IV
UTOPIAN AND DYSTOPIAN FUTURES

Description of the Michelangelo Hand

A hand is the primary way that humans manipulate their local environment and how well you control your environment is a critical measure of ability[1]. It is not lost, therefore, that the word manipulation, from the Latin manipulus meaning “handful” is a direct reference to the appendage we use to control the environment around us. It is evident that the loss of a hand and the arm attached to it is an impairment to functioning in an environment where technologies are designed for the hands to operate them and even the hands themselves have evolved to manipulate the objects on this planet.

It can be expected that a resourceful species such as ourselves wouldn’t let the loss of an upper limb inhibit our ability to survive, and it hasn’t. We have been developing technologies that replace and attempt to restore the function of the upper limb since antiquity[2]. Our technoscientific culture has more opportunity to restore functionality to upper limb amputees than ever before with recent developments in robotics, lightweight materials and bioelectric sensors. Technologically speaking, these developments were science fiction less than 100 years ago. The current apex of the scientific research and engineered solutions as applied to upper limb amputation is the Michelangelo Hand, a myoelectric (muscle sensing) robotic prosthetic made by the company Otto Bock[3]. The Michelangelo hand has a battery life of 20 hours, is made of lightweight metals and plastics and controlled through built in electrodes that are filtered and interpreted through state of the art software. The hand has multiple actuators in its five fingers and is capable of performing complex precise tasks such as opening a toothpaste tube, gripping a key and cooking[3]. The American distributor of the myoelectric prosthesis, Advanced Arm Dynamics states that, “The Michelangelo Hand offers unprecedented speed, strength and a natural, anthropomorphic look”. The device costs $73,800 USD[4].
Analysis of the Michelangelo Hand

Like many problems that seem solvable through science and engineering, erasing upper limb functional impairment with technology seems like an inevitability, but in what form does this erasure come? If the purpose of the research and engineering was to erase the disability of upper limb amputees as defined by Stedman’s Medical Dictionary (1976) as “a medico-legal term signifying a loss of function and earning power” then the solution would come in the form of erasing the loss of function and earning power. I want to address the motivations of the research and design that went into making the Michelangelo hand. I want to trouble the idea that the Michelangelo hand is an example of advancement towards enablement through improving function and earning power. I do not mean to say that myoelectric prosthetics are bad and serve no good purpose for amputees. I instead want propose that the noble research and design motivations behind the Michelangelo hand may be confounded by the allure of the control and creation of life, the ableist notion that a complete body is a good body and marketability.

The Control and Creation of “Life”

Hands are tools, biological tools that have evolved in different iterations over countless generations of natural selection. That selection acted to give shape to the current natural design of the human hand. Is a five digit appendage with limited degrees of freedom the optima engineered design for survival and the control of the environment around us? When looking to nature, we see the answer is no. Animals who swim and run with greater speed, grasp with greater strength and climb with greater dexterity should be a reminder of the hubris in thinking that the human hand is the natural choice to be mimicked. It has been said that our greatest asset as a species is our intelligence and adaptability, with our physical bodies often being a limitation, thus inspiring technology to push that limit. Even the fastest human would lose a footrace to an average housecat, but our clever domestication of the cat is a testament to the irrelevance of the footrace. I do not deny that human hands are beautiful and intricate devices capable of innumerable tasks, but they require training to be used effectively. Observing any untrained person clumsily throw a ball or hunt and peck on a keyboard can attest to that. This does not discount, however that a trained hand can do something as magnificent as play a musical instrument. Even an untrained hand is sensitive to heat, pressure, temperature, touch and can even amazingly heal itself within limits. The complexities of the musculoskeletal, nervous and vascular anatomy along with all their interrelations that allow such seemingly incredible feats to be performed so gracefully are staggering to all and captivating to some.

“Be Bionic”

Amidst a culture of progress, the possibility of mimicking the beauty of not only the form but also the function of the human hand is alluring and inspiring. The inspiration is enough for Otto Bock to invest millions of dollars into the research and design of the Michelangelo hand[5]. The Michelangelo hand is not only a feat of science and engineering in a vacuum however, it purports itself as an assistive device for patients. The patient who it aims to assist is an amputee, a widely recognized symbol of physical disability. Evidence based healthcare takes into account scientific evidence, practitioner expertise and patient evidence[6]. Patient evidence shows that the uptake of myoelectric hands is low, many patients refuse to wear them citing that they are clumsy, heavy, lack control and ultimately that they do not improve the quality of life of the amputee[7][8]. Instead the main complaints of prosthetic wearers in relation to function are socket/stump fit, weight and gripping strength[7]. One would think that if the researchers and designers end goals were focused on the quality of life of amputees and the improvement of their function and earning power, the focus would be on those complaints. Examples like functional, interchangeable attachments, lowering the total weight and comfortable sockets. Instead, the Michelangelo hand is made to look as ‘lifelike’ as possible in its form and function instead of ‘deathlike’ and disabled. The development of the anthropomorphic shape reflects the notion that this ableist culture considers amputees to be in need of elevation through our most advanced technology to ‘be bionic’ instead of disabled.

A Complete Body is a Good Gody?

Before myoelectric prosthetics, there were bodypowered or cableoperated prosthetics. These devices rely on the adjustments made with the other hand, or by swinging the torso. These types of prosthetics are still in use by many amputees as a day-to-day prosthesis since they are cheaper, lighter, more reliable and easier to repair than myoelectric prosthetics[7][8]. They can also be customized with attachments to perform a variety of tasks like swimming.
rock climbing, typing, basketball etc…[10] The caveat is that these attachments are usually custom made by individual prosthetic technicians and are not covered by national insurance plans, therefore are often expensive. In addition to these functional prosthetics there are also aesthetic prosthetics, often hand painted to resemble a human hand and convincing replicas come with a high price tag. The existence of aesthetic prosthetic and their use brings into light the desire of an amputee to possess an anthropomorphic form. The desire to have a complete body and to approximate what a good human form looks like can be a matter of selfesteem for the amputee. Looking from a disability studies framework, we can see that it doesn’t have to be that way. The notion that a good human form is a complete human form is a cultural conception that is imposed upon the amputee and everyone interdependent with them. An amputee may have lived the majority of their lifetime with a complete form or they may have never possessed a complete form. In either case the implicit understanding of normalcy produces their incomplete bodies to be understood as socially and culturally inferior to a complete one. The Michelangelo hand, with its anthropomorphic appearance and movement, applauds itself as a technological solution to that inferiority and thus reinforces the conception that an anthropomorphically complete body is the only good body.

The Uncanny Valley

The research and design focus on anthropomorphic hands has a long history. From antiquity onwards, humans have crafted the shape of the hand from the materials available to them in order to mimic its form and function[2]. As we humans have become more adept at imitating life we started to notice that there was a point close to a perfect imitation that elicited a feeling of horror. Like Frankenstein’s monster, this creation in the space between life and death is regarded as horrible. In 1970 a Japanese roboticist coined this space the Uncanny Valley when observing the androids he created[11]. This fear has been theorized to stem from a fear of death and disablement, an example being that a dead body has the same form as a living one but is dangerous to our health and reminds us of our mortality[11]. As applied to prosthetics, when the researchers and designers create these imperfect replicas of life, they potentially subject the wearer to the ancestral prejudice of their fellow humans. There have been studies done exploring these ideas[12] but an examination from a disability studies framework allows us to see that the very pursuit of a lifelike appearance is fruitless if the goal is to make the patient comfortable. The perfect imitation of normalcy is impossible for those with complete bodies, and even with the most perfect replica, even the slightest mechanical twitch or botched paint job will betray the abnormalcy to another humans finely tuned sense of the uncanny. A disability studies framework can allow us to see that the solution isn’t creating a more perfect replica of a normal hand, but in dismantling the concept of a normal hand altogether.

A Maimed Market

The prosthetics companies that are now global leaders all have their roots at the beginning of the 20th century, in the interwar period when the industrial revolution was in full swing and the First World War had ended[5]. There was a recognized need for prosthetic devices for the maimed soldiers, who were being saved from death due to antibiotics but were now living with disability. Like lifesaving antibiotics, the question of disability was answered by technology and the fabrication of prosthetics became an industry. The goal of any forprofit company within this industry is growth and profitability. In the case of prosthetics, or any other medical device, growth can be a problem, since the very device you create can serve to eliminate your market. The multitudes of industries centered on disability are all subject to this dilemma, that if they truly eliminate impairments then they become obsolete. From a disability studies framework we can see that a solution to the problem of growth is the continued reinforcement that disability is a problem in need of an advanced technological (read: expensive) solution and perpetual monitoring from highly paid experts.

“Buy Bionic”

If a prosthetic lasts a lifetime, restores function, earning power and is inexpensive to buy, the growth and profitability of the company that makes it can be challenged. The prosthetic industry avoided stagnation by continuing to put research funding into the development of expensive bionic limbs for further progress while simultaneously selling the appeal of the SuperCrip. In the absence of war or an increase in disease related surgical amputations, the prevalence of amputees in a population does not display constant growth. An answer comes in the form of convincing its existing market to buy robotic myoelectric hands are more expensive; require more parts, more repairs and a team of highly trained personnel to manage. It would seem like milking your
already small market would alienate them, and this would collapse the industry altogether but this is avoided in developed nations. In many developed nations both the research funding and health service is nationalized so the prosthetic industry can draw from these deep pockets because this ableist culture expects that an amputee would want to be bionic, and will therefore buy bionic.

Conclusions And Resistance

The development of the Michelangelo hand is a product of a long history of man’s attempt to progress through rational examination and creative design. The application of assistive technology to those considered disabled by society provides an insight into the motivations of the society, especially when it comes in the form of lending a helping hand, or this case selling it. The research and design motivations are confounded by the allure of the control over nature, the ableist conception of a whole body and the marketability of the technology. Those people who were deemed disabled and in need of assistance can resist the application of a technology to erase their disability by not buying and buying into the helping hand that is offered. Instead, they can and do accept their forms and functions as they are, or would rather wear a prosthetic that outstrips the normal limitations of form and function that a human hand can achieve.

References

[0] In my discussion on disability and examining from a disability studies framework I leaned on the works of Simi Linton 1998, Oliver 1990, Rethinking Normalcy, Michalko and Titchkosky, 2009 and the blog of Swisswuff.ch who provided an analytic insight into the issues faced by upper limb amputees


