Intelli-Parts: A Science Faction Short Story about Future Prostheses

Christopher O'Hara (1325884)
c.a.ohara@student.tue.nl

April 20, 2019

Introduction

The current year: 2025. Location: *United Continental States* (UCS). In only six years, the technological, political, and financial landscapes had greatly shifted worldwide. Two technology giants from the UCS had united, creating a monopolistic conglomerate that dominated the media, politics, and social equity of the West. *Virago* was a company that led the world in product creation, distribution, cloud services, and automation. *Moogle* is a Big Data, lobbyist company that single-handedly controls the market for social media, internet searches, and healthcare industries. In 2023, *Moogle* acquired *Virago* to become a monopoly on all things related to data, media, and healthcare. *Moogle* launched a sector name '*Moogle Care*' that integrates medical information with predictive analytics, insurance companies, and the centralized government. With this merger, *Moogle Care* has access to nearly all of the data that a user could possibly generate; from media interests to purchasing trends to eating habits. While monopolies are 'forbidden,' the tech giant effectively loses no revenue to pay the 'monopoly fee' since the company cleverly influences government policy through its lobbies and evades paying taxes.

In the East, the *People's Federation of the East* (PFE) has a government-controlled corporate entity, *Daidu*, that is responsible for all product creation, telecommunications, media influence, and Big Data. However, after the brief *Second Cold War* (CWII) ended, the PFE had closed its walls from the outside world, preventing any form of international trade, tourism, or communication. The *European Community Union* (ECU) has been resisting situations in which massive companies control the markets with a 'winner-takes-all' behavior. Some of the political leaders are pushing towards similar adaptations of policies from the UCS while the general public is opposed due to the potential slippery slope of infringements on privacy, freedom, and opportunities.

Due to recent advances in machine learning, artificial intelligence, and robotics, progress in many Industry 4.0 areas has greatly advanced. Engineers were focused on scalability and interoperability but had not envisioned all of the potential pitfalls and the irreversibility of technology. While many social problems were solved, many new challenges have appeared that impact the ethics and quality of life for denizens. This story focuses on the impacts of intelligent prostheses: a technology that gave many individuals their ability to live 'normal lives' at a cost - their personal values regarding freedoms and privacy.

Intelli-Parts

This story primarily follows Kim, a low-income resident of New Los Angeles. In a work-related accident at *Virago*, she lost an arm and a leg. As such, she lost her ability to work and live as a 'normal person.' However, there is a solution: **Intelli-Parts**. Intelli-Parts are intelligent prostheses that operate and learn to work with the user created by *Moogle Care* [3]. Utilizing a combination of deep learning (based on a nearly endless amount of datasets available) and reinforcement learning, the user is capable of not only regaining full functionality but can also employ several benefits like improved strength, workplace task accuracy, and instantaneous bio-metric factor analysis thanks to a plethora of sensors that empower *Ubiquitous Computing* (UC) [5].

Intelligent prostheses in the 2010s sought to create an interface with the nervous system to create an intuitive, reactive *Natural User Interface* (NUI) system. Prior to Intelli-Parts, these prostheses had several different approaches from interfacing directly with the nervous systems (i.e., integrating with the nerve endings) or allowing for control and manipulation through "thoughts," i.e., a *Brain-Computer Interface* (BCI) (Fig. 1, [1]). These prostheses also allowed for connectivity to *Internet of Things* (IoT) devices such as smartphones and tablets. However, these devices were merely in their introductory phase and were not optimized for usage, causing a large amount of 'user pain' in terms of cognitive load, incompatible operations, poor ergonomic-caused strain, and general frustration when the prosthetic does not behave with the full intention of the user. Intelli-Parts has resolved these

issues. Similar to a real arm, Intelli-Parts uses sensor fusion to filter out noisy signals, reduce cross-track error, and capitalize on multi-modal and sensorimotor signals with machine translation to not only properly operate as intended but also predict the intent of the user. Beyond this, machine learning is implemented while collecting data for the prostheses to 'learn' the user, becoming more accurate and predictable over time. This biocybernetic process is essential to the performance of affective computing [6].

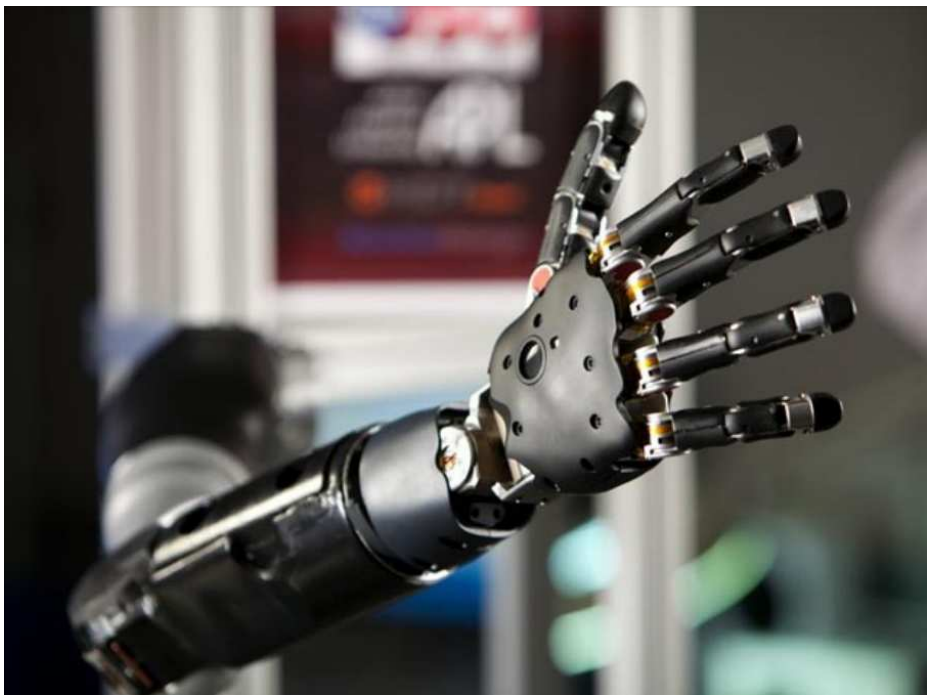

Fig. 1: Modular Prosthetic Limb by the John Hopkins Applied Physics Laboratory. This prosthetic arm is from a DARPA project and can be controlled by the user's mind.[1]

Boasting additional functionality relative to the most advanced IoT devices (inter-connectivity to applications and bio-metric analysis) while moving realistically in real time, Intelli-Parts is the ultimate personal *Tangible User Interface* (TUI). It is integrated directly into the biological system of the user, it is capable of analyzing emotion/mood [8], blood pressure, blood composition (vitamins, alcohol, etc.), and the caloric/composition of intake from food consumption. Each user has a personally created dataset that is fed through the network to monitor their status while also using this information to improve their quality of life... or so we thought.

Scenario: E-Class Kim

With the promise of being able to return to a 'normal life' after losing her limbs, Kim was interested in acquiring Intelli-Parts prostheses from *Moogle Care*. However, there is an issue: these devices are not cheap. Kim was a factory worker that could barely make ends meet as it was and now she is out of work after the ruling declared that the accident was due to her own poor choices (operating a device while under the influence, caused by a lack of sleep). Fortunately, *Moogle Care* offers a solution... at a price. Kim will be able to 'freely use' Intelli-Parts products if she consents the company collecting her personal data. This personal data is, supposedly, meant to ensure that Kim will have the best user experience while *Moogle Care* improves future technologies based on her personal dataset [10].

Kim quickly agreed without paying attention to the fine details. If she consumes any alcohol at all, her Intelli-Parts inform her that there will be dire consequences once she gets to her car. Her location and actions are constantly being tracked. When she orders fast food from McBurger, her device keeps a log of her eating habits and reports this to her insurance company. If she does not improve her diet and exercise routine soon, her premiums will increase. Whenever she becomes agitated at work or while driving on the freeway, her emotions and mood are analyzed. *Moogle Care* especially believes that these 'negative emotions' could lead to accidents, confrontations, and even situations/events that could lead to the devices being damaged. Again, the device keeps a log that it sends to her psychiatric evaluator in her company as well as her insurance company. This is a reoccurring theme for individuals living in the lowest income tier in the UCS known as the *E-Class* (bottom 20%).

The device analyzes trends in Kim's behavior and has begun to implement recommender systems that prevent Kim from getting into these situations (like guiding her on a different route while driving or avoiding mistakes in the workplace). In fact, it seems that her whole life and decisions are being made autonomously without her knowing these hidden affordances. Based on her purchasing trends, regardless of not having much revenue, the device interacts with smart advertisements to alter and suggest new products [11]. In fact, Kim's interest is now vastly different than before owning the device since there is some implicit reward factor for selecting recommended products (reward). In short, Moogle Care is reducing risky behavior and encouraging 'proper social interactions.'

Ethics: Fairness & Equality

Kim's situation is not unique to her, as this impacts all impaired persons using *Moogle Care*'s Intelli-Parts 'free tier'. Unfortunately, while being a member of the free tier, Kim's surroundings are also being monitored (audio and video). This has led to her family members and peers to not want to interact with her as much. In the public, there are 'no free-tier prostheses" zones like schools and theaters, as the general public is not comfortable with their information potentially being recorded.

However, for users that are able to afford the device based on their revenue, they do not have to provide the same data. Higher quality Intelli-Parts products are equipped with a 'Flight Mode' that allows the user to disable certain external communications, location tracking, and data collection. In fact, these users can choose not to have these functionalities at all. The wealthy can by Intelli-Parts products that are much more natural and contain functionality that the user can choose via personalization and customization. This has increased the cases of 'techno-doping,' a strategy to gain performance due to augmentations, in Paralympic sports competitions [2]. Some people have even gone as far to willingly replace their natural limbs with improved prostheses for work-related activities. For lower-income individuals, this might help them exceed their quota in manual labor for additional revenue. For augmented techno-humans, a number of applications and libraries can be installed to make tasks, such as type (programming) and writing be much faster and allowing for the output of 'standardized aesthetics' related to drawing, drafting, and design. These libraries can also be employed for creating music that requires a certain dexterity and strength, or implementing a 'game adaptation' for improving certain intrinsic skills by a form of 'mental resistivity training' recently improvised in *Flow Theory*.

The disparity between the rich and the poor has grown since the wealthy have the luxury of gaining all of the benefits with none of the (social or personal) limitations while the poor need to utilize Intelli-Parts in order to maintain their previous morphology and body image related to their personal sense of embodiment [7]. Celebrities have begun to adopt similar smart prostheses via sponsoring from *Moogle Care*. However, the devices they use do not contain or accentuate the limitations that the free and lower-tier users have and with an allusion of social standing that comes with trendiness.

Conclusion

Kim is doing her best to adhere to the requirements of *Moogle Care*'s Intelli-Parts device without understanding the implicit changes she is experiencing in her personality and future opportunities. Is she still the same person as she was before the augmentation that promised a return to her normal life? Is trading her personal data worth the infringement of her data and privacy?

Moogle Care promises that it has kept value-sensitive perspectives in check and has followed the *Reality-Based Interaction* (RBI) framework when integrating the sensorimotor and perceptual data from the user and their environment for smooth, intuitive operation in the Intelli-Parts products [4] [12]. However, intrinsically, something is lacking in social equality (and interaction) when comparing all levels of users. Since *Moogle* is the dominating force behind the technology and policy, a single individual has little power to challenge this technological revolution. Like the advent of the internet and smart devices, a new entry for the irreversibility of technology is underway. Of course, there is always the 'choice' to not become augmented for E-Class denizens like Kim but these individuals are viewed as lazy, social degenerates. Once 'equal opportunities' were made available for all people, those who reject the technology are not done so on the merit in a 'freedom of choice' but on a 'deliberate reluctance for assimilation.' It might be possible that the '*Singularity*' has occurred but not with the artificial agents we thought that would explicitly surpass us - instead with corporations at the helm of 'recommending' people to be the model that benefits corporate expansion [9]. At least, so it seems for Kim in the UCS.

References

[1] [Modular Prosthetic Limb], n.d., URL Modular Prosthetic Limb (MPL)

[2] Nir, Sarah Maslin, 2012, Paralympics Equipment Raises Debate on Fairness, in: The New York Times, 8. September, accessed 10 April 2019, URL Equipment Used by Disabled Athletes Fuels Debate on Fairness

[3] Robotics in Healthcare, Intelligent prosthetics URL Robotics and Prosthetics

[4] Jacob, R.J.K. et al. (2008). Reality-Based Interaction: A Framework for Post-WIMP Interfaces.. Proc of the CHI 2008, 201-210.

[5] Weiser, M. Seely Brown, J. (1996). The Coming Age of Calm Technology. Xerox Parc.

[6] Fairclough, S.H. (2009). Fundamentals of Physiological Computing Interacting with Computers, 21 (1-2), 133-145.

[7] Haans, Antal Ijsselsteijn, Wijnand. (2012). Embodiment and telepresence: Toward a comprehensive theoretical framework. Interacting with Computers. 24. 211-218. 10.1016/j.intcom.2012.04.010.

[8] James, Gary S Yee, L Harshfield, Gregory Blank, Seymour G Pickering, T. (1986). The influence of happiness, anger, and anxiety on the blood pressure of borderline hypertensives. Psychosomatic medicine. 48. 502-8. 10.1097/00006842-198609000-00005.

[9] Kurzweil, R. (2010). Chapter 1, Preview the document from The singularity is near. Gerald Duckworth Co.

[10] Wigan, M. R., Clarke, R. (2013). Big data's big unintended consequences, Computer, 46(6), 46-53. URL Big Data's Big Unintended Consequences

[11] Anil Dash (2018). 12 Things Everyone Should Understand About Tech, Medium.com, URL 12 Things Everyone Should Understand About Tech

[12] Friedman, B., Kahn, P. H., Borning, A., Huldtgren, A. (2013). Value sensitive design and information systems, In Early engagement and new technologies: Opening up the laboratory(pp. 55-95). Springer, Dordrecht. URL Value Sensitive Design and Information Systems