How Language Affects Adoption of Prosthetics

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

Prosthetic devices are meant to empower and enable disabled people to become independent and perform their daily necessary functions. If left untreated, mental health may suffer as a result of impairments. For example, when hearing loss is left untreated, there is a higher risk of dementia, cognitive decline and general mental health issues (Sohn, 2024). On the other hand, when amputees adopt prosthetics, it can enable the individual to have a better quality of life and to operate independently. Thornhill et al. found that of 80 patients with bilateral below-knee amputations, those who adopted prosthetics were the only ones able to return to work. This enabled them to achieve better long-term survival rates (Thornhill, 1986). The adoption of prosthetics is beneficial for mental and physical reasons, and their acceptance could prove to be useful.

Although the adoption of leg prosthetics has been shown to significantly improve user's quality of life, acceptance is not consistent across different types of prosthetics. For example, the rejection rate of upper arm prosthetics is a staggering 44% (Salminger et al., 2020). This raises many concerns and questions as to why this may be the case. If engineers ignore why these prosthetics are being rejected, it defeats the purpose of creating these products since the intended audience is not using it. I will delve into the psychosocial and cultural reasons for this rejection, focusing on the language surrounding disabilities and prosthetics to better understand its impact on individuals and how to meet their needs.

Methods

Throughout this essay, I utilize disabilities studies and discourse analysis as a framework to analyze and drive my research. I draw inspiration from the work of Shew and Earle, where

they propose a new philosophical framework in which cyborgs and technology are related. Throughout their work, they examine how technology fits between the human and the world, creating a new kind of relationship. This aids in my analysis, for it provides a more nuanced understanding of how prosthetics are perceived and experienced. Furthermore, Shew and Earle critically assess the ways in which disabled individuals are portrayed in North American media and their own experiences. This provides a foundation on understanding how media representations contribute to societal views towards disability technology and a model on how to analyze media. Throughout my essay, I utilize various experiences and sources to examine how media representations influence perceptions of prosthetic technology adoption.

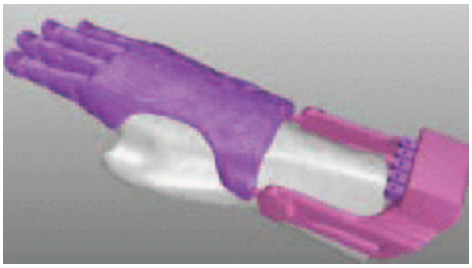
Discourse analysis serves me to examine the language surrounding prosthetics, disabilities, and adoption. Rather than focusing on individual meanings of words, I look at how narratives within cultural, medical, and commercial contexts shape societal attitudes towards prosthetics. I define the cultural aspect as to how the media depicts and talks about prosthetics and devices. Moreover, different societies across the world may have different values, religions and preconceptions that form peoples' beliefs and views towards disabilities and how to aid disabled folk. I define the medical aspect to how prosthetics are spoken about in research, medical, and scientific papers. I refer to the commercial language as the language and ways in which companies market and sell their products for the disabled.

Cultural and Societal Beliefs

A study in Haiti offered different prosthetics to amputees, with one prosthetic limb being named "Cyborg Beast" (Arabian et al., 2016). The prosthetic can be seen in Figure 1.

Figure 1

Cyborg Beast



Arabian et al. found that a patient chose this prosthetic for use but later rejected it because of its size and non-anthropomorphic appearance. In Haiti, the belief system Vodou emphasizes the fact that a spiritual wholeness is tied to their physical wholeness, so amputees would value the aesthetics of the prosthetic heavily to resemble a natural human hand (Arabian et al., 2016). Cyborgs are evident in science fiction movies and literature with superhuman characteristics. Having a prosthetic named after such an entity can evoke a sense of alienation. The term "beast" implies a wild, non-human entity, further distancing the prosthetic from the natural and human elements within the Vodou belief system. As a result, amputees may feel a disconnect between their own identity and the prosthetic, potentially leading to rejection or reluctance to embrace the technology.

The knowledge that people have of other cultures and how they may talk about and view prosthetics can either promote or impede adoption. “In many countries in tropical areas, barefoot walking or the use of open toed sandals is common, or footwear is removed when entering a home or place of worship. Cosmesis is clearly important in these areas, as well as durability of the foot. The Jaipur foot seeks to address this problem…” (Meanley, 1995) Cosmesis refers to maintaining the aesthetics of the body. The focus on durability, utility, and cultural relevance demonstrates the need for inclusive terminology when discussing prostheses, taking into account users' cultural and technological requirements. The acceptance and use of the prosthetic in this

instance are greatly enhanced by language that respects and acknowledges cultural practices, transforming it from a mechanical instrument into a tool that enhances the user's everyday life and culture.

The common theme of not wanting to draw attention to the disability is prevalent in peoples' stories. In one instance with 8-year-old Thaddeus, he explains that a 3D prosthetic would draw more attention to him (Campbell, 2018). He says "I don't think kids would be my friend because of me. They would just want to play with my robot hand." There is a sense of feeling different or standing out because of the prosthetic. He mentions that he can figure out how to complete day-to-day tasks his own way, utilizing his arms, neck, and feet to assist him in his tasks. It is evident that some people may reject prosthetics and be content with their disabilities; that they are whole and can adapt to life without a limb. This instance highlights the fact that inhuman attributes can be viewed as negative when referring to prosthetics.

Although prosthetic limbs that look very drastically robotic and otherworldly can be difficult to adopt because of how much it stands out, prosthetic limbs that look normal may also be detrimental by conforming to a particular sense of physicality.

Vlachaki split prosthesis into three groups: realistic prostheses, functional prostheses, and expressive prostheses. Expressive prosthetics are unique and focus on the user's identity. With the expressive prostheses, one participant of a study reported that people smiled and made comments about the prosthetic when they usually received a strange look with other types of prosthetics (Vlachaki, 2020). It is evident that how strangers react and talk about the prosthetics to the person can make the individual feel. With prosthetics that were not expressive prostheses, some had made the subconscious correlation that the amputee would also have other disability problems, such as mental (Vlachaki, 2020). Depending on how the prosthetic looks, there are

different reactions from the public. This can affect how the individual perceives themselves and their adoption of the prosthetic. The casual manner in which prosthetics are talked about and acted towards can influence the amputee's thoughts and perceptions.

Depending on the type of disability, people may have different perceptions. For bilateral amputees, they have a stronger relationship with their prostheses, speaking of the legs as their "ability," for without them, they would be in a wheelchair (Vlachaki, 2020). The ways that the individuals themselves refer to their prosthetics and their disability can reinforce how they feel about the technology. The positive connotations can positively impact the relationship that one has with the prosthetic. Not only does it affect their own relationship, but it can help shift others' perceptions about disability as well. When others hear about how others are empowered and autonomous because of prosthetics, it can normalize its presence in everyday life and reduce its stigma.

There are different kinds of prosthetics which bring about different reactions from people. People could use whatever fits their needs and how they feel most comfortable. For example, if having a unique interesting prosthetic makes people feel more approachable and less taboo, having an expressive prosthesis might work. For Thaddeus, what worked for him best was being as natural and not standing out as possible.

The acceptance of prosthetic limbs is shaped by how one talks about their own disability and how others within a society talk about and react to it. A prosthetic could focus on being expressive, natural, or purely functional. The impact lies in the wearer's identity and how they want to be perceived in society. Ultimately, there is so much diversity in how amputees react with and choose prosthetics, and one needs to consider the cultural context and personal needs when choosing the correct decision for them. By understanding diverse perspectives, functional

prosthetics that resonate with the user's sense of identity, autonomy, and belonging can be created.

Medical and Scientific Terminology

When talking about medical devices and disabled people in a medical and scientific context, some bias and undertone can ooze out. In the context of prosthetics, the terms used to describe these devices carry significant connotations that can influence how amputees view themselves and their prosthetic limbs. Terms that are not neutral carry psychological and cultural weight that can empower or stigmatize the wearer. The way prosthetics are framed in academic and popular discourse, through language and metaphor, forms a powerful baseline with peoples' relationship with technology. This section aims to delve into how specific terminology and the shifting language surrounding prosthetics can impact the perceptions of disabled individuals.

Prosthetics are sometimes labeled as "terminal devices," a term with potentially negative associations (Salminger et al., 2020). For instance, "terminal" is commonly linked with terminal illnesses, suggesting an incurable condition leading to death. If a patient unfamiliar with the term associates it with such diseases, it may deter them. Additionally, "terminal" implies limitations and finality, suggesting loss rather than empowerment. This perception can be daunting for amputees already facing physical and emotional challenges. The sense of permanence may discourage exploration of the prosthetic's potential and hinder acceptance.

Making definitive, generalizing claims in scholarly articles about amputees can reinforce negative stereotypes and assumptions. Vujaklija et al. mentions that the "absence of an upper limb leads to severe impairments in everyday life, which can further influence the social and mental state." This statement is lacking nuance and is not backed by any factual means.

Thaddeus, the 8-year old boy that chose not to use a prosthetic, was able to function just fine without a prosthetic and even preferred not to utilize one. While upper limb loss can present significant challenges, the degree of impairment and its impact on social and mental well-being can vary widely among individuals. Moreover, their quality of life can improve through coping mechanisms, religion, acceptance, and humor (Pereira, 2018). Some people may adapt well to their limb loss and lead fulfilling lives with minimal impairment, while others may face more struggles. Framing upper limb absence as a source of severe impairment may inadvertently contribute to the stigmatization of disability. Individuals may internalize these negative perceptions and feel ashamed or embarrassed about their condition, leading them to avoid seeking prosthetic interventions out of fear of judgment or discrimination.

There have been changes in language that reflect changes in perspectives. “Sometime, fairly recently, after ‘the cyborg’ became somewhat tired and tiresome form academic overuse, we started to hear and read about ‘the prosthetic’ – less as a specific material replacement of a missing limb or body part than as a sexy, new metaphor that, whether noun or (more frequently) adjective, has become tropological currency for describing a vague and shifting constellation of relationships among bodies, technologies, and subjectivities.” (Tannenbaum et al., 2009) This quote shows how the shift from cyborg to prosthetic has different connotations. Cyborg describes the person itself and how the device changes them as a person, while a prosthetic refers to an extension or addition to oneself. This change in language and verbiage makes medical devices for disabled people seem more personal and adoptive rather than transformative.

Terms such as “terminal devices” and “cyborg” have implications on how people view prosthetics. It reflects how research and the scientific field views prosthetic devices and therefore labelling and making connotations about amputees. The words and manner in which amputees

are spoken about matter because they shape and reflect cultural values. In medicine and science, when there is some biased way of speaking, it can be particularly powerful because it is supposed to come from a fact-based source. Because medical and scientific language is generally seen as neutral and authoritative, it has the potential to shape societal views on disability in ways that might be harder to challenge. This can perpetuate negative stereotypes, influence societal attitudes, and even shape how amputees perceive themselves.

Marketing and Commercial Language

Recently, businesses have been trying to sell items that promise to enhance or "fix" perceived flaws, and the disabled body is increasingly commercialized and exploited. These industries influence consumer behavior and uphold cultural norms around what makes a "normal" or "ideal" body by presenting disability and physical limits as something that can be improved or remedied. This section examines how the commercialization of disability affects how people view the disabled body and how marketing tactics help shape identities for both individuals with disabilities and society as a whole.

With new developments, the disabled body has become something that the market uses in order to sell their product. In the United States, the disability-related markets have been the fastest growing sub-group for the past two decades. (Fahn, 2020). "…the disabled body is transformed into a canvas for augmentation as technology turns the disabled body into a marketable commodity by "selling one's capacities (and, now, incapacities) in a market economy" (Fahn, 2020). In order for a business to succeed, they must have an audience. The audience must realize that they need the product, and the business makes them realize this in various ways such as making one feel as though they are lacking or could have more

“superhuman” capabilities. Fahn adds on to the idea of how having a disability makes one feel like an “other”, saying “disability has always contravened the traditional classical humanist conception of what it means to be human”. When we talk about disabilities, we idealize the typical human body and strive for something similar through prosthetics.

Markets also target completely healthy people. Fahn mentions that disability is inevitable once someone grows old enough. There will be problems with one's health. People also know of these diseases and disabilities that people develop as they grow older, and the market targets those who want to prevent this. Although not a disability, there are creams, lotion, and all sorts of beauty products to give the illusion of a younger, youthful face. Growing and looking old and less able bodied is looked down upon. A young, healthy, “normal” looking body is the ideal, and companies push that narrative for their own benefit.

Open Bionic creates bionic arms such as the “Hero Arm” which aims to make users feel like superheroes (Fahn, 2020). An advertisement showed Robert Downey Jr., the actor for Iron Man, giving a disabled child a robotic looking prosthetic arm. This has led to the association between high-functioning prosthetics to superheroes. They emphasize that the limb is their own superpower. This can be troublesome in its own aspect because it might spark unrealistic expectations for both the user and society. If the wearer doesn't experience the type of dramatic empowerment portrayed in advertisements and seen in media, it can be disappointing and deterring. This type of representation may cause a distorted understanding of what living with a prosthetic is really like, possibly leading to a gap between the user's expectations and reality and putting pressure on them to constantly feel "super" or empowered when it's acceptable to just be “normal” and human.

Highlighting the extraordinary feats of prosthetics can inadvertently turn away the average prosthetic user. “The emPower success led Herr’s team to further their innovative designs in extreme bionics and build prosthetic legs that not only allow the disabled to walk, but to run, climb, and even dance with ease.” (Fahn, 2020) The language used here promotes the idea that prostheses can be used to overcome obstacles outside the body and to achieve nearly heroic powers, such as walking, sprinting, climbing, and dancing with ease. The underlying expectation that all prosthesis users should strive for this high degree of physicality makes this phrase problematic even though it might be empowering. The language presents prosthetics as tools for extraordinary achievements rather than practical assistance for day-to-day living by using phrases like "run," "climb," and "dance." For those with impairments, who might not prioritize or be able to accomplish such tasks, this type of language can set unrealistic expectations. Users who are looking for prosthetics for basic functional mobility rather than great physical performance may unintentionally be marginalized.

As technology changes, the implications of what prosthetics are begin to change. “The spokesperson for the center of Extreme Bionics as well as product prototype, Herr quips, ‘I’m kind of what they’re selling’ Each presentation Herr gives as a frequent public speaker is a visual display of the agility and capability of his bionic legs.” Herr's statement, "I'm kind of what they're selling," associates the prosthetic to an ideal of athletic agility and superhuman potential by positioning him as both a product of the technology and its ambassador. Words like "agility" and "capability" are used to emphasize the idea that prostheses are not only useful tools but also tools that enable users to reach new heights of physical prowess. Nonetheless, the terminology supports the notion that the real worth of prostheses is found in their capacity to carry out extraordinary activities by emphasizing mobility and competence. This runs the risk of

overshadowing the fact that many prosthesis users could require more straightforward, useful mobility solutions rather than necessarily increased athleticism or performance.

The complexity of disability may be overshadowed. “During talks and interviews, Herr constantly directs audience attention to a narrative that emphasizes superhuman capabilities achieved through technology, explaining that with innovative technology his amputation was an advantage, not a disability.” It could alienate those who don't agree with Herr's viewpoint and who could still be grieving or struggling after losing a leg if amputation is described as an “advantage" As a result, the terminology runs the risk of oversimplifying disability by portraying it as a clear-cut chance for self-determination rather than a profoundly unique and nuanced experience.

The rebranding of prosthetics reframes disability as a gain rather than a loss, but this may belittle user’s experiences.

> The branding of prosthetics with superhero imagery as well as studies in augmented bodies’ actual advantages and affirmative power have transformed the disability market. Prosthetics are less representative of stigma and more an invitation to explore the differently abled body’s capabilities. In the near future, physical augmentation will no longer be a response to infirmities but a neo-liberalist choice to embrace diverse embodiment. (Fahn, 2020)

The choice of words like “superhero imagery,” “affirmative power,” and “capabilities” positions prosthetics as tools for empowerment, linking them to an idea of strength and potential. This reframing removes the focus from what is lost through disability and instead highlights

what can be gained through augmentation. However, the language risks turning prosthetics into a commodity associated with idealized representations of strength or power, potentially sidelining the needs of individuals who see their disability not as something to be overcome or “fixed,” but as part of their identity. This emphasis on “capabilities” might overlook the realities of pain, discomfort, or emotional challenges that can come with using prosthetics, framing them in a somewhat one-dimensional light.

Another level of difficulty is added by the marketing of prosthesis. Superhero symbols are frequently used in the marketing of prosthetics, fostering a narrative that links advanced technology to empowerment and superhuman capabilities. Some people may be inspired by this, however users and the general public may also have irrational expectations. By emphasizing "capabilities" and "empowerment," marketing rhetoric frequently positions prosthetics as a means of accomplishing remarkable achievements. This framing, however, runs the risk of excluding people who use prosthetics for basic functional mobility and who might not identify with the notion that prosthetics can be used to achieve athletics or "superpowers."

Discussion

In The Prosthetic Impulse, Tannenbaum et al. notes the nuance and complexity of the word prosthetic. They say “...here are both an oppositional tension and a dynamic connection between the prosthetic as a tropological figure and my prosthetic as a material but also a phenomenologically lived artifact”. This emphasizes the juxtaposition and gap between how prosthetics are represented in a figurative, abstract manner versus the actual lived experiences of those with prosthetics. They note that the phrase "the prosthetic" often feels impersonal and external, whereas "my prosthetic" reflects its deeply personal and integrated role in someone's

life. There is such a big disparity between the word prosthetic and its connotations and the actual experiences that people go through. More descriptive, nuanced language can be utilized around the conversation around prosthetics to reflect real life.

Tennenbaum et al. explains how "...'technology as prosthesis' attempts to describe the joining of materials, naturalizations, excorporations, and semiotic transfer that also go far beyond the medical definition of 'replacement of a missing part'". Instead of framing a prosthetic as an object that is a replacement or associating disabilities with a sense of loss, technology as prosthesis joins together the more complex interactions between technology and the flesh and bones of people. A prosthetic reshapes someone's sense of self and perception of themselves. It is a symbol of transformation of a person rather than repair of some object similar to a car. The person breathes life into the prosthetic.

Solutions

Through scientific papers, culture, and society, there are various negative connotations about disabilities. They put people into boxes and assume that people have to perceive their disability in a particular way. These form and change the way they perceive themselves and the adoption of prosthetics. There is a need to speak of prosthetics and people with disabilities with more nuance, care, and empathy. There are a multitude of reasons why people may not adopt prosthetics, and one of the reasons may be that people do not wish to utilize them and they find their own way of life perfectly fine. Engineers should direct their attention towards ways to support and empower those with disabilities. Tangible objects may not be the solution, but rather the conversation and ways we approach our mindset towards disability would be helpful.

Furthermore, we could begin to change people's expectations surrounding prosthetics, highlighting that they are meant as a tool to help whatever tasks that are desirable for the user. This may encompass sports, menial tasks, or higher level skills, but it should not be limited to a singular aspect. The perception of prosthetics should begin to be broadened to consider the user's autonomy, choice, and potential for innovation. By expanding societal expectations and engaging in nuanced discourse, we can begin to shift towards a society that allows for self-expression and capability.

References

Arabian, A., Varotsis, D., McDonnell, C., & Meeks, E. (2016). Global social acceptance of prosthetic devices. *2016 IEEE Global Humanitarian Technology Conference (GHTC)*. https://doi.org/10.1109/ghtc.2016.7857336

Campbell, C. (2015, May 18). *Giving Up a 3-D Printed Prosthetic for a Different Vision of Perfect*. Motherlode Blog. https://archive.nytimes.com/parenting.blogs.nytimes.com/2015/05/17/giving-up-a-3-d-printed-prosthetic-for-a-different-vision-of-perfect/

Fahn, C. W. (2020). Marketing the Prosthesis: Supercrip and Superhuman Narratives in Contemporary Cultural Representations. *Philosophies*, *5*(3), 11. https://doi.org/10.3390/philosophies5030011

Meanley, S. (1995). *Different approaches and cultural considerations in third world prosthetics | O&P Virtual Library*. Www.oandplibrary.org. http://www.oandplibrary.org/poi/1995_03_176.asp

Salminger, S., Stino, H., Pichler, L. H., Gstoettner, C., Sturma, A., Mayer, J. A., Szivak, M., & Aszmann, O. C. (2020). Current rates of prosthetic usage in upper-limb amputees – have innovations had an impact on device acceptance? *Disability and Rehabilitation*, *44*(14), 3708–3713. https://doi.org/10.1080/09638288.2020.1866684

Shew, A., & Earle, J. (2024). Cyborg-Technology Relations. *Journal of Human-Technology Relations*, *2*(1). https://doi.org/10.59490/jhtr.2024.2.7073

Sohn, E. (2024). *Psychology's Role in Developing Pioneering Prosthetics*. Apa.org. https://www.apa.org/monitor/2024/07/developing-prosthetics

Tannenbaum, J. (2009). The Prosthetic Impulse: From a Posthuman Present to a Biocultural Future. *Information, Communication & Society*, *12*(5), 756–758. https://doi.org/10.1080/13691180902866059

Thornhill, H. L., Jones, G. D., Brodzka, W., & VanBockstaele, P. (1986). Bilateral below-knee amputations: Experience with 80 patients. Archives of Physical Medicine and Rehabilitation, 67(3), 159–163. https://doi.org/10.1016/0003-9993(86)90057-2

Vlachaki, A., Paterson, A. M. J., Porter, S. C., & Bibb, R. J. (2020). Exploring users' attitudes towards prosthesis aesthetics in the UK and Greece. *Design for Health*, *4*(1), 4–23. https://doi.org/10.1080/24735132.2020.1727699

Vujaklija, I., Farina, D., & Aszmann, O. C. (2016). New developments in prosthetic arm systems. *Orthopedic Research and Reviews*, *8*, 31–39. https://doi.org/10.2147/ORR.S71468