ROBOTIC PROSTHETIC LIMBS: AN IMPROVEMENT TO THE QUALITY OF LIFE FOR AMPUTEES

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PROSTHETICS AND THEIR DEVELOPMENT

“In 490 B.C., it was a Persian soldier who cut off his own feet in order to escape from a prison and later replaced it with a wooden foot which is the first prosthetic” [4]. Obviously technology has radically changed since then, but the purpose of prosthesis remains the same. Prosthetics still serve to replace a missing limb or body part in order to carry out the function of that missing part. Now in the present day full teams of scientists and engineers seek to further develop prosthetic arms and legs. One aspect of the current prosthetic limb market is robotics. Developers wire different parts of the prosthetic limb to the nerve endings remaining in the body, so that a brain function has the ability to move the limb. This process of making and developing robotic prosthetics is still in its beginning stages, however, if successful could change the lives of amputees for the better. As of right now, the government has little to no interest in subsidizing the development of these prosthetics making it hard for private corporations to work on them. People also contest robotic limbs because they say it results in a loss of human identity. In terms of engineering ethics, government funding is very dependent on the situation and research at hand. The “Code of Ethics for Engineers” only covers this topic briefly and does not fully describe the specific situations in which engineers would be funded for different projects. In reality, this effect is outweighed by the positives these prosthetic limbs bring to people. It is important for the government fund these businesses so that these businesses continue to improve these robotic prosthetics so that people with missing limbs can live with an improved quality of life. In addition, it is essential for engineering education programs to inform students about topics and ethics through research and projects in order to put the information that students are learning into the context of the real world.

Movement via Brain Control

Original prosthesis usually only consisted of a solid, dense object not built for movement and only used for support. Now scientists have utilized the electronic pulses in the nervous system to allow these prosthetics to move. In order to do this, doctors implant electrodes in the cortex of the brain, the area of the brain that controls movement. This is such a vast change from the older style of prosthetics. Aaron Leitko, Washington Post author, describes the current state of prosthetic limbs by saying, “Prosthetic limbs have come a long way in recent decades. By using electrodes that can receive signals from nerve endings, for example, scientists have developed robotic arms that their patients can control using only their thoughts” [2]. In a PBS interview, anchor Margaret Warner discusses this system with Dr. Leigh Hochburg of Massachusetts General Hospital. The two discuss Cathy Hutchinson, a recipient of this prosthetic system. After treatment, Cathy showed her success by reaching out and picking up a coffee cup [1]. Although she has no functioning arm, her brain still signals the new arm to perform a function. In the interview, Dr. Hochburg summarizes how the technology works in his own words. He says, “There's a small array of microelectrodes that's tapped into that top of the motor cortex. And the brain signals, the neurons, we capture that electrical activity, which is really the language of the nervous system” [1]. All in all, this new technology allows a person to carry out many of the same functions as a real limb would. At this time, the technology linked into the cortex of the brain remains experimental. Dr. Hochburg describes this perfectly when he explains, “And I'm encouraged by the stage of the research that we're at and the progress that we're making. There's still a lot of research left to do” [1]. If research is effective, scientists can work to make the experimental technology much more superior. In its current state, this technology can be very slow and has several glitches but if supported, these kinks can be worked out.

ROBOTIC LIMB CONTROVERSY

There are several issues that people discuss when talking about robotic prosthetic limbs. Due to varying opinions, different people have certain problems with the use and development of these false limbs. All of these topics come from people that are most likely playing devils-advocate because many of the problems discussed are not detrimental to the recipients of the treatment. In essence, they are solely forming opinions and statements just to argue against prosthesis. First, people say that giving a person a robotic limb can lead to the person not being considered fully human. For example, if someone is partially dependent on a robot for living, others may not consider this person a true human being. While this problem is understandable arisen, this is not a big enough reason to discontinue research on such limbs. Another problem with the development of robotic prosthetics is discussed when author P. Brey raises the question, “Can the addition of artificial part cause a transformation or even a loss of identity?” [3]. While it is understandable that the recipient of a prosthetic
Prosthetic Limbs in Context

There is a plethora of examples of robotic prosthetics benefitting different types of people in a variety of ways. Members of the U.S. army are a large group of the recipients of robotic prosthetics [6]. Members of the army are usually injured during duty and return to the United States with a less than standard quality of life due to their lost limb. This makes acclimating to civilian life much harder than it already is. Robotic prosthetics are one method of repairing their injury in order to improve their life and make them happier about their current standard of living. Jason Ghannadian, TATRC program manager for advanced prosthetics, explains, “Our mission is to turn every service member back to the fullest quality of life, whether they want to return to their civilian lives or get back to the war. A lot of them want to know how long until they can get back to their unit” [6]. Receiving a false limb allows a soldier to contribute themselves to society, although they may not be able to fight on the battlefield again. Ghannadian explains, “The goal is to let all of them get back, if they want, and to not have prosthetics be like a death sentence forcing them to sit behind a desk the rest of their lives” [6]. Soldiers who have dedicated their lives to defending others should not be overlooked when receiving prosthetic treatment. These limbs allow veterans to acclimate themselves to a normal life, even though their lives have already been altered. Research within prosthetics will allow more and more soldiers to receive robotic limbs improving the quality of their lives exponentially.

These robotic limbs also allow amputees to participate in athletics when otherwise, they would be excluded. German Paralympic athlete, Heinrich Popow, is competitive within his sport of short-distance sprinting due to his robotic prosthetic leg. His leg moves in coordination to the rest of his body at the knee, just as any other person’s leg would move [7]. Not only does the limb allow him to competitively compete, he can also live without having to depend on a wheelchair or inferior prosthetic.

Personal Effect

I originally became interested in the development of robotic prosthetics because they were the first topic that really inspired me to be interested in engineering as a whole. When deciding what I wanted to study in college, an informational pamphlet about robotic prosthetic limbs caught my eye. Within the text of the pamphlet I read about the positive effects and good opportunities robotic limbs gave to people. Each recipient of a limb was quoted, and each person seemed to be much happier than they were without the limb. This struck me in a positive way as I saw how these people’s quality of life was affected so greatly. At the same time, funds for research such as this tend to be lacking as the government looks to spend money on other things that gain more media attention like the military. It is for this reason that robotic prosthesis research requires more funds.

Discussing Ethics within Prosthetics and Engineering

Within the world of the engineering profession, engineers are bound by a certain code of ethics. This code of ethics is a list of statements written with the intention to inform engineers and to help them make the right decisions in the workplace. In terms of government funding for topics such as the government funding of robotic prosthesis, this engineering provides minimal guidance and appears to be somewhat vague in its description. The “NSPE Code of Ethics for Engineers” reads, “Engineers shall not offer, give, solicit, or receive, either directly or indirectly, any contribution to influence the award of a contract by public authority…” [5]. In summary, engineers may not attempt to bribe public authority such as government in order to gain subsidies for a research project. Within this statement, there are several aspects missing, which would otherwise aid engineers in going about receiving governmental money legally. For example, there is no statement spelling out how to go about requesting a subsidy for research on topics such as prosthetics. There is solely a proclamation saying that using bribes to achieve a contract contradicts the bounds of the code of ethics. The “Biomedical Society of Engineers Code of Ethics” also attempts to set rules pertaining to the situation of receiving public money. This code of ethics says that, “Biomedical engineers involved in research shall comply fully with legal, ethical, institutional, governmental, and other applicable research guidelines” [8]. This takes a more vague approach, leaving interpretation up to individual engineers, rather than making a concrete statement. The biomedical code of ethics only instructs engineers to follow the rules that already exist within other entities and does not really instruct anything specific. Overall, this code of ethics says that if a biomedical engineer wanted to go about receiving money for research, he would have to go about it.
Research and Ethics in Education

It is important for university engineering students to learn about topics and take positions because it prepares them for employment later in life. Naturally, as a student, kids are not experienced, and through research projects engineering students gain experience. In the world of employment, engineers will have to be informed about many different topics and by educating students on how to research and form opinions; they will be much more prepared for the future. In the current state of engineering, education is focused on a large majority of math based classes. While this is good, classes should also focus on subjects such as decision making and taking responsibility for one’s research. This topic is discussed in “The Changing Face of Engineering Education”. Volkwein writes, “The new criteria radically altered the evaluation of undergraduate engineering programs, shifting the emphasis from curricular specifications to student learning outcomes and accountability” [9]. Engineering education should focus on aspects that will prepare students for future employment. Also, it is important for students to learn and inform themselves about the “Engineering Code of Ethics”. This way students understand guidelines to follow when they become a fully employed adult engineer. Learning ethics while students are still young will make it easier for them to follow the code of ethics and be successful when they are older.

RESEARCHING ROBOTIC PROSTHETICS AS A WHOLE

At first glance there may seem to be several negative aspects to researching and developing robotic prosthetics, but there are many more positive effects on the recipients’ lives. False limbs do not cause people to lose their identity; however, they improve the quality of life for treatment recipients. People who are unable to carry out everyday functions are affected positively by the robotic limbs they are given. (2254 Words)

REFERENCES


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