain they will embrace them regardless of the risks. Based on this, it would be unrealistic to try and ban such technologies, however one might worry about their ethical and social consequences. A ban would only probably force them into a large, criminal black market, as illegal drugs and weapons already have been. It is probably imperative for society to assert that the scientists and engineers charged with creating this new technology exert the proper amount of social responsibility.

Safeguards will have to be insisted on to prevent the possible negative impacts discussed above, and many of these things will have to be built in at the instrumental level, since they probably cannot be achieved only through policy and regulation.

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