Cybernetic Augmentation - a Key to Utopia or Dystopia?

WM0324LR Ethics Essay 2014-2015

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Abstract

Cybernetic augmentation (in short, CA) technology is a newly emerging field of human engineering. In an attempt to analyse and discuss the ethical implications of the technology, a cost-benefit analysis is carried out as the first step. Major potential benefits of CA are identified as: ease of hardships, improvement of health and survivavility, creation of new opportunities, enhanced sense of safety and welfare, increased efficiency and productivity, and greater happiness. On the other hand, major potential risks could be: detrimental restructuring of human life, loss of humanity, hazard to health, decreased safety and security, and greater unhappiness. Next to the risk-benefit analysis, the ethical aspect of the intoduction of the technology is contemplated in terms of three normative ethical theories - utilitarianism, duty ethics, and virtue ethics. Discussions showed the complexity of the issue, and emphasized the neccessity of a pragmatic application of all three theories in order to obtain a solid ethical code for CA. Finally, the authors provide recommendations which suggest the importnace of a gradual and careful development process in prallel with a continuous public discussion for the better comprehension and appreciation of the technology.

I. Introduction

Humanity's ability to make tools to complement itself can arguably be the most important contributor to its success over the last few millennia; we have made tools to adapt the environment to our needs, ensure our food supply, increase our strength and dexterity, widen our knowledge and improve our ability to carry out mental activities. However, after millennia of progress we are approaching a new dimension of technology; a dimension which some believe will be our salvation while others think it will be our undoing. The dimension referred to is the prospect of actively and intrusively improving the human mind and body. Developments in fields such as electronics, nanotechnology, robotics, cybernetics, information technology, neurotechnology, genetic engineering and pharmacology, among others, are enabling a new field of technology labelled by some as "Human Engineering" to emerge.

The authors of this paper realize that human engineering is a very broad and trans-disciplinary field, and it would take volumes to analyse its ethical implications; thus this paper attempts to narrow the field by only looking at the ethical implications of one form of Human Engineering; namely cybernetic augmentation of human beings (henceforth CA). For the purpose of this paper CA is defined as the following: any (1) electro-mechanical addition to the human body that (2) becomes a natural part of the human body and that (3) improves the performance of an individual beyond normal human capacities. Needless to say genetic or chemical forms of human augmentation are external to the purview of CA. Furthermore, the scope of CA as defined for this paper deals with the enhancement of human capabilities "beyond the statistically normal standard". Therefore it does not consider the therapeutic use of the technology (e.g. prosthetic limbs for the amputees, artificial eyes/ears for the blind/deaf,

memory chip for the patients suffering from Alzheimer's disease, etc.). Although there are complications for making this divide between therapy and enhancement, they will also be considered external to the scope of this paper.

The paper is structured as follows; the first part of the essay looks at the effects of CA on society; following this an ethical theories are used to analyse the morality of augmentation. After looking at the effects and their ethical implications, recommendations are made to support the implementation of CA on society. Finally, the conclusions are drawn regarding the viewpoints and approaches towards CA, its ethics and its effects on the future of humanity.

II. Analysis

Let us analyse and discuss the ethical implications of CA. Before we start, it is important to ask ourselves "What is meant by an ethical implication?". According to the Longman Dictionary of Contemporary English, an implication means "a possible future effect or result of an action, event, decision, etc" [6]. Therefore, an ethical implication would mean the possible future effect or result with regard to associated moral values and principles of morality. For analysis, this section is divided into three main parts:

1. Potential benefits of CA
2. Potential risks of CA
3. Application of ethical theories

The first two parts provide an insight into the possible social, economical, and technological influence of the development and application of CA technology, as well as its potential direct impact on users' physical and psychological state. Finally, the ethical implications of the technology are analysed

and discussed by relating to the existing ethical theories and models.

A. Benefits of CA

There can be numerous potential benefits when the CA is implemented to enhance the user's physical and/or cognitive ability. In this essay, some of the main benefits of CA are considered and discussed: ease hardships, improve health and survivability, create new opportunities, improve safety and welfare, improve efficiency and create happiness. Of course, there will be many other unmentioned potential benefits (and risks), but it should be noted that our intention is to give an overview and "food for thought" that is useful and adequate to comprehend the general implications, rather than to give you an exhaustive list of every possibility in the future.

(1) Ease hardships
One way that the CA can be used to achieve the sense of better well-being is by enabling the users to carry out their daily actions in a more convenient way. For example, with augmented arms or legs, one may never have to struggle when lifting or carrying things. Also, the level of pain might be controlled in those augmented organs - for example, when you touch something very cold or hot beyond a certain threshold level, then it may regulate the synaptic information to your nerve system that you do not feel the pain you would have felt if you were not augmented. Such technology of physical CA can give the user more control over their bodies, and thus reduce the level of inconvenience and stress. Furthermore, one can also consider the use of sensory/cognitive augmentation, such as an augmented eye which enables the user to see clearly during night with little light; this may be done by modifying or improving visual prosthesis devices [15]. Another kind of cognitive augmentation can be a computer chip that can be implemented in the brain to enhance the memory capability [3]. Such technology of cognitive CA can lead to the better perception and management of daily-life information.

(2) Improve health and survivability
Since CA will enhance the mind and the body of the person in question, it can be argued that their chances of survival will increase. A stronger, smarter person will be able to handle herself better in case of dangers such as natural disasters or accidents. In addition, the CA can help the users maintain or improve their health by incorporating advanced medical technology. For example, the research is ongoing on the development of nanorobots which are designed to navigate through our bodies' blood vessels, detect cancerous cells, and kill them [9]. Through the technology of CA, such nanorobots can monitor our body more comprehensively, and perform medical tasks more quickly and efficiently at an early stage.

(3) Create new opportunities
Imagining further into the future, CAs may give us the ability to inhabit currently uninhabitable environments; for example, underwater or other planets with hazardous environments. Also, enhancements may lead to the creation of newer jobs and professions; the tasks which are considered as currently impossible or very difficult may become practicable when a workforce with enhanced ability are engaged. Additionally, once CA becomes an active trend for society, there will be more initiatives for further research, development and application of the technology in other fields of science and industry.

(4) Improve safety and welfare
CA will improve safety beyond the discussed health and physical improvements of the individual. Mankind will be physically and psychologically better equipped to deal with its problems. Society will have a stronger physical presence with improved capacities of the armies and police forces; psychologically our society will be better equipped as our leaders will have enhanced minds which will improve their faculties to solve social and political problems [4]. We can also increase safety and moral behaviour of users of CA by incorporating safety and morally right decision making processes or fail safes in the augmentations. As an example imagine cognitive augments which informs the user of locations of rubbish cans if she needs to dispose of some waste; the 'moralization of technology' will be easier and more effective [1].

(4) Increased efficiency and productivity
Enhanced physical capability of the workers by means of CA is most likely to increase the efficiency and productivity of humanity. We will be able to better optimize and specialize our manpower, meaning as a sum effect we will get more done. Augmentations can be doctored to suit the professions of individuals; for example, construction workers can get physical augmentation that make them stronger, miners may consider improving their lungs to filter out harmful pollutants, businessperson can consider neural implants that will keep their mind connected to important information networks.

(5) Create happiness
Although it can be argued that the cumulative effect of the aforementioned benefits will be a general increase, the authors wish to assert that CA in and of itself can be a source of greater happiness. Besides the obvious improvement to self image from being able to do more, people maybe able to use CA to fulfil lifelong dreams that were previously unattainable; for example, someone with physical augmentations, wishing to scale mountains but with no previous experience will be safely able to do so. Cognitive augments can monitor the brain for depressive thoughts pattern and attempt to alleviate them for the user by suggesting her activities or providing more context for the sadness by referring

to the arts, thereby allowing her to cope better. As extreme cases, neural implants may allow the user to experience a virtual reality or even directly stimulate parts of the brain that make people feel happy. ¿¿¿¿¿¿¿ origin/master

B. Risks of CA

CA may also have negative consequences. As mentioned in the previous section, the examples of technologies discussed can be imagined to be a double edged sword; it may help humanity but it may as easily harm it. These possible risks of CA are: detrimental restructuring of human life, loss of humanity, hazards to health, decreased safety and security and finally unhappiness.

(1) Detrimental restructuring of human life
CA will most likely make many of the current social institutions and regulations meaningless; it would require them to be redefined and rethought to account for the effect of new CA. For example, new laws would need to be defined for physical CAs that may allow human beings to run at really high speeds; academic performance may become meaningless if cognitive implants capable of storing or recalling information like a computer become available [4]. CA may drastically increase the life expectancy of people which may require us to change the way we approach reproduction. A great deal of jobs will be lost because fewer people would be required to perform jobs; this may lead to a global economic crisis. It will most likely intensify the already problematic situation of social stratification in the world; if augmentations are expensive the rich will get an even greater edge over the poor. Different types of enhanced humans may create their own closed communities and due to their enhancements maybe assigned different (possibly greater) rights over non-enhanced humans.

(2) Loss of humanity
Critics of CA (and human enhancement in general) often present what is referred to as the argument of naturalness [10, pg. 190] against augmentation; there is an intuitive belief that changing human biology would be detrimental to what it is to be human [2]. Supplanting these arguments are, among others, the fear of 'playing god' and the notion that a human being is forged through hardships she overcomes; if augmentation make those hardships easy to obtain, they may lose their meaning.

(3) Hazards to health
There are many potential health hazards to CA. Due to its invasive nature, there would be great amount to risk to human life both in the research and the development phases of such technology. The research phase will be hazardous because it will need to be tested on human beings. Assuming the technology is developed and implemented, there would be the perpetual risks of having a malfunctioning cybernetic

device inside the human body; besides the possibility of malfunction there would be risks of hazardous interactions with the environment.

(4) Decreased safety and security
Safety may also decrease since augmented criminals will be better criminals. The controlling of CA may lead to the formation of black markets which will contribute further to crime. Wars may become more dangerous since both there will be deadlier soldiers and more capable generals leading them. With cognitive augmentation there is the risk of loss of autonomy and privacy; there maybe the risk of thought monitoring by criminals or governments. In an extreme case, ones mind maybe hacked or their personality significantly altered without their consent.

(5) Unhappiness
Besides the above mentioned risks and their consequential unhappiness, CA may cause unhappiness intrinsically. If augmentations are impossible or riskier to remove than implement, than there would be the chance that one would limit the possibilities of her life by choosing a specific type of augmentation. A highly prolonged life may be a source for unhappiness; one may find herself to be bored of life and find nothing meaningful left to pursue. If ignorance truly is bliss, cognitive enhancement that would lead to greater amounts of intellect may end up leading to unhappiness.

C. Normative ethical perspective on CA

Ethics is defined as "the systematic reflection of morality"[7, ch. 3.2]; morality is the notion of right and wrong as expressed by the thoughts, actions and decisions of an individual or a collective. The introduction of CA technology in society leads to a vast array of ethical issues. In this essay the perspective of normative ethics will be applied to look at how ethical theories may consider CA to be moral or immoral; the three major ethical theories applied will be Utilitarianism, Duty ethics and Virtue ethics.

C..1 Utilitarianism

"In utilitarianism, actions are judged by the amount of pleasure and pain they bring about. The action that brings the greatest happiness for the greatest number should be chosen." [7, ch. 3.7] Further addition that need to be made to refine this theory is the Freedom principle, which states that people are free to pursue their own pleasures as long as it does not hinder the freedom of others.

For CA to be acceptable according to utilitarianism the net benefits need to outweigh the net risks. This is something

that will be hard, if not impossible, to establish with scientific studies. The effect of the Collingridge dilemma [5] is extensively pronounced in the case of CA research and implementation due to both the potential unknown capability and the extensively strong effect it may have on humanity's development. Notions of Constructive Technology Assessment (CTA) [14, 13] can be possibilities to guide its progress. There are also issues with the freedom principle and the notion of distributive justice that maybe problematic with the applications of CA.

However, in the end it must be realized that greater utility is what has driven technological progress; CA will lead to a net increase in human potential. If too many social costs are not incurred and an equitable distribution of CA can be achieved while maintaining the rights and liberties of the individuals, it can easily be imagined how CA would lead to a better life for humanity's majority.

C..2 Duty ethics

Duty ethics judges actions to be right or wrong based on how much they agree to a moral norm. These norms are described by duty ethics as "Categorical imperative". There are two primary categorical imperatives in duty ethics; the universality principle states that only actions that can become universal laws are moral[7, ch. 3.8] and the reciprocity principle which says only actions that treat humanity as an end are moral [7, ch. 3.8].

A big issue with the application of duty ethics, more specifically the universality principle, will be the "slippery slope argument" [16, 12]; this argument states that if permitting a good action X creates precedent for permitting a bad action Y, X should not be permitted. Due to the nature of CA it is unlikely that a rigid framework of universal laws will be applicable. The second categorical imperative can be applied to CA in two opposite ways. Firstly, it can be argued that CA causes human beings to lose humanity (i.e. become more machine like) and thus may encourage the tendency of treating them like means to achieve certain ends. On the other hand, if one adopts the view that CA will be a means that humanity will use to aid or improve itself with negligible risk to itself, than this imperative is no longer violated.

It can be understood from the above discussion that the application of duty ethics to CA may lead to more problems than solutions.

C..3 Virtue ethics

Virtue ethics focuses on the characteristics of the people involved. It is different from the other ethical theories in the sense that it ignores the moral quality of actions and argues that qualities of the actor will lead to moral actions. This theory encourages the nurturing and developing of virtues that lead to the realization of an "individual's unique human potential"; this leads to what is called "a good life" or "eudaimonia" [7, ch. 3.9]. The good life is not necessarily a state that brings the greatest pleasure to an individual neither is it one that can be achieved by adhering to a strict code of norms.

In light of this theory, CA seems to find a reasonable standing; however, it must be noted that according to virtue ethics, only the kind of CA that can allow a person to flourish and improve upon her virtues will be accepted and encouraged, ones that weaken virtues will all be discouraged. Virtue ethics espouses an idea of "practical wisdom" for the individual which allows her to make the right moral decision when faced with ambiguity. The application of such practical wisdom will be required by humanity as a whole to guide it through the many pitfalls of CA.

Although useful for the rightful and beneficial application of CA in humanity, it has a big problem. It makes regulation and legislation difficult for it is hard to judge an action based on the vice or virtues of the people involved.

III. Authors' Opinions and Recommendations

Despite a multitude of identified technical risks and ethical concerns, the authors of this paper claim that the emergence and development of the CA should not be simply avoided, but should rather be encouraged in such a manner that the moral autonomy of those who are willing to utilize the technology is respected while the possible risks are striven to be minimized. Moreover, we argue that an excessively conservative view which tries to indiscreetly restrict the entire human augmentation technology itself will not only hinder the gateway to the great benefits of the technology, but also limit the possibility to develop a more encompassing social, economical, technological, and ethical framework which would help us better comprehend the implications of the related technologies and allow us to deal with the risks more effectively.

As a way of utilizing the technology while minimizing the technical risks and ethical concerns, the authors propose the following recommendations:
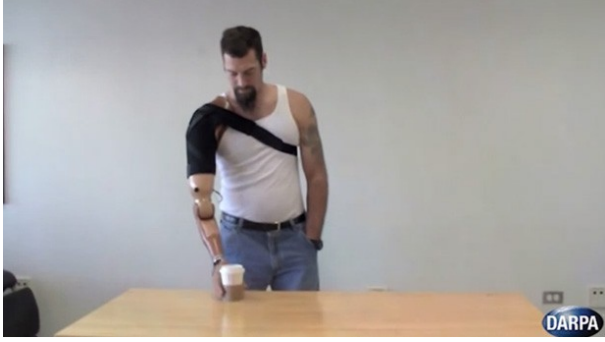
Figure 1: *Prosthetic arm developed by DARPA. An artificial arm is connected to the user's existing muscles and nerves[11]*

Figure 2: *Prosthetic retinal implant concept illustration [8]*

- Active encouragement of the application of CA technology for therapeutic purpose (e.g. prosthetic limbs for the amputees illustrated in Figure 1, and visual prostheses for the blind illustrated in Figure 2). Since such kind of use of the technology is much less controversial, it is recommendable that the development of the augmentation technology be focused on these medical fields for the time being. Once the technology gains more maturity and people become more familiar (and knowledgeable) with it, we can then have more meaningful discussions concerning the acceptability of the CA technology that is intended to enhance the human ability "beyond the normal level".

- Active encouragement of the development of non-permanent/wearable cybernetic devices, starting from the smallest scale. If the intrusive nature of the CA is removed, there will be much less technical risks and ethical concerns. Therefore, it can be a great stepping-stone for the introduction of the CA technology for similar reasons as in the previous item.

- A discussion as to whether the CA is a key to Utopia or Dystopia can be meaningful as long as the discussion actively continues throughout the development and deployment of the technology, whilst refraining from making hasty conclusions (i.e. slippery slope fallacy). Note that CA is a very broad technology. Therefore, instead of judging the final possible outcome of the entire concept of the technology, one should rather try to find specific fields and aspects in which the technology can be applied with the highest acceptability.

IV.   Conclusions

This essay has attempted to briefly discuss what CA may mean for the future of humanity. It has firstly discussed the five potential benefits and five risks of CA. It than moved on to apply three normative ethical theories to analyse the morality of CA; the analysis found that utilitarianism can be used to justify CA if implemented correctly, duty ethics
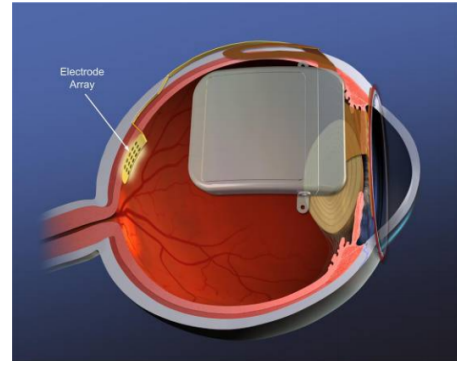
may face some difficulties with CA due to its rigid nature and finally that virtue ethics can be guiding principle for a positive implementation and application of CA in society. However, the ethical discussion revealed some pitfalls associated with each ethical theory is present when implemented for CA, thus a pragmatic application of all three theories need to be made to obtain a just and fair ethical code for CA.

Finally some recommendations were made about the humanity's approach towards CA. It is the belief of the authors that CA is something that we will need to deal with; conservatism will not only hinder progress, it will handicap our ability to control the development of CA and implement policy and framework to regulate to lead to the greatest human good. Emphasis was put into both a gradual and thoughtful development process as well as a slow exposure of this technology to the public. These would be pivotal in the way CA pans out in the future because having a slow and careful development process in parallel with a slow step wise public exposure of the technology will allow the developers to better understand the consequence of the technology and leave time for ancillary institutional and policy frameworks to develop. Better understanding of the technological consequences as well as an accommodating framework will guide this technology so

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