Title: From Assistive to Enhancing Technology: Should The Treatment-Enhancement Distinction Apply to Future Assistive and Augmenting Technologies?

Abstract: The treatment- enhancement distinction is often used to delineate acceptable and unacceptable medical interventions. It is likely that future assistive and augmenting technologies will also soon develop to a level that they might be considered to provide users, in particular those with disabilities, with abilities that go beyond natural human limits, and become in effect an enhancing technology. In this paper we describe how this process might take place, and discuss the moral implications of such developments. We argue that such developments are morally acceptable and indeed desirable.

WHO IS A SUPERHUMAN?

"We are the superhumans" was the slogan of the 2016 Paralympic Games in Rio. This slogan appeared in a three-minute video[i] featuring disabled people, both athletes and non-athletes, competing in various Olympic sports or doing everyday life activities such as shopping and looking after their children. The soundtrack, a cover of the Sammy Davies Jr. song "Yes I can", is performed by disabled musicians also featured in the spot.

The slogan "we are the superhumans" in this context does not suggest that these people are engaging in activities that are beyond human capacities, such as flying between skyscrapers or juggling wrecking balls. It refers to the fact that they are able to perform normal human activities starting from a disadvantaged position. What is superhuman, in this context, is the capacity to overcome objective obstacles in order to perform normal human activities. This is done using alternative methods, such as playing the piano with only two fingers, and sometimes relying on assistive technologies like wheelchairs and prosthetics.

When assistive technology becomes sufficiently advanced, however, it will amount to augmenting and enhancing technology. People with disabilities will then become the first superhumans in history in a different sense: they will be able to perform activities that are beyond the capacities of able-bodied people. In this paper, we describe how this process might take place, we discuss the moral implications of such foreseen developments, and we argue that such

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[i] The video can be found at: https://www.youtube.com/watch?v=IocLkk3aYlk.

developments are morally acceptable and indeed desirable[ii].

WHAT IS DISABILITY, AND IS IT BAD?

We are not used to welcoming disabling impairments as lucky circumstances. Most people think that a body that functions normally – or better than normally – is ideal, and view any obstacle to such functioning as an obstacle to wellbeing. Indeed, it seems that the whole point of the expensive enterprise of medicine is to treat diseases and fix disability in order to improve either quality of life, long-term wellbeing or both. One of the traditional goals of medicine has been to restore normal functioning so that people are able to perform the activities necessary for survival, and, hopefully, thriving. Thus, the "medical model of disability" [1] approaches disability (roughly) on the following terms: the main problem of a disabled person is her impairment, i.e. her functioning below normal levels, and medicine's priority is to fix such impairment. However, the medical model of disability has lost popularity over the years. In particular, it has been criticized by proponents of approaches to disability that do not focus exclusively on the impairment itself, but also on the role of society as a disabling factor.

According to the social model of disability [2][3], impairments *per se* do not necessarily equate to disability. Disability is rather the result of various contributing factors, which include not only physical or cognitive impairments, but also social exclusion, stigma [4], and lack of supportive infrastructure to assist people with impairments in performing everyday activities. Thus, according to this model of disability, the difference between "impairment" and "disability" is crucial: while "impairment" refers to the physical or cognitive impediment faced by the individual, "disability" additionally refers to a person's overall loss of functioning from an impairment, which is not only a result of this impediment but also of 1) the restrictions imposed by a society that fails to accommodate the needs of individuals with impairments and 2) the social stigma around people with such impairments.

Yet no matter how accurate a conceptual analysis of disability may be, it cannot portray the real-world complexity of disability. For instance, there are significant differences between physical and cognitive disabilities, between mild and severe

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[ii] At the time of writing, physical enhancements are more common, so we will refer to more foreseeable forms of radical physical enhancements such as bionic organs and limbs. The arguments we present in favour of such enhancements could also apply to radical cognitive enhancements, although it is possible that other considerations should be taken into account when radical enhancements are direct to cognitive capacities (see Agar 2010 [12]).

disabilities, between being disabled as a poor or as a wealthy person, and between being born disabled or becoming disabled later in life. Moreover, differences among individuals in resilience translate into significant differences in how people deal with their disability. This may explain why some people seem to be perfectly comfortable with their impairments –experiencing their disability as a mere difference [5] – whereas others feel that their impairments have a very negative impact on the quality of their life [6] [7].

Given the complexity of the issue at stake and the different responses to disability that people have, it is perhaps unsurprising that the debate on disability is open and quite lively. It is not our goal to participate in this debate with this paper. What is relevant in the context of this paper is this: *for people who want to get rid of their impairmen*t, regardless of what motivates this desire, technological development offers them the ability to one day perform activities that are unavailable to non-disabled people unless they use the same technologies as disabled people. We argue that if the additional costs are low, there is no reason to confine ourselves to developing technologies that would assist disabled people by merely restoring their normal functioning, if the same types of technology can also allow disabled people to perform "superhuman" activities or perform human activities at a "superhuman" level[iii]

Radical enhancements (henceforth REs) are often considered impermissible for various reasons. According to Michael Sandel, for instance, interventions aimed at bringing an individual beyond her species' normal functioning amounts to desecrating nature and letting our desire of mastery trump our appreciations of life as a gift [11]. Nick Agar argues that REs would be: *disappointing*, because we cannot value experiences way beyond the normal human range; *immoral*, because they would need to be tested on healthy poor people; and *dangerous*, because the enhanced would claim a higher moral status over "mere people"[12]. Contrary to these types of positions, in this paper we argue that radical enhancements *are* morally permissible, in particular when the beneficiaries are people with disabilities.

FASTER THAN THE FASTEST?

[iii] In this paper we use the term enhancement to refer to RE as defined by Nicholas Agar [8]: "Radical enhancement improves significant attributes and abilities to levels that greatly exceed what is currently possible for human beings". This kind of enhancement is also defined as the "Beyond-Species-Maximum Approach" by Gyngell and Selgelid [9], or "superhuman" or "posthuman" enhancement [10].

In 2012, Oscar Pistorius competed in the Olympic games, becoming the first double amputee runner in the history of the games. He ran on carbon fibre-reinforced polymer prosthetics (running blades) that allowed him to run at roughly the same speed as top non-amputee runners, eventually making it to the semi-finals of the 400-meter sprint. The prospect of his participation in a competition for non-disabled runners raised concerns about the fairness of using prosthetics and similar devices in sporting competitions. The International Association of Athletics Federations (IAAF) was concerned that such devices could provide disabled athletes with an unfair advantage over non-disabled ones, and Pistorius was initially considered ineligible for competitions for non-disabled athletes. Pistorius appealed against the IAAF decision, and in 2008, the Court of Arbitration for Sport ruled that he should be allowed to participate in competitions for non-disabled athletes. The decision was based on a report by a group of experts who found that Pistorius had no advantage because he was "physiologically similar but mechanically dissimilar" to athletes without prosthetics [13].

A more recent example is that of the 1500-meter race in the 2016 Paralympics game in Rio, wherein four disabled athletes ran faster than the "regular" Olympics gold winner [14].

As a general point, it is not unreasonable to claim that, at least in the case of running, prosthetics can make disabled athletes faster than the fastest able-bodied ones. If technologies keep developing at this pace, we can easily imagine a not-so-distant future wherein disabled athletes consistently outcompete their non-disabled counterparts. Over the next few years, prosthetics could evolve to effectively become REs. Should they be forbidden once they reach this point?

OBJECTIONS

Unfairness
One possible objection to the development of REs is that they would confer an unfair and undeserved advantage to those who have access to them, thereby increasing overall unfairness in society. Some authors argue that healthy, rich people will get first access to RE, giving them yet another advantage over the poor [11]. However, it is unlikely that rich, able-bodied people in pursuit of enhancement would be the first to employ such technologies. Given that RE will be an extension of assistive technologies, it is more likely that its first users will be the disabled (both the rich and poor, at least in countries with public healthcare), as is already happening with prosthetic legs. It is also not obvious that people with no impairment would opt for removing healthy parts of their

bodies in order to replace them with bionic ones.

Now, it is possible that disabled people who opt for enhancement will gain an undeserved advantage over both able-bodied people and disabled ones who choose not to or cannot be enhanced. In turn, this could bring about a society wherein some people have more and better opportunities in virtue of their enhanced capacities. However, we already live in a world where the "genetic lottery" has randomly distributed physical and cognitive capacities, resulting in some people being more gifted than others in activities such as singing, running, painting, processing complex information, etc. It is therefore already the case that certain people have more opportunities. Suppose we could create a society wherein disabled people – those who have access to technologies like the bionic eye – develop capacities that go well beyond the level of those currently in the normal range. There is no reason to believe that such a society would necessarily be worse and less fair than the one in which we currently live, where human capabilities are already distributed unequally. We are not arguing against efforts at making societies more egalitarian; rather, we argue that REs are unlikely to significantly worsen the situation.

Some have argued that justice demands making people function as close to normal as possible, so as to protect fair equality of opportunities – but no more than that [15]. In deciding what treatments to give to people, however, justice is not the only relevant consideration. Benefitting individuals and society by allowing certain people to use radical enhancements, and considerations of autonomy in decisions about what treatment to undergo are also relevant considerations that might trump considerations about undeserved advantages of the enhanced. This is at least the case when the resulting unfairness is no worse than what we currently experience as a result of the natural lottery. When the resulting unfairness remains within certain boundaries, beneficence and autonomy might trump considerations of justice.

Moral status

Agar points out that radically enhanced people might claim a higher moral status than non-enhanced people and that this could, in turn, significantly harm "mere persons"[8]. However, "mere persons" do not currently enjoy a higher moral status than disabled ones. We do not use physical capacities as a proxy for attributing different degrees of moral status. Nobody would ever argue that Stephen Hawking, or indeed any person with some disability, has a lower moral status than Usain Bolt on the basis of the two's radically different physical capacities. Hence, it does not seem that giving disabled people capacities beyond the normal range would also give them a higher moral status.

Costs

One possible objection to implementing the aforementioned enhancing technologies is their high cost; at least in countries with public health systems, they would impose an unsustainable burden on taxpayers. We must not forget, however, that society is already paying for assistive technologies. Prosthetic limbs, wheelchairs and similar technologies are provided for free (at least in public health systems) to people with disabilities. For instance, in the financial year 2014/15,the UK government spent 41 billion GBP in disability benefits [16], but even this high investment is unlikely to guarantee optimal support for all disabled people.

Of course, RE will probably be, at least initially, more expensive than the assistive technologies currently available. Implementing them would thus lead governments to spend even more money on counteracting disabilities. However, there are two important considerations to take into account.

Firstly, enhancing technologies, like all technologies, will become cheaper with time. Even if a bionic eye would be very expensive at first, the cost would decrease steadily.

Secondly, enhancing technologies hold promise for greater economic returns compared to current technologies. If someone in a wheelchair cannot perform all the activities that she wants to perform, this comes with opportunity costs in addition to the wheelchair itself. For instance, the house of a wheelchair user often requires expensive remodeling to become wheelchair accessible. New assistive/augmentative technologies are likely to solve this kind of problem, however. People who are paraplegic and who currently need wheelchairs will have the option of using bionic exoskeletons that partially or wholly replace muscle function in the limbs. This will give them the physical independence to live in unmodified houses and no longer require many other costly forms of aid. Such an exoskeleton will also allow them to perform any job of their choice, thereby contributing to their economic independence and, arguably, improving their quality of life.

So, although the upfront investment in a bionic exoskeleton would certainly be higher than that of a wheelchair, a public health system may actually save money in the long run with this updated form of assistive technology.

CAN TECHNOLOGY ELIMINATE DISABILITY?

The Biomechatronics Group at MIT is dedicated to designing and developing human rehabilitation and augmentation technology [17]. Their website states a twofold mission: "First, we seek to restore function to individuals who have

impaired mobility due to trauma or disease through research and development. Second, we develop technologies that augment human performance beyond what nature intends". In line with the group's slogan "towards the end of disability", Professor Hugh Herr – head of the research group and a double amputee himself – has claimed that his goal is to "eliminate disability"[18].

Herr's idea that technology can "eliminate disability" can imply different things. We consider three possible implications of this claim:

1) It may imply that disabled people will cease to be disabled once they gain access to technology that restores, or even augments, the abilities they have lost or they have never had – assuming that disability and impairment are functionally the same.

However, even if technology eliminates disability (understood as disabling impairment), it might not eliminate all the negative aspects associated with disability, particularly its social stigma. According to the social account of disability, having an impairment is not the same as being disabled; rather, disability is defined, among other things, by the social stigma around certain forms of impairment. If this is correct, then it is not obvious that the social stigma around impaired people disappears the moment they (re-)gain all the abilities of a normally functioning person. After all, they would still perform such activities *differently* from the way normally functioning people perform them, and the difference might contribute to maintaining or even reinforcing the stigma. The mere fact of looking different (e.g., having limbs that look prosthetic) may cause a negative reaction. Thus, it may be that stigma does not only affect people who are impaired in their functioning, but also people whose appearance is "different".

For instance, it may be that a disabled person who plays the piano using her feet rather than her hands is nonetheless stigmatized for her lack of hands, even though she is perfectly able to play the piano (or do anything else) with her feet. In the same way, there may be stigma around someone like Oscar Pistorius. Although his body functions so well that he can compete in the Olympic games, he can do so only thanks to technological means, and is hence still perceived as "different".

If the social account of disability is right and there is more to disability than the simple lack of ability to do something, then it seems that restoring a certain ability is not going to eradicate the stigma associated with disability – no matter how much technology helps people overcoming their impairments.

2) The idea that technology will "eliminate disability" may also imply that technology, by enabling disabled people to perform *above* normal levels of

functioning, can eliminate the stigma of disability. It may be that "merely" being able to perform normal activities on the level of able-bodied people is not sufficient in order to overcome bias against disability, but that enabling disabled people to perform "superhuman" activities could change social perception of disability and eradicate its associated stigma.

For instance, it has been suggested [18] that as soon as prosthetics allow disabled athletes to outcompete their normal-abled counterparts, some people might ask to have their (perfectly working) limbs amputated and replaced by such prosthetics. It is also plausible that a form of admiration or even envy toward people who have access to such enhancing technologies would become common. Moreover, disabled people with primary access to augmented prosthetics may become more qualified for certain jobs, thereby gaining social prestige over able-bodied people. For example, someone born blind would have a legitimate claim on bionic eyes that give her better eyesight than any un-augmented person, and thus become more sought after for jobs that require keen eyesight.

Of course, at this point in history, it is hard to predict what attitude society will adopt towards people with radically enhanced capacities. However, we cannot exclude the possibility that current biases against disability will merely be replaced by biases in favour of people with superhuman abilities. If this happens, then Herr is right in thinking that technology can eradicate disability as understood also by the social model.

3) There is also a third possible interpretation of the idea that technology can eliminate disability. According to Herr, "We have to go beyond what nature intended, a future where technology and what it is to be human are blurred. A new nature that will give us new bodies and where disability is no more" [18].

In a perhaps not-too-distant future, it is possible that human tissue and machines will be integrated so as to enhance capacities of both able-bodied and disabled people. Although the use of these new technologies will initially be limited to people who need them to function normally, it is likely that they will eventually be used also by able-bodied people seeking to enhance themselves[iv]. For instance, exoskeletons could be used to lift heavy loads and endure strenuous physical efforts. Similarly, bionic lenses could be used not only to restore perfect vision, but also provide superhuman vision, hence allowing both people with and

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[iv] It seems that wearable REs would more likely be used by non-disabled people, as their use does not require permanent modification of one's body. For instance, given the ease with which they can be applied and removed, it is more likely that bionic lenses would be more widely employed than bionic eyes. In this sense, it is possible that the use of RE will be largely contingent on the kind of technology that will be developed.

without visual impairments to see wavelengths and levels of detail unavailable to human eyes. In a scenario where virtually everyone uses one or more piece of enhancing technology, it will be difficult (if not impossible) to distinguish at a glance those who were initially disabled and those who were not. And where such perceived differences disappear, not only is the impairment itself eliminated – it is also unlikely that the (originally) disabled individuals would be stigmatized.

UTILITY

Besides, it may be that everyone in such a society would benefit from the contribution of "superhuman" members that can perform jobs and do things that no one else can do. Consider the following rather trivial exhibits: the whole society would benefit from having people with bionic eyes flying planes, or from having people with bionic arms and legs as sea-guards. From a utilitarian perspective, the development of such technologies would definitely increase the net utility in societies where they are adopted by both (1) increasing the wellbeing of people who choose to use them and (2) providing society with a new range or level of services that could not be provided otherwise.

IS ELIMINATING DIFFERENCE OR DISABILITY GOOD?

Some disabled people identify strongly with their condition and consider it a defining property of themselves. In their view, eliminating disability is not a goal that society should pursue; rather, we should aim at changing societies to make them more inclusive of differences. We do not think that this is the only alternative available, however. Disability is complex, and different impairments affect different people in different ways. For those who perceive their impairments as a burden without which they would be happier, future technology might offer the option of not only fixing the impairment, but of enhancing certain traits. If it is their desire to have the impairment fixed, or to be enhanced, they should be given the option to do so. Those who perceive their disability as a valuable and defining feature of themselves, meanwhile, should be supported in their decision to forgo therapeutic or enhancing options. Precisely because disability is complex, affecting people in different and even opposite ways, we think it is important to respect their autonomy. This, in turn, implies letting them choose what they think is in their own best interest – even when that choice is radical enhancement.

CONCLUSIONS

In this paper, we have considered the option of using future technologies to not only allow disabled people to perform tasks at a normally human level, but to perform them at a level beyond current human capabilities. We have argued that since REs are simply a development of current assistive technologies, their use would initially be limited to people with disabilities. Over time, as these technologies become more widespread and cheaper to produce, they will likely be made available to large parts of the population – as is usually the case with cutting-edge technologies.

Respect for autonomy implies that we must allow people to choose for themselves whether they want to be disabled, non-disabled, or enhanced. A ban on REs, and specifically on REs used on disabled people, would therefore clash with both respect for autonomy and maximizing utility. Concerns about inequality and threats to moral status should be considered carefully, and policies that minimize these bad outcomes should be implemented. However, these concerns alone do not amount to sufficiently strong grounds for preventing the disabled from using REs if they so wish.

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