A Techno-Anthropologist's view on mending the disconnect between theory and the world in the next generation of philosophy of technology.

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Abstract

This thesis focuses on addressing the gap between contemporary philosophy of technology and other stakeholders in the technological system such as designers, users, or management. The point of departure is two of contemporary mainstream theories - Critical Constructivism and Postphenomenology. After being presented through the seminal case of the Internet as a communication tool, critique of the two theories is presented. Thereafter, the contemporary discourse on the complementarity of the two theories is summarised and analysed. Lastly, the shortcomings in connecting the theoretical insights with stakeholders in the technological system are identified and suggestions are given towards their resolution. Specifically, Anarchist principles are imported as a possible theoretical basis for the next step in philosophy of technology. Furthermore, Science-Fiction prototyping is offered as an example of a methodology that could create common grounds for communication between different stakeholders. The thesis closes with a summary of the arguments that lead to the two suggestions made, as well as with identifying alternative routes that could be taken to address the overall question of brining philosophy of technology closer to wider acceptance.

Contents

Introduction

Genesis Homo

Thinking about technology dates back as far as civilization itself. The way that pre-historic humans have thought about their tools, their origin, and their use might have been largely lost in time, but what remains of the history of early human thought on technology has been passed down through collective cultural memories codified in myth and legend. Probably the most ubiquitous type of myths in cultures across the globe are creation myths. Creation myths universally tackle existential questions: how the world and its inhabitants came to be, and what is the place and role of humans in this world. In addition to that, creation myths represent the most important story of any civilisation, since they typically codify a model of "the human act of creation in whatever form it takes" (Leeming, 2010).

In most of these creation myths, the use of tools and the knowledge of technical action plays a central role in the ontology of humans. In Sumerian mythology for example, humanity is created when the Gods decide to create servants during a drunken banquet (Leeming, 2010). While the first attempts fail due to the inebriation of the gods, the river god Enki succeeds in creating humans out of clay and blood – failing to reach perfection due to his own drunkenness. To compensate the flawed humans that he created, Enki decides to teach humans the ways of agriculture, animal husbandry, and building.

Another similar myth can be found in the accounts of the Maasai people. In this case, the creator god Enkai forms humanity out of a tree that he splits into three, creating the Maasai, Kikuyu, and Kamba tribes. The first part becomes the Maasai father, to whom he gives a stick to herd animals with; the second one becomes the Kikuyu father, to whom he grants a hoe to till the soil; the final one becomes the Kamba father, who is gifted a bow and arrow to hunt with (Leeming, 2010).

In both examples the importance of technology is of a similar significance. Without access to the tools that allow for its survival, humanity is not only lesser to other animals, but is ontologically incomplete. The ubiquity of this pattern should not come as surprising seeing the physical characteristics of humans: quite frail, relatively slow, limited biting and chewing capacity, etc. (Wrangham, 2009). An explanation of the disproportionate impact that human life has on the rest of the planet cannot ignore our use of technology as a force multiplier: to protect us from the weather we do not need thick hides and hair coverage – we call upon the skills granted by

Enki to build domiciles. To feed us we do not need sharp teeth, speed, or talons - instead, we domesticate and butcher as the Maasai father, plant foods we can easily digest as the Kikuyu father, and compensate for our lack of speed and sharp talons with weaponry as the Kamba father.

Homo Formator

The force multiplication that technology provides to humans is of a magnitude that technology ends up forming humanity itself. Even with the relatively simple technologies of the earliest of human eras, there is archaeological proof to the significance of this relationship. For example, in his book "Catching Fire: How Cooking Made us Human", anthropologist and primatologist Wragham describes the "Cooking Hypothesis". According to this theory, by mastering fire and using it to cook food that they hunted and foraged, early Hominids unlocked a vast reserve of otherwise indigestible calories that allowed for significant physiological and social changes to happen.

He goes as far as to claim that comparing the physiological changes with the findings of tools demarcates relatively clear lines in the evolution of the species (Wrangham, 2009). At first, similarly to other great apes, hominids used tools to tenderize meat and crack open bones to consume the marrow. Then, Wrangham claims that a sharp increase of brain size of about 40% can be tightly corelated with traces of the use of fire by Homo Erectus. After this period, he identifies two additional leaps in evolution that can be corelated to technological advance. The leap from Homo Erectus to Homo Heidelbergiensis represents another 20% increase in brain capacity that according to Wrangham could be attributed to significant advances in hunting tools. Lastly, he identifies the evolution from Homo Heidelbergiensis to the current Homo Sapiens as happening simultaneously with the first evidence of advances such as long-distance trade and the development of containers allowing increasingly sophisticated cooking methods.

Even in these relatively rudimentary forms, the ever-evolving human technologies resulted in remarkable impacts on the surrounding environment. Directly related to the increasing technical and social ability of hominids to hunt large prey (Wrangham, 2009), the "Pleistocene Overkill Hypothesis" theorises that even early humans had a significant – and catastrophic – impact upon multiple occasions around the globe (Nagaoka et al., 2018). According to this theory, the very same technologies that propelled the biological changes in modern hominids allowed humans to travel further and hunt increasingly larger prey - rendering early human settlers effectively as "locusts killing megafauna and eating their way across [the world]" (Nagaoka et al., 2018). The basis of this theory relies on archaeological evidence of the arrival

of humans to localities such as North America or Oceania, and the subsequent dramatic extinction of megafauna (ibid.). The same pattern often emerges: in early findings fossils of larger animals are abundant, followed by a period where human and prey findings co-exist, followed finally by a period where proof of the existence of large prey effectively disappears (Wrangham, 2009).

Nagaoka et al. point out that the "Pleistocene Overkill Hypothesis" is problematic for several reasons. They argue that the fact that the best proof for the theory is this mechanism of 'humans appear-megafauna disappears' often ignores the fact that during this era major climatic changes also took place around the globe. In reality, they cite a number of 82% of archaeologists being in agreement that the megafaunal extinctions in North America are thanks to a Combination of factors (Nagaoka et al., 2018). Within that group, 18% stated disease as a factor, with 33% and 63% attributing some responsibility to anthropogenic landscape change and human hunting, respectively. Most importantly however, 88% of correspondents reported that climate change was one of the most significant factors.

Facing the crisis

Human Impacts

According to the "Pleistocene Overkill Hypothesis" humans were only partially responsible for the extinction event, and climate is only seen as an externality. The rapid and explosive progress of technology since the Pleistocene extinction event has enabled humanity to impact the planet in ways that our palaeolithic predecessors probably could not have even imagined. One of the most striking effects of this progress is the fact that for the first time ever, humans are undeniably causing the change of the climate itself (Meyer & Newman, 2020). While climatic shifts happened routinely in the past as well (Meyer & Newman, 2020; Nagaoka et al., 2018), the sheer speed and magnitude of the current change does not allow for species to adapt or re-locate in order to survive (Meyer & Newman, 2020). As one study shows, local increase in yearly hottest temperature could lead to the total extinction of 55% of a world-wide sample of 538 species (Román-Palacios & Wiens, 2020). This number becomes even more shocking by noting that this does not take into consideration other anthropogenic factors, such as habitat loss or pollution.

Even if one would reject the importance of conservation of nature for its own sake, this crisis that we are irrefutably contributing to directly endangers humanity itself. Within the topic of climate change, there is consensus for example that among others, anthropogenic climate change will impact global food production through factors as diverse as change in rain patterns,

higher peak temperatures (Tian et al., 2016), impossibility of pollination due to collapsing pollinator populations (Brunet, 2019), algal blooms, increasing heavy metal and methylmercury contamination, proliferation of foodborne pathogens and parasites and mycotoxins (FAO, 2020). These complex challenges that the food system faces do not only limit the capacity of food production by sheer volume leading to malnutrition, but also jeopardise the post-harvest safety of foods or can lead to deficiencies in micronutrient- and protein consumption too when only a limited type of crops remain viable (Tian et al., 2016).

While currently also contingent on other factors, such loss of food security acts as the catalyst for numerous conflicts globally – especially in areas considered already volatile and vulnerable (Helland & Sørbø, 2014). Compounding the effects of climate change with the additional anthropogenic environmental strains, the impact that our current technological system has on the natural world and humanity itself is undoubtedly grim.

Technical solutions

Viewing the contemporary extinction event solely in the light of a 'modern overkill hypothesis', where humans and their actions only negatively affect the world, carries the danger of treating human actions as inherently destructive – in turn implying that efforts of future management and restoration are futile (Nagaoka et al., 2018). One stance that is often taken is that while it is the first time that humans have the capacity to cause change on this level, it might also be the first time humans have the capacity to prevent it (Meyer & Newman, 2020) - purveyors of this perspective also noting that we are likely not yet past the point of no return (ibid.).

On a societal level, I believe that this notion of finding a technological 'way out' from the impending environmental catastrophe often is at the core of the zeitgeist. Challenges are largely viewed as technical challenges to which technically oriented experts must find technical solutions. For example, as a response to the threat of the climate catastrophe to the environment, discourse in the industry is often limited to purely technical suggestions: future food shortages are to be addressed by the near occult powers of Artificial Intelligence, Gene Editing, Robotics, and the sort (Herrero et al., 2020). Even on the side of consumers, lifestyle adjustments such as reducing or totally forgoing the consumption of meat is often discussed in terms of the technical achievement of creating meat substitutes that the consumers would regard as viable alternatives, instead of taking inspiration from traditional cuisine for example (Apostolidis & McLeay, 2016).

I believe that this example is a strong reflection of the problem with how the impending environmental catastrophe is being mis-diagnosed as a purely technical malady. The technical

solution of developing meat substitutes on its own has seen limited adoption, with only a small percentage of the population replacing or reducing their meat consumption with products designed to this end (Apostolidis & McLeay, 2016). When the reasons for non-adoption of such technical solutions is analysed, studies have shown that more than the quality, price, taste, or nutritional value of meat-substitutes, the cultural and social environment surrounding meat-eating is the main driver for this non-adoption (Lacroix & Gifford, 2019).

This point towards an issue that has been underappreciated in the public eye: solutions to our biggest challenges must go beyond viewing technology in the light of a saviour that can correct for the industrial sins of humanity. At the same time, turning out back to 'technology' by 'returning' to some past way of food production is not a realistic way out either. The 'luddite' approach of denying the usefulness of contemporary technologies such as gene modification and nanotechnology to increase the resilience of agricultural plants, or a multitude of sensors and preservation methods to ensure that food already produced experiences the least possible degradation (Tian et al., 2016), is also a counter-productive one when food shortage is one of the biggest fears.

Theorising Change

In dealing with the conundrum of interpreting our technological system, the contemporary main stream of philosophy of technology recognizes that just by utilizing the same industrial system that has led to the creation of the crisis in the first place, humanity might not be able to overcome the challenge (Feenberg, 2002; Van Den Eede, 2020). By stepping back and re-evaluating what is the role of technology in relation to humans and the world at large, the mainstream theories such as Andrew Feenberg's Critical Constructivism (CC) and Peter-Paul Verbeek's Postphenomenology (PP) depart from several base assumptions that revolve around this shortcoming of an overly technically focused response to our challenges:

- **Mutual constitution of technical subject and object**: As in the creation myths of old, the theories recognise and affirm that technology, humanity, and nature are essentially inseparable and cannot exist one without the context of the other. To put it in different words, there is no humanity without technology – while neither of the two can exist without a surrounding nature.
- **Co-construction of society and technology:** Just as we have seen through the evolution of humankind, the theories support the notion that neither technology, nor society is 'in control' of the progress of the other. The two exist in a constant flux where information and pressures flow from one to the other, co-shaping their respective realities.

- **Rejection of technological determinism:** Supporting the idea that technology can be steered by society to some extent, the theories reject perspectives of technological determinism. Instead of viewing technology as moving along an unchangeable trajectory, contemporary theories believe in a technology that is dynamic and pliable.

The two theories share a deep heritage, as both carry in them influences from both the 'Classical' Philosophy of Technology of the mid-20th century (Van Den Eede, 2020), while attempting to apply it in more empirical environments inspired by Science and Technology Studies (B. de Boer, 2020). Feenberg and Verbeek attempt to answer the same question in similar, but distinct ways. Their difference in rooting results in two Theories that focus on different elements of the human-technology-world system, giving less attention to others (Van Den Eede, 2020).

Problem Statement

Theory and Industry

During my education as a Techno-Anthropologist, I had the opportunity to cooperate with a wide range of technical experts. One of the most interesting take-aways of this experience was the disconnect that I felt between philosophical approaches such as CC or PP, and the way that the drivers of these corporations' view technology. The intended effects of technological innovation by said companies and the calls of CC and PP are seemingly in the same ballpark: sustainability, democratization, equality, etc. However, despite this seeming harmony of intent, virtually all of my interactions with 'technical experts' fell in one of two broad categories.

On the one hand, explicitly talking about issues such as how ethical considerations are incorporated in the workflow of the company was met with outright resistance and rejection of partaking in such a discussion. In these cases, the reasoning was mainly based on arguments that these kinds of considerations are not the responsibility of the developer but rather the user and legislature. At the same time, the very same people expressed the opinion that legislation that seeks to regulate their work is a conservative force against their innovation. On the other hand, some were more sympathetic towards learning more about the theoretical perspectives that I would introduce them to. Discussions in this case where often very positive and enlightening, but often ran into difficulty when attempting to find ways to incorporate the guidance that philosophy of technology could give.

Of course, this might only be my personal experience and is not exhaustive proof of the state of technological development in general. Considering my experiences in the resistance to adopt perspectives from contemporary philosophy of technology into their work and the fact that public discourse is steadfast in focusing on technical solutions to our global problems instead of

adopting the more nuanced perspectives of theories such as CC and PP, I cannot help but feel a disconnect between these two 'worlds'. While it would be easy to blame the 'industry' or the 'system' for this shortcoming, I think that there might be merit to the thought that the contemporary mainstream philosophy of technology bears part of the responsibility of not being able to connect with the industry in ways that promotes their common goals.

I am not alone in making this observation. In recent years many have recognized the shortcomings of CC and PP, as well as have theorised a complementarity between these two theories to be a step towards bridging the gap between "doing and talking" by overcoming the differences between CC and PP (Bantwal Rao et al., 2015; B. de Boer, 2020). Efforts to reconcile the differences range from borrowing from each other in attempt to respond to critique (Feenberg, 2020; Verbeek, 2020) to third-party efforts to connect (Bantwal Rao et al., 2015; Rosenberger, 2020) or even combine the two (Van Den Eede, 2020). While each effort for reconciliation focuses on a different detail of the relationship of CC and PP, each author providing their own unique flavour to the mix. The overarching project seems to have a singular goal: to improve the argument of philosophy of technology by providing a holistic view on the relationship of human-technology-nature through addressing the weaknesses of contemporary theories.

The Next Step

The goal of this thesis is to provide an outline of what I believe to be the next step in philosophy of technology. To achieve this, I start by collecting and co-relating existing suggestions on how CC and PP can operate in complement of each other's weaknesses. Subsequently, I identify the areas where the approach of simply combining some of the ideas of these two theories is lacking in order to operate as a more comprehensive theory. Finally, I am interested in examining some ideas on how to fill these gaps. In other words:

> *What are the directions that the next step of philosophy of technology take towards closing the gap between theory, industry, and users; what are the elements of Andrew Feenberg's Critical Constructivism and Peter-Paul Verbeek's Postphenomenology that could be carried over, and what additional inspirations could be beneficial to import?*

Overview

To answer this question, the first section of the thesis concentrates on the genealogy of the two theories. In this part, the elements of the two theories are contextualized over a background of the development of the philosophy of technology, aiming to provide an overview of the overall discourse on the topic. The following sub-questions are answered in this segment:

- What are the elements that CC and PP draw upon in their attempt to explain the relationship between technology-humans-nature?
- What are the main ways CC and PP differ from previous theories?

The following section presents Critical Constructivism and Postphenomenology. Initially the two theories are presented through one of the seminal cases that both authors have analysed: the use of the Internet as a medium of communication. In addition to the analyses that the authors themselves present, the case analysis are further unfolded through additional elements from each theory. At the end of each case analysis, various criticisms geared toward the theory are be presented by addressing specific points in the analysis. This section answers the following sub-questions:

- How does CC and PP view the Internet as a communication medium?
- What does each of them focus on, and what are the perspectives they do not address?
- What are the criticisms geared towards them?
- How do they each contribute to the gap between philosophy of technology and the different stakeholders?

In the next chapter literature on the reconciliation effort between the two theories is presented. First, a short presentation of the differences and the similarities establishes a basis for the subsequent analysis. The analysis then focuses on three themes that are commonly present in existing literature: issues of Power, Democracy, and Action. This segment seeks answers to the following questions:

- In what ways do CC and PP differ?
- What is the theoretical basis of their reconciliation effort?
- What are the topics that existing literature addresses?
- What does the reconciliation contribute to the effort of closing 'the gap'?

Subsequently a short sketch of a re-analysis of the Internet as a communication tool is presented, informed by the theoretical lenses that the existing literature circumscribes. The goal of this segment is to take the new insights on an 'empirical walk'. By testing out how the

existing theoretical suggestions 'behave' in an empirical analysis, I aim to point at what are the areas where the literature considered addresses critiques in a constructive manner, and what are the topics that would need to be addressed in the future.

- How could a theoretical analysis based on the unified CC/PP perspective look like?
- What are the areas where this unification succeeds at addressing critique?
- What are the areas where further work is necessary?

In the final segment of this thesis I aim to present suggestions that could potentially contribute to the further development of the next step in philosophy of technology. One area I focus on are finding a political theory backing that could 'host' a methodology that combines both the communal focus of CC and the individual focus of PP. At the same time, I will also suggest an example of a methodological tool that would in my opinion accommodate closing the gap between the heterogenous and multi-faceted stakeholders in the technological system.

- What political philosophy could support the work of a unified CC/PP perspective?
- What kind of methodologies could act as a bridge between the various stakeholders?

Finally, a conclusion on the main question is reached, and the limitations of this thesis are presented:

- Do the existing suggestions on the reconciliation of CC and PP further the development of the philosophy of technology?
- What are the strengths and weaknesses of this idea?
- What alternative routes could one take to answer this question?
- What's next?

Thought on Technology

As shown in the Introduction the relationship between humans and thought on technology is one that goes back to the imagination of early creation myths. Since they were a part of religious beliefs, these myths informed the way communities as a whole interacted with technology. However, since the rise of contemporary discreet philosophy of technology, a rift between thought on technology and society at large has opened. Philosophy of technology now is less engrained in daily life, and more of a niche academic pursuit.

In order to proceed to the goal of diagnosing the shortcomings of contemporary philosophy of technology as far as this gap between it and society goes, I believe that it is pertinent to understand how though on technology in the past operated. Furthermore, the genealogy of philosophy of technology may suggest the areas from within which the next step in its development could draw inspiration from.

The Flame of Prometheus

As the earliest form of thinking about Technology, human creation myths most typically address how humanity has come into possession of technology (Leeming, 2010). Undoubtedly one of the most formative origin stories of the Western spiritual – philosophical tradition is that of the Titan Prometheus. Originating from Ancient Greece, Prometheus has travelled through time inspiring artists and philosophers alike throughout the ages (Raggio, 1958). His story is inexorably intertwined with notions of humanity and technology and has been interpreted again and again to demonstrate philosophies of science and technology.

Echoing philosophers of the past who have themselves chosen to demonstrate their relationship with technology through the story of Prometheus, I have chosen to use this ancient tale and its different readings to demonstrate the developments in Philosophy of Technology. First, a short introduction to the tale of Prometheus will set the baseline version of the story. Then, starting from Ancient Greece, the story will change and evolve simultaneously with the Philosophy of Technology that it accompanies to our days.

One of the most detailed accounts of the story of Prometheus comes from writer Aeschylus from the 5th century BCE. In the drama "Prometheus Bound", Prometheus himself presents the following rendition of the story:

After the defeat of the Titans by the Olympians found himself on the side of Zeus. Once Zeus took the throne, he started distributing power and responsibilities to the other Olympians. However, he did not care for humans, and was planning to destroy them by sending them to Hades. Prometheus seeing these proto humans as blind, ignorant, and helpless pitied them, and decided to enlighten them. As such, he decided to steal from the gods and share with humanity the knowledge to create and control fire. Zeus was furious at the Titan and decided to condemn him to eternal punishment. He ordered his servants Kratos and Bia to detain Prometheus and take him to the forge-god Hephaestus to forge a chain strong enough to chain him. Once a reluctant Hephaestus forged the chain, he carried out the sentence of Zeus by binding the Titan to a mountain – condemning him to eternal suffering of disembowelment by a hungry eagle.

"Prometheus Bound" – Peter Paul Rubens & Frans Snyders

According to this legend, in his act of sharing the mastery of fire, Prometheus completes humans by giving them the power to survive independently. In essence, this gift unbound humans from the mercy of the gods, giving them agency over their fate. As such, the existence and being of humans is indivisible from this divine gift.

Furthermore, Prometheus claims that in addition to the mastery of literal fire, he also provided humanity with the "fire of reason" (Raggio, 1958), by providing them with knowledge about the stars, agriculture, animal husbandry, mathematics, and language (Aeschylus, n.d.). This detail provides opportunity to an interpretation that humans took their current form not only by mastery of fire, but by a complex collection of knowledge of the world and its manipulation.

Generation Zero: Techné

One of the earliest thinkers who have addressed the question of human technical knowledge and its relationship to the natural world is Ancient Greek philosopher Plato. He attributes the genesis of humankind and its separation from the animal kingdom to a different version of the

tale of Prometheus (Raggio, 1958). In his dialogue "Protagoras", Plato claims that it is the Olympians who have created all animals, humans included. Prometheus and his brother Epimetheus are tasked with distributing a number of characteristics amongst these creatures. Epimetheus throws himself at the task, but by the time he gets to humans they have run out of any desirable attribute.

When Prometheus learns of his brother's short-sightedness, he concocts a plan that would allow humans to create their own characteristics. Stealing the fire of creative power from Athena and Hephaestus' forge and giving it to humans, Prometheus completes the creation of humanity – not by dealing out set attributes but differentiating them from animals by imbuing them with a creative spark. While the Titan does not escape his horrific punishment in this version of the story either, Plato views Prometheus in the light of a tragic apotheosis (Raggio, 1958). He sees the gift of techné (creative power), as being a superior characteristic of humanity compared to animals exclusively guided by physis (instinct).

Plato defines techné as being embodied in craftsmanship. While he gives no general criteria to what he counts within this category, he gives a wide range of examples such as huntsmanship, medicine, calculation, cookery, etc. (Parry, 2020). In other works, the notion of techné is intertwined or even interchangeable with the notion of empistéme (knowledge). He explains that techné is defined by a goal and is a kind of empistéme. Furthermore, he believes that techne intrinsically "seeks the welfare of its object" (Parry, 2020), be that the physical welfare such as in the case of the doctor, or the spiritual welfare such as in the case of the judge and the legislator.

Agreeing with Plato in the central ideology of the importance of technical knowledge but giving a differing view on empistéme and techné in his Nicomachean Ethics. Aristotle places empistéme in the domain of physis (natural things) – separating it clearly from techné, which sits firmly in the domain of poiesis (constructed things) (Reydon, 2021). As such, he makes a clear distinction between artefacts that are "subject to their own internal principles of existence" and ones that are "subject to externally operating principles of existence" (Reydon, 2021). Furthermore, Aristotle points out that artefacts can move between the domains of physis and poiesis. For example, when building a bed from wood, techné is involved in the construction; when a wooden bed is buried or burned however, one would think of it in the manner of empistéme as it 'returns' to physis (Parry, 2020).

While both Plato and Aristotle made extensive use of technical imagery in their explanation of the world, their perspective on technical knowledge cannot be viewed as a true overarching

Philosophy of Technology as such (Reydon, 2021). However, it is also undeniable that their philosophy sets up some of the basic assumptions that endured until the first 'real' generation of Philosophy of Technology in the 20th century: humans, nature, and technology are treated as separate (but not impermeable) realms - while techné as such is ascribed an overall positive morality.

First Generation: 'Classical' Philosophy of Technology

While it is hard to ascertain a specific moment as the birth of Philosophy of Technology as its own discipline, it might be most pertinent to start the account of the 'Classical' Philosophy of Technology around what is probably the starting point of an unprecedented increase in rates of technological development: the Industrial Revolution (Reydon, 2021). Despite their separation of more than 2000 years from Plato and Aristotle, this 'First Generation' that culminated with the clear birth of a self-sufficient Philosophy of Technology clearly echoes the ancient discourse on techné, empistéme, fysis, and poiesis.

Broadly speaking, most theories from this era can be placed in two categories: instrumentalist and substantivist approaches (Feenberg, 2002).

Instrumentalist Approaches

Instrumentalist approaches are based upon the notion that technology itself is neutral, and operates as an instrumental means towards fulfilling purely human ends (Feenberg, 2002). Technology from this perspective most closely resembles Plato and Aeschylus' reading of the Promethean myth. The gifts of technology themselves are given to humans as a power that enables them to fulfil their ends and needs without the involvement of the gods (Raggio, 1958). The main question surrounding the social impact of technology within instrumentalist accounts revolves around the question of managing the steering or 'pointing' of technology – who is in control, who is oppressed, and who is emancipated (Feenberg, 2002).

An example of an instrumentalist perspective (or at least one that lends itself to an instrumentalist reading), is Marx's portrayal of technology. According to Marx, the oppression of the proletariat stems from the instrumental use of technology by the bourgeoisie (Bimber, 1990). The technology itself in this case is seen as neutral. It is merely as a function of its application that it has negative effects on the proletariat. In this light the deterministic aspect of technology is less related to the artefacts themselves, rather focusing on how leading technological rationalities determine the wider social system (Bimber, 1990).

Marx does not "condemn the steam engine or the spinning mill for the vices of the bourgeois mode of production", but rather sees them as an essential step towards reaching his vision of society (Franssen et al., 2020). He does not blame the Promethean flame itself for the oppression of the proletariat, and as such does not aim at extinguishing or modifying it. He views the impact of this proverbial flame as being fully contingent on its wielder - suggesting that the emancipation of the proletariat hinges on taking control of it from the oppressive hegemony (Feenberg, 2002).

Substantive approaches

The opposite pole to the Instrumentalist approaches is expressed by the Substantive approaches. The overarching theme within these approaches is the idea of technology itself having a level of agency that slowly and inevitably overtakes and shapes social life (Feenberg, 2002). Furthermore, substantive approaches tend to differentiate between technical action before the industrial revolution and technology after it (Reydon, 2021). For example, Simonodon describes the difference in that in the past humans bore tools and acted as technical individuals, while post-industial revolution the machines themselves are the bearer of tools and humans either assemble them or otherwise serve their needs (Stiegler, 1998).

Undoubtedly the most influential figure promoting this perspective was Martin Heidegger. Witnessing the destruction and desolation in the aftermath of World War II, Heidegger in his later works conclude that technology must be more than an instrument (Van Den Eede, 2020). In the second part of his book "Technics and Time", Stiegler presents a reading of Heidegger's view on technology through the lens of the Promethean myth. Specifically, he refers to both the Platon retelling, but also the earliest version of the myth originating from Hesiod. The Hesiodic interpretation of the myth contrasts from others in a way that fits well with the substantive approach: technology is not a positive gift, but rather a punishment (Raggio, 1958).

From this standpoint, the tricked Zeus allows humans to keep technology because he recognises that by gaining control of the flame of creativity humans are removed from a worriless and tranquil natural state and are condemned to an eternity of need to create (Raggio, 1958; Stiegler, 1998). Heidegger views society as being enframed by the compulsion of a technological rationality that regards humans in the same instrumental light that instrumentalist theories of technology view artefacts (Wheeler, 2020). Over his lengthy and diverse body of works, an overall rejection of (post-industrial) technology can be traced – mirrored by a consistent romantic view of a "pre-technologic" society (Wheeler, 2020). As such, Heidegger mourns the loss of the tranquil state of humanity before the punishment of Zeus and aims to get in touch with this 'purer' form of the "essence of man" by stepping back from technology (ibid.).

Second Generation: The Empirical turn

At the end of the 20th century, theories on the nature of technology started recognizing the fact that the previously employed Cartesian approach of separation of subject and object when describing the relationships of humans and technology has its shortcomings (Van Den Eede, 2020). They realised that technology must be understood in the way it has always impacted humans: "both in terms of their nature and structure and in terms of their social, cultural, and ethical implications". The resulting event is often referred to as the "Empirical turn" (Verbeek, 2011), but I would rather call the 'Second Generation' Philosophy of Technology.

Philosophies during this period reject the previous method of looking at Technology as a monolithic unit with a capital "T", and start observing different technologies within their specific social contexts (Verbeek, 2005). Probably the most characteristic movement emerging from these two developments is the birth of the field of Science and Technology Studies (STS) (Verbeek, 2011). Philosophers of this period in a sense have de-deified Technology – and in the process unedified their Prometheus. Instead of viewing technology as an externality and recognizing the fact that different technologies operate in different ways in their specific environments, STS theories connect with their specific subjects of study and allow for the Philosophy of Technology to more actively engage with not only itself and other related fields of humanities, but also with the fields of engineering and design (Verbeek, 2011).

Paraphrasing Plutarch, the Prometheus of STS stops being a god, but rather becomes a personification of human reason who is then bound by his own creation (Raggio, 1958). Humans and artefacts are viewed as not being essentially different, treating them with a degree of "symmetry" within their relations (Feenberg, 2017). For example, seminal cases such as the work of Pinch and Bijker on the co-construction of society and technology (Pinch & Bijker, 1984), or Latour's description of how intentionality in the design of hotel keys influences the behaviour of patrons (Latour, 1990) all provide insights into how technology is built, and make implications on how it can be modified and formed. In a sense, humanity both forges and is bound by the proverbial chains.

While well suited to the study of specific cases of use of technology, the rejection of the overarching determinism of "Classical Philosophy of Technology" had the side-effect that STS appears heavily withdrawn from the "critical and sometimes even activist spirit" (Verbeek, 2011) of the more "classical" approaches. Instead of answering more normative questions, STS has been critiqued for taking a "descriptivist" route, where describing the system itself becomes an end (ibid.). Furthermore, the symmetric method of dealing with humans and artefacts renders the understanding of power and influence particularly difficult by making two

contradicting implications: on the one hand it implies that hegemony cannot exist in a 'flat' network as such, while on the other it presents humans as non-resistant subjects in the face of conflicts with the established order of affairs (Feenberg, 2017).

Third Generation: The Philosophical (re-)turn

The focus on descriptive accounts of the Second Generation Theories was subsequently addressed and compensated for by the start of the 21st century (Verbeek, 2011). Instead of fully disposing with the classical views on philosophy of technology, authors such as Andrew Feenberg and Peter-Paul Verbeek seek to enrich them with sensibilities and ideas imported from STS (B. de Boer, 2020). On the one hand they do not fully overwrite the instrumentalist and determinist perspectives. Rather, they draw the two together in an effort to understand the inevitable co-constitution of society and technology - not by separating subject from object, but rather "thing" from "structure" (Van Den Eede, 2020). On the other hand, they rely on an empirical rooting in STS, for example in that they both explicitly reject the object-subject separation and attempt to view humans and artefacts as inseparable parts of a singular system (B. de Boer, 2020).

Despite the similar aims and general orientation, Feenberg and Verbeek go about building their theories from largely different building blocks. In producing what he calls his "Critical Theory of Technology" (CTT), Feenberg departs from Marxist tradition and generally a Frankfurt School orientation, first by combining it amongst others with ideas imported from Latour's Actor Network Theory (ANT) (Feenberg, 2002). Later on, he addresses critique by developing "Critical Constructivism" (CC) by revisiting CTT and addressing its shortcomings with further borrowings from Social Constructivist (SCOT) perspectives, such as the work of Pinch and Bijker (Feenberg, 2017).

Verbeek on the other hand arrives from a wholly different direction. His relation to the 'classics' is from Heidegger's standpoint, via Don Ihde's Postphenomenology (PP) (Verbeek, 2005, 2011). His specific flavour of PP concentrates mainly on the specific aspect of how technology mediates the relationship of humans, society, and the world – often referred to as Mediation Theory (MT). Similarly to Feenberg, Verbeek heavily relies on Latour and ANT as well – yet due to the different normative rooting arrives at a rather different conclusion overall (Verbeek, 2005).

Despite the differing routes that they take, both CC and PP arrive at a similar conclusion on their view of technology. Similarly to their STS predecessors, Feenberg and Verbeek bring humans, nature, and technology to be parts of the same system. At the same time however, in their own unique ways they dip into Classical Philosophy of Technology to understand and explain the role

of the human element in the system. Their Prometheus is not the godly creator of the Ancient Greek telling of the myth, but he is neither Plutarch's representation of human creativity and reason. CC and PP recalls a Prometheus as described by Ovid in his Metamorphosis: Prometheus creates the physical form of humans out of clay in the shape of gods – but it is only with the help of Minerva who imbues them with the human spirit that they come alive (Raggio, 1958). This pattern of the duality of the 'technical' and 'human' rationality and motivation is a commonality that both ties together CC and PP, but also the site of many of their disagreements.

Case studies

Introduction

Internet as an exemplary case

It is due to this rich, complex, and far-reaching impact of the Internet on humanity that it has taken a central part as an exemplary case in contemporary studies of technology. The wide gamut of uses and billions of users of the Internet provide us with a singular case that can exhibit a great range of mechanisms in the relationship of humans-nature-technology. I believe that the ways the Internet has radically transformed the lives of all humans in the past decades in both positive and negative ways is a strong example of the role that technology plays in the definition of human existence. By looking at such a complex and ambivalent technology (or at least 'group' of technologies), we are able to picture the wider impacts that humans through their technology can have on human and non-human alike.

One of the most fascinating angles is to focus on the way the Internet morphed communication between people, be that on a person to person, or a one to many basis. Andrew Feenberg and Peter-Paul Verbeek both recognise this aspect of the Internet as one worth discussing. Feenberg makes his first references on the Internet in his book "Transforming Technology: a critical theory revisited", where he talks about the potentialities of the "Internet as the city" – a place of cosmopolitan interactions and communication (Feenberg, 2002). With the benefit of an additional 15 year in the development of the Internet, he later on provides an extensive analysis of the Internet as a "public information utility in flux" (Feenberg, 2017). He declares that this is an ideal candidate for the application of Critical Constructivism, as it embodies an ambiguity that is central to his theory.

When using the Internet as an example, Verbeek choses to talk about Social Media. Similarly to Feenberg, he analyses the Internet as a platform that provides the opportunity for interaction and through which relationships form (Verbeek, 2013). In his later paper titles "Politicizing Postphenomenology", he focuses on the way in which the Internet may play a role in the democratic process (Verbeek, 2020). He sees Social Media as being a particularly good field to apply Postphenomenology, due to the ways it provides people the opportunity to freely form their experiences through and with the technology (Verbeek, 2013).

In the following chapters the two theories are presented through this case. In addition to the specifics that the authors point out themselves, further details of the two theories are drawn out through the case, aiming to provide a general presentation of each theory. Finally, existing critiques on each theory are also presented and contrasted against the case analysis provided.

Inbefore continuing to the theory specific analysis however, a short historical reference on the development of the Internet and its impact provides some context for the following discussions.

Origins of the Internet

In the early 1960s, approximately 15 years after the invention of the modern computer, the Department of Defence recognised the tactical potential of linking together remote computer systems (Mowery & Simcoe, 2002). In opposition to what one would expect to be the strategy with a technology planned for military applications, the development of this early form of internet networking focused in a de-centralised and "generic" system that would be then adopted by the civilian space (ibid.). The reasoning for this was two-fold: on the one hand they recognised that in order to promote the development of a robust computing infrastructure allowing the network to be used for academic purposes would be imperative; on the other hand with the belief that a de-centralised network would be less susceptible to targeted attacks.

Based on the technical developments and enabled by the spread of the personal computer throughout the 1980s, the Internet in its contemporary form was invented by Tim Berners-Lee and Robert Cailliau in 1991 (Mowery & Simcoe, 2002). Their contribution - the protocols that allow the existence of what we understand as websites today - was what led to the commercialization of the Internet and its morphing into the form that we know it today. The importance of this invention cannot be emphasised enough. I am certain that anyone born before 2000 probably has memories from the 'pre-Internet era' and can appreciate the changes that the proliferation of this technology brought.

Impacts of the Internet

Proof of the impacts of the Internet are all around us – and it gets very personal. As a child of an immigrant and an immigrant myself, I can attest to the impact that the ubiquitous access to the internet as a communicational tool has on everyday life. I remember the days when speaking with my grandparents abroad was only possible through costly (and often of dubious quality) phone calls. Videos of myself and my siblings growing up reached them by post on VHS tapes that my mother recorded. In contrast with that, today my parents and grandparents might live thousands of kilometres away, but I can reach them virtually at any moment, practically anywhere. Loved ones became a part of life in a way that was not possible before: they can virtually join me for walk in my neighbourhood, see the parks where I like to spend my free time, or see pictures of the traditional dish that I prepared.

In addition to the effect on personal life, the Internet has changed other aspects of life that have larger repercussions on society at large. Physical stores have been for years now battling with

the rise of online shopping, changing the faces of our high-streets (Ellis, 2014). Office workers can work from home with relative ease, changing notions of the relationship of work life and private life (Rupietta & Beckmann, 2018) , and leading to many considering leaving cities that in the past were vital for employment (Cassel, 2020). Libraries have re-focused to provide seating and internet access for students and workers working on their personal computers alike (Marshall & Weiner, 2020). These changes undoubtedly impact the everyday lives of individuals in ambivalent ways; working from home for example can result in higher overall worker satisfaction due to the added flexibility, but at the same time the blurring of the work-life line can also lead to negative effects such as struggling to disconnect from work or feelings of social exclusion (Rupietta & Beckmann, 2018).

However, these ambivalent impacts are not only affecting lives on an individual level. By providing previously unparalleled communication capabilities to the masses, the Internet has transformed public life as well. Internet-based platforms now are the set where political life happens: public opinion is formed (Feenberg, 2017; Verbeek, 2013),revolutions are organised (Salem & Mourtada, 2011), and conspiracies and populism blossoms (Allington, 2021; Groshek & Koc-Michalska, 2017).

A Critical Constructivist approach

Making Technical Codes

True to his Critical Theory rooting, Feenberg approaches the Internet as a site of struggle of multiple interests (Feenberg, 2017). He believes that the development of the Internet is governed by a "technical code" that defines the direction progress takes (Feenberg, 2002). For example, the standards that were developed for the physical infrastructure of the internet, or the protocols and conventions that govern its operation are all parts of this technical code. The formation of this technical code is contingent on two elements: the sociogram and the technogram.

The technogram represents all the different ways the different "technical elements" such as wires, screws, processors, antennas, etc. can be interconnected. While there are many ways that these basic elements can be used, the specific configuration that defines the technical code is selected by an "alliance of social interests" (Feenberg, 2002). In other words, the sociogram is based on multiple "rationalities": the interests of the users may dictate a rationality where the internet is freely and easily available for anyone; at the same time, the interests of a corporation providing streaming services through the Internet could more align with a rationality that favours control and profitability (Feenberg, 2017).

While from a purely CT perspective this difference in interests would be resolved through the " social hegemony" imposing their interests on the rest of society (Feenberg, 2002), Feenberg avoids this deterministic perspective by adopting a Social Constructivist (SCOT) stance: instead of a capitalist rationality monopolizing the technical code of the internet, various actors are largely free to interpret technical problems that arise in different ways, and provide different answers to them. The many different functions of the internet are proof of this "multiplicity" of application: the same infrastructure is used to provide access to practically limitless information to the user through online encyclopaedias and dictionaries, but at the same time provide the medium of generating profit by large corporations through for example subscription-based streaming services.

Instead of viewing this situation as a finalised situation, Feenberg encourages us to recognise that the development of the Internet is incomplete (Feenberg, 2017). He claims that what currently exists is a "hybrid system" within which two competing technical codes co-exist: the consumption model and the community model (ibid.).

Community and Consumption

Feenberg claims that the original technical code of the internet inherently favours a "community model", due to its history (Feenberg, 2017) as being developed inherently decentralised, distributed, and freely accessible (Mowery & Simcoe, 2002). According to this reasoning, the fact that the Internet is not dominated by the "consumption model" is not for a lack of effort from big business to control it, but rather because of the interplay between its initial design and the subsequent efforts of its users representing their interests. But how do the two models differ, and how can they co-exist within a singular system?

The community model privileges online group activity and social life, as it "supports new forms of sociability through which individuals communicate and appropriate alienated aspects of their lives" (Feenberg, 2017). It represents and embodies values of freedom of expression, social life, and political engagement. The influence of the community model is best reflected in communal projects that often involve community contributions in the form of a wiki or forum or are part of an Open-Source project. For example Wikipedia, that has become synonymous with 'source of information' in the past years, is financed through a non-profit foundation, and is written, reviewed and updated solely by user contributions ('Wikipedia', 2021). Another example of a similar project is the Signal cross-platform messaging application, which is also backed by a non-profit foundation and focuses on privacy and open-source contributions (*Signal Foundation*, n.d.).

Adversely, the consumption model is driven by the rationality of capitalism: objectifying human capacities as commodities (Feenberg, 2017). Values at the centre of this model include such as marketing freedom and the market's importance in fulfilling societal and personal needs. The consumption model is best exemplified in platforms where the focus is on entertainment, commercial activity, or transactions. Subscription services that offer access to TV shows, movies, music, or eBooks are a characteristic example of the Internet providing existing businesses with a new avenue to distribute their materials. The impact of this development is so dramatic that for example basically every major TV and Film studio such as Disney or HBO has started offering their own streaming service the last few years – to match the offering of tech-first streaming services such as Netflix or Amazon Prime (Leger et al., n.d.).

One could argue however, that most of the Internet does not exist in a way clearly definable by either model, but rather in a space in between. Feenberg attributes this development to an effort by the proponents of the consumption model to monetize an infrastructure that is inherently communal (Feenberg, 2017). Commercial interest found its place in a communal model not by overtaking it, but rather incorporating its interests, mainly in the form of advertisement. In this way, the overall ontology of the internet is still largely dictated by the community model, but it is under constant pressure from elements of the consumption model.

Hybrid Systems

This hybrid system works can be exemplified well by social media such as Facebook. Feenberg identifies five features "that support functions distributed in the two models" (Feenberg, 2017). This means that specific parts of the system can function in favour of both models – albeit in different ways.

Facebook features a largely non-hierarchical structure, where anyone can share or consume information. The basic functionality fulfils the requirements of the community model: it provides users with the opportunity to communicate and share information, to form virtual communities, to organise, and to debate. However, this non-hierarchical structure is also exploited by the elements of the commercial model: advertisement and data mining turn the content produced by the community into marketable commodities. Feenberg likens the way Facebook operates to a shopping street: companies compete for the attention of the customers by selecting favourable 'locations' (Feenberg, 2017). In this model, the value of the 'location' is increased by data mining that can provide advertising companies with knowledge that gives them a more advantageous position. This data-mining driven advertisement can be targeted by parameters as specific as neighbourhood of residence, political leanings, or shopping habits (*Facebook Ads Manager*, n.d.).

Furthermore, the ability to broadcast information in a one-to-many or many-to-many manner on Facebook is also a feature that serves both rationalities. Messages can be broadcast live and reached on-demand by virtually anyone on the planet. This capability of the platform allows communities to self-organise leading to public interventions such as protests, raise funds, and mobilise on politically motivated issues. Famously, the role of Facebook as a platform during the series of protests in the early 2010s collectively referred to as "Arab Spring" has been widely recognised (Salem & Mourtada, 2011). At the same time, the ability to easily broadcast to a large number of people is the backbone of the advertising capabilities that the platform offers. For as little as 10dkk per day, at the time of writing Facebook advertisements can reach as many as 4000 people (*Facebook Ads Manager*, n.d.).

In addition to these more 'stable' functions, Feenberg further identifies functionalities where the a more "rough equilibrium" is reached (Feenberg, 2017). Data storage for example is an are were the interests of the community and consumption models clash, and the difference is resolved in a manner that is not ideal for neither the users nor business interests. Ownership of data uploaded and stored on Facebook servers is an ambivalent topic. In their terms of service, they claim that the users "… own the intellectual property rights (things such as copyright or trademarks) in any such content that [they] create and share on Facebook" (*Facebook*, n.d.). At the same time however, they also clarify that "if you share a photo on Facebook, you give [Facebook] permission to store, copy and share it with others" (ibid.). The ability to freely store data on its servers is not always in Facebook's favour. For example, in 2019 an Italian court found Facebook liable for infringing the Copywrites of Italian media company Mediaset by hosting user uploaded and unlicenced content from an animated series (Aless & Rosa, 2019).

Last but not least, Feenberg identifies Anonymity as a function that typically is distributed between the two models of the Internet (Feenberg, 2017). He claims that anonymity supports the consumer model by guaranteeing freedom of expression under oppressive regimes, as well as the ability to debate viewpoints that are viewed as "risky" by society at large (ibid.). At the same time, he attributes the commercial perspective of anonymity to its function of protecting the user from social stigma; as it is the case of the purchase and consumption of online pornography. In the case of Facebook this anonymity in the past functioned in combination with the ability to communicate as the driver behind the organisation of political dissidence. In 2014 however, Facebook introduced a policy that required users to use their legal name as their Facebook profile name. This change was highly controversial and resulted in public uproar that resulted in the policy to be changed to require "authentic names" (Hern, 2015). However, to this very day the Facebook terms of service do include a paragraph that states that Facebook

reserves the right to verify a persons real name by submission of a government issued ID card or similar (*What Forms of ID Does Facebook Accept? | Facebook Help Centre*, n.d.).

Concretisation

The example of the Facebook and how it can serve the two different rationalities of community and commerce, a question clearly emerges: how do such hybrid systems come to be? Feenberg explains that this process is a fundamental law of development that he calls "Concretisation" (Feenberg, 2017). He claims that "sophisticated" technologies maximalise the possible functional compatibilities between competing rationalities, meaning that the functions that serve multiple rationalities in a sociogram are likely to survive and be developed. In the example of Facebook, we can see that the functions that serve both the community and the commercial model such as mass communication and a non-hierarchical structure comprise the uncontested core of the platform.

Controversies emerge at the sites where this concretisation is less than perfect. For example, we can see that the way file sharing on Facebook operates is a field more contested than communication. The struggle in this case is both 'internal' and 'external'. Facebook is internally disincentivised to freely host the users' data, since every additional file uploaded incurs server costs for the company; at the same time however a big portion of this content uploaded is a valuable source of mined data that the company can utilise. The external pressures somewhat mirror the internal ones: there is user demand for the platform to host data for no cost, but at the same time questions do arise about the ownership and use of said data. The same applies to other external pressures, such as the copyright case against Facebook in the Italian courts (Aless & Rosa, 2019).

The question of anonymity is one where the struggle of the consumption model to overtake the community model of the Internet seems to be of larger success. While Feenberg views anonymity one of the cornerstones of the communal nature of the Internet, and an integral part of its existence, Facebook disallowing the use of pseudonyms is an example of the consumption model being put forward by a platform owner. While the specific reasoning behind this decision is contested with Facebook stating that it "makes it so that you always know who you're connecting with" (*What Names Are Allowed on Facebook? | Facebook Help Centre*, n.d.), one could argue that solid confirmation on the identity of each user may be a major driver of the value of their data and attention to advertisers. In this case, control of the community over this policy has been lost, since even after the public outrage to the shift in policy (Hern, 2015), the new name requirement was not reverted. Instead, it was modified to allow for use of "Bob instead of

Robert", and the option to add an "another name" – all still of course after ID based validation (*What Names Are Allowed on Facebook? | Facebook Help Centre*, n.d.)

Democratic Interventions

The loss of anonymity on Facebook that could be attributed to the advancement of the consumption model presents us with a great question: what can users do in order to respond to changes that go against their interests and rationalities? Feenberg supports the notion that once one becomes situation as a part of a network of stakeholders in a technology, they gain certain interests and expertise (Feenberg, 2017). For example, the Facebook user who uses the platform towards the organisation of dissident activity under an oppressive regime gains the interest of keeping anonymity, as well as the expertise in what the impacts of taking away anonymity is on the community.

According to Feenberg, this expertise is often the focal point of conflicts over technology that he calls "democratic interventions" (Feenberg, 2017). The outraged response of the public to the name policy changes on Facebook (Hern, 2015) is a form of democratic interventions. Feenberg refers to such interventions as an "a posteriori" intervention, since the change in the technology is demanded by the public after the fact of its creation/modification (Feenberg, 2017). Another type of "a posteriori" intervention is when users through creative appropriation of technology find ways to meet their demands. For example, one could argue that Facebook never intended the platform to be used for political organisation, and such use by dissident movements happens through appropriation of a medium beyond the intentions of the company.

Feenberg also identifies a third type of public intervention. The main difference in this third kind of intervention compared to the other two is that it happens prior to the decision making process. In this case, Facebook can provide the platform for virtual townhall meetings or polls where the opinions and expertise of citizens are solicited by decisionmakers. Examples for this include governmental agencies interacting with their citizenry on matters of governance or using Facebook as a platform to directly request input by designers and engineers at private firms.

When looking at the ways they facilitate democratic interventions, it becomes clear that technological platforms such as Facebook are deeply entangled into multiple facets of our societal life and democratic governance. The parallel with the sidewalk that I previously used for the commercial perspective of advertising on Facebook this time becomes pertinent in a communal light: Facebook as the "sidewalk" is not only the site of business, but also provides the

basis for civic engagement, and as such becomes an integral part of the public sphere (Feenberg, 2017).

Internet as Public Sphere

Feenberg specifically underlines the role that the Internet carries as a public sphere. According to him, social media sites such as Facebook are the facilitating sites of public discourse in an era that when public assembly does not happen in physical form (Feenberg, 2017). As such, public discourse on Facebook can not only match, but in certain aspects can potentially add to the quality of democratic governance.

As a platform, Facebook can empower citizens to reach a larger audience than ever before without the financial or otherwise backing of traditional media outlets or other mass communication tools. This means that the platform has emancipatory potential to those otherwise underprivileged in society. For example, by gathering into groups on the platform, citizens have been successful at challenging authority through education and organisation in ways previously impossible. Feenberg specifically brings the example of patient interest groups bringing patients together against "medical paternalism", or to lobby for specific research funding (Feenberg, 2017), but other examples such as the role of Facebook in the Arab spring also bear witness to the democratic potentialities of such platforms (Salem & Mourtada, 2011).

Furthermore, addressing critiques of an alleged "depolitisation" that social media platforms drive, Feenberg addresses the topic of 'weaker' political action that the Internet can facilitate. Talking about online petitions, he clarifies that while the petition itself might not achieve the goal that it sets out to fulfil, even comparatively less actionable political engagement on the Internet has emancipatory potential (ibid.). By signing an online petition, he argues, the signer does not expect big change in exchange – rather the existence and public support that such petitions garner reduce the loneliness of and increase the likeliness of dissenters to speak up and spark political action.

On the other hand, the question of the negative effects of social media platforms such as Facebook cannot be ignored. Feenberg argues that the heated arguments in many comment sections is evidence that the "echo-chamber theory" is at least less-relevant than what many estimate (Feenberg, 2017). Other research supports this claim, claiming for example that they find no evidence for "filter bubbles" contributing to the rise of populist political candidates in the political system of the USA (Groshek & Koc-Michalska, 2017). Other research on radicalisation through conspiracy theories on digital media on the other hand seemingly disagrees, claiming that the way Facebook brings people with similar interests together "carries an inherent risk

because of its obvious potential to lead susceptible individuals into progressively more extreme views" (Allington, 2021).

In reality however, Feenberg argues that blaming the specific medium is unfair and misguided, since the real damage is encouraged by wealthy actors who are not only not underprivileged, but often own more traditional media outlets (Feenberg, 2017). Social media in this case mirrors any other public space: those privileged in traditional means still have an advantage overall (Groshek & Koc-Michalska, 2017), while people who are susceptible to such manipulative tactics offline are also susceptible online (Allington, 2021).

Finally, Feenberg identifies the struggle between the communal and commercial rationality on and over the Internet to not be fundamentally different that that offline. However, he does point out that the Internet is one of the few spaces that is still pre-disposed to support a communal rationality from its design, and that business interest is only an encroaching pressure rather than the trend-setter (Feenberg, 2017). He believes that for the Internet to reach its democratic potentialities, the conditions of an online community must be preserved. As such, according to Feenberg protecting the functionalities that provide non-hirerarchical mass communication and data sharing anonymously are the cornerstone of resisting the enclosure of the internet by business interests, and safeguarding its democratic potentialities (ibid.).

Critique of CC

One of the main directions of critique towards Critical Constructivism addresses its rooting in Critical Theory and Marxian ideology. According to Don Ihde, framing the interactions between different actors forming what the Internet is, is a "nostalgic-romantic view" of a previous era that does not automatically apply in equal measures today (Ihde, 2020). The monolithic treatment of actors is such an example of an outdated viewpoint: there is differentiation made between different kinds of applications of the internet, but no matter what that overall technology is seen as a Technology with a capital "T" (Bantwal Rao et al., 2015). The analysis would focus on the struggle between the community and consumption models, not providing flexibility to differentiate and address the various functionalities that each of the distinct applications allow.

The assumption is made that the 'community' of which interests the communal model is in favour of, and the 'business interest' of which the interests the consumption model is in favour in, are monolithic, homogenous, unchanging entities. Simultaneously, the assumption is made that the values that drive each of these groups are universal and stable too (B. de Boer, 2020).

However, if one is to claim that a dynamic and ever evolving co-constitution of technology and society exists, one must challenge the stability of values of any of the actors involved (ibid.).

Finally, Verbeek directly critiqued CC for talking and not doing much. He claims that the Marx-informed focus on power that CC carries through Critical Theory leads to a pretentious undertaking of merely discussing power imbalances (Van Den Eede, 2020). Characteristically he describes such action as "intellectual masturbation" in that "It's nice for you but you won't make the world a better place" (ibid.). He concludes that in order to "make the world a better place", one would need to develop a theory that explicitly aims at doing instead of talking.

Industry Disconnect

I believe that where CC succeeds is connecting with the perspective of the 'oppressed' users. The way CC describes the development of technology as a negotiation process between the differing rationalities and interests of the various stakeholders may connect well with activists amongst the userbase who CC would describe as 'oppressed' by the power relations that define the technical codes. The theoretical scaffolding that CC provides could be a powerful framework around which these 'resistors' can organise their intervention – but mainly after the fact.

Where I see CC to fall short is in the pre-factum involvement in the design process. By my experience, it is particularly challenging to connect with the industry, since representing the rationalities of the oppressed is often not in the direct economic interest of the corporation. As long as the generation of profit is the main driver of a capitalist organisation, this situation is unlikely to change. Even when they are considered, the interests of the subject of the technology are relegated to secondary status and are observed only in cases where it is in the interest of – or at least not impede – the profitability of the corporation.

Furthermore, I believe that the lack of fidelity when it comes to understanding the nuances of different 'stakeholders' disallows CC to communicate well with industry in a productive way even willingness to improve exists. The presupposition that designers can only be informed on the directions that the development of technology can take towards improving the life of its subject is contingent on allowing for some representative intervention by this monolithic idea of the demos harbours multiple weaknesses. On the one hand, I believe that it provides the basis for surface-level adaptation of technologies in the vain of 'greenwashing' or 'ethics washing'. In this case, it is easy to point to a cherry-picked issue and produce a 'solution' that does not meaningfully engage with the issue in a meaningful manner.

On the other hand, I believe that the non-involvement of CC with design methodology is an oversight. While admittedly one could argue that user involvement in design is a field that already is populated by many different methodologies, I strongly believe that guidance on how to assess design methodology should be included in a future theory. In other words, I agree that democratisation of design processes is necessary, but I also believe that at least the evaluation of design methodologies and the provision of tools of communication between stakeholders should be a central part of future frameworks.

A Post-Phenomenological viewpoint

In building Mediation Theory of technology (his own flavour of Postphenomenology), Verbeek inherits key aspects from Bruno Latour's Actor Network Theory and Don Ihde's interpretation of Postphenomenology. He believes that "non-humans" should also be included in the "moral community" (Verbeek, 2011), affirming a level of "symmetry" between humans and non-humans that is developed in ANT (Verbeek, 2005). This means, that formation of the values that Facebook represents originate from an intertwined system of engineers, designers, the platform itself, and users. According to him, "nothing can be understood by itself, removed from the world", since every element of the system is mutually constituted and qualitatively different than the sum of their parts (ibid.). At the same time, he refers to Ihde's idea that technologies by themselves have no "essence", but rather gain meaning in the context they are placed in (Verbeek, 2013). According to Ihde, due to this dynamic it is impossible to describe an experience before it happens (ibid.).

To support this idea of moral agency of the technical elements of technology, Verbeek presents two criteria of moral agency (Verbeek, 2011). On the one hand he claims that freedom is a necessary condition for agency. He does not require artefacts to be free "in on themselves", but can operate with a degree of autonomy. The fact that the users are free to post functionally anything they would like on Facebook, create communities, and select the ways they interact is proof that the platform in this sense is autonomous, since these interactions go beyond any intentionality in design. As such, Verbeek recognizes a technological intentionality (ibid.). The function of a social media platform like Facebook in this scenario does derive from the rationality of any of the human actors, but it rather comes to existence through its interaction with humans. Users, designers, user interfaces, and infrastructures are "folded together" through technical action; the final functionality is not a question of negotiation and power struggle but emerges from this "fold"(ibid.).

Relations of Mediation

This 'folded' constitution of the function and morality of artefacts is also reflected in the Classical Phenomenology rooting of Mediation Theory: the world is not a collection of things to know or control, but a "lifeworld to live in" (Verbeek, 2005). The role of artefacts in this relation to the lifeworld is to "mediate" the relation of humans to the world. Verbeek does not see Facebook as an invasion into human nature – rather he understands it as another medium through which friendships can take place (ibid.). For example, through its capability to allow for instant communication with any of its users, one could argue that Facebook has changed the way people think of the idea of reaching others. While in the past one would need to have some form of personal information such as an address, phone number, or email address to send a message to someone , the fact that through the ubiquity of reach that Facebook provides more people can be instantly reached today than the estimated world population in 1955 (*International Data Base*, n.d.; Tankovska, 2021) has according to Verbeek certainly changed the notions surrounding personal relations.

People who were once disconnected by barriers such as letter delivery time, or the high cost of international phone calls, now are re-connected and able to form close-knit communities. Borrowing from Idhe, Verbeek would describe this function of Facebook as an "embodiment relation". This means that the platform operates "transparently", not drawing attention to itself, and allows for the experience it mediates to be of the same 'quality' as the unmediated experience (Verbeek, 2005). In other words, when sending a message through Facebook, one does not think about Facebook itself, but rather the communication that happens. Furthermore, interpreting incoming messages does not happen in a different way than interpreting any other written message.

However, since the functionality of artefacts is context-dependant, the same artefact can take up different functions in different contexts – a phenomenon that Verbeek refers to as "multistability" (Verbeek, 2005). For example, with an average high-speed mobile internet coverage of 98.2% even in rural areas (IHS Markit & OMDIA., 2020) messaging through Facebook is virtually constantly and universally available for citizens of the EU. The mobile network infrastructure and the universal availability of Facebook means that in a sense the whole platform mediates experience as a "background relation" (Verbeek, 2005). The users can access the platform at any time, with most never ever thinking about the artefacts that allow this interaction – except when it becomes visible by breaking down and not functioning as expected.

Other types of mediation can also be found even within the specific chat functionality of Facebook. For example, business have the opportunity to operate chatbots within the very same messaging application where one reaches out to their friends (Introduction - Messenger Platform - Documentation, n.d.). In this case, the artefact functions within an "alterity relation", since it creates the impression of a "quasi-other", seemingly independent entity with which one can interact (Verbeek, 2005). In this case, the human interacts with the technology itself, which then acts upon the world on behalf of the user in ways that the user is not directly aware of – creating the illusion of an Artificial "Intelligence" (ibid.).

Last, but not least, other capacities of Facebook are also capable of functioning in a different way. It's functionality as a one-to-many platform lends itself to gaging public interest or agreement in a given topic. Having the ability to react to a certain post made by selecting one of the standard reactions (at the time of writing: Like, Love, Care, Haha, Wow, Sad, Angry), it can also act in the capacity of a "hermeneutic relation" (Verbeek, 2005). In this case, it represents the reality of public opinion in a way that it "needs to be read" (ibid.) and interpreted. The information that can be gained from this mechanism allows the user to perceive the world by means of translation that the artefact mediates – transforming an emotion or opinion into a quantifiable measure.

Democracy

While Verbeek rejects the idea of technology acting as an instrument of some ruling class or rationality, he does affirm that the way technologies mediate the human experience has implications and repercussions on democracy. The platform acts as the mediator of sharing ideas and discussing politics in the same way as any space would host such discussions: individuals who form a community can meet and interact with each other in a free way (Verbeek, 2020). As such, Verbeek views the platform as inherently social and not political. He claims that while the platforms themselves mediate the interactions of individuals with the world, private opinions and interactions can be elevated to a socio-cultural level through the capabilities of Facebook (ibid.).

As such, while he does not believe in the concept of the opposition model where the artefact can be wielded by some dominant social group to further their own interests to the detriment of others (Verbeek, 2013), Verbeek does believe that artefacts do have a wider political significance. For example, by hosting the clash of interpretations of different political actors, Facebook does embody forms of power in the way it functions (Verbeek, 2020). Furthermore, by mediating communication and building the "polis", Facebook takes part in the very organisation of political action both in the private and public spheres.

This mechanism of course it not understood as neither inherently positive nor negative, but rather is the origin of ambiguous impacts. As an example, the way the platform allows for the quasi-private congregation of likeminded people can be partially responsible for the proliferation of fake-news – since fringe ideologies that previously would have been rejected and ostracised and rejected find a new home to recruit and organise (Groshek & Koc-Michalska, 2017). At the same time, the very same platform is the one that allowed the gathering of the public around the issue, and has brought the question of "facts" and "truth" to the centre of public discourse (Verbeek, 2020).

Design

Seeing the impact that mediation of technology can have on the way humans experience their personal and public life, it is imperative to assess the "moral quality" that these artefacts are imbued with at their design (Verbeek, 2011). While he believes that steering behaviour through design is morally questionable, Verbeek points out that the way technological mediation functions does not need to be forceful or forceful, and that in reality it can contribute to overall freedom (ibid.). He refers to the fact that since human actions are always mediated, instead of ignoring the mediations would not result in more freedom – since freedom does not inherently mean lack of external influence.

Since design is understood as engaging the human/technology dynamics and not intervening with human behaviour, Verbeek believes that the intentional moralization of technology is not wrong nor undesirable (Verbeek, 2011). For example, the requirement of Facebook to provide a real and verifiable name to link with a given account (Hern, 2015) is a design choice that Facebook claims explicitly "to maintain a safe environment and empower free expression" (*Community Standards*, n.d.). Presumably, the rationale behind this choice is that by ensuring that each person can only operate one account, as well as removing anonymity, problematic content uploaded by fake user profiles can be eradicated, as well as discouraging online harassment due to the possibility of eponymous prosecution.

Verbeek believes however, that such design decisions should emerge through a democratic process (Verbeek, 2011). He supports design methodologies that involve "all relevant social actors" in a "democratic, domination-free discussion between" them in a systematic and explicit way in the agenda of technological design and development (ibid.). At the same time, he points out that purposefully "inscribing" morality into technological objects would be a mislead effort from the side of the designers of a given artefact.

Verbeek explains that there are a number of methods that designers could engage the human-technology dynamic during the design process (Verbeek, 2011). For example, if a new feature or update would roll out on Facebook, the designer would first need to choose whether to find a way to explicitly moralize their design, or to just assess the implicit role of the design once it will be implemented. If they choose to explicitly moralize their design, a mediation analysis of the feature could take place through "the moral imagination of the designer" or assisted by the involvement of users and other stakeholders. The designer would attempt to foresee the mediating role that different versions artefact would play in the world, and those correspond to their goals (Verbeek, 2011). Departing from this analysis, the designer should be able to choose the specific design of the feature they are developing.

Verbeek however points out that this process is highly experimental, there is no guarantee that the planned mediations will occur, just as much as there is no way to ensure that unintended consequences will not appear. Furthermore, unexpected interactions, interpretations, and appropriations will always necessitate adaptation of the original design.

Responsibility and the good life

Finally, Verbeek often touches on questions of what constitutes a good life. On the one hand he claims that he takes a "hermeneutic approach", studying the meanings and interpretations of technology, instead of prescribing a normative value set (Verbeek, 2011). He believes that living in a technological culture does not mean that one should set limits to technology, but rather that humans should shape their existence in relation to technology.

Verbeek explicitly supports a Liberal Democratic perspective that the good life is the responsibility of the individual (Verbeek, 2005). According to this ideology, humans are considered capable of freely relating to technology and the way it mediates their experiences. As such, the role of technology becomes one of creating availability so humans can chose and form their own ways. However, Verbeek clarifies that this availability must not be confused with the practices imposed by a culture of "mass consumption and work in order to make more consumption possible" (ibid.).

Searching for the alternative, Verbeek would not call for neither the rejection, nor the explicit regulation of Facebook. Instead, according to him the answer lays in the involvement of a plurality of voices in the discourse, similarly to how public discontent already contributes to the development of features and policies (Hern, 2015). Ultimately, Verbeek suggests that the solution of the negative impacts of technological mediation should not be conceptualized a fight

between actors, but should rather entail recognising the moral significance of technology, and taking responsibility for it (Verbeek, 2011).

Critiques of PP

The most central critique that Verbeek's Postphenomenology receives is targeted towards its perceived lack of consideration for larger than individual levels of engagement between humans and technologies. This means that in a PP analysis, one would mainly focus on how an individual technology mediates the relationship of individual humans with the world, not accounting for wider societal questions. Even though a "political turn" was attempted by Verbeek, assuming that by compounding individual mediations we arrive to a societal account does not in on itself provide a satisfactory account of the political role of technology (Gertz, 2020). Political life is not just the sum of individual lives, and as such analysis of political life is a qualitatively different, rather than quantitatively larger effort (ibid.). Focusing on the micro-level parts of the system, only semblances of reality can be re-constructed (Bantwal Rao et al., 2015). In order to understand society at large, and the political landscape within it, one would need to analyse society in it's totality (ibid.).

However, it is also clear that Verbeek is not interested in employing any kind of political normativity in his theory. The Liberal Democrat perspective that he takes on personal responsibility bars Mediation Theory from being employed as a tool to address rationality on a political level (B. de Boer, 2020). Some have gone to the extent of accusing Verbeek of reproducing a conservative agenda (Bantwal Rao et al., 2015), since he actively rejects the idea of resistance (Verbeek, 2013) in favour of finding ways to live within the confines of the existing socio-political system (Bantwal Rao et al., 2015).

While recognising the fidelity with which a platform like Facebook can function in different ways and mean different things for the various actors, the notion of any power imbalance within the system is totally absent from PP. The presumption is made that all actors within the system are capable to freely select how and if they engage with the platform without any external pressures. In attempting to mitigate for the context-free perspective that Classical Philosophy of Technology took in the past, Verbeek ends up identifying small local contexts, while denying that larger contexts are any different that he finds on the micro-level.

Representation Disconnect

I believe that the strength of the PP perspective is that it essentially talks to developers. It is mainly concerned with providing them with a framework to conceptualize how the users interact with the technology, and how that forms a 'new reality'. However, it's emphasis on co-

constitution obfuscates a normative and systematic view of technology. As such, PP driven technological development might end up overly conformist and fall short of achieving the transformation of our technological systems as to respond to their detrimental effects on human and non-human environment alike.

By my estimate, the solution to this shortcoming should be addressed by matching the PP mentality with a political philosophy that allows for it's basic perspectives to function – but at the same time one that can provide the basis for a more holistic analysis of complex systems. Instead of avoiding addressing structural issues out of fear of bowing down to 'grand narratives', I believe that PP would benefit by engaging with ideological underpinnings that share similar sensibilities when it comes to personal freedom – but that are more actively concerned about the cases where it is broken.

As such, I believe that it is key to expand the world view of PP in ways that speaks not only to those who are already 'at the table', but also points out ones who are not. It is only by becoming more aware and reflexive of the context that PP-inspired methodologies could bridge their disconnect from the stakeholders who are currently not involved in the development of technology. I believe that by 'closing the distance' between designers and users the true potential of PP to emancipate users can really shine.

Arguing for reconciliation

Both Feenberg and Verbeek's work as a part of a "third generation" movement in the Philosophy of Technology is recognised as being some of the most important and influential of our time (Franssen et al., 2020). However, contemporary experts in the field have felt the need for a discussion around the possibility that the two theories can be combined or at least used in parallel. The main focus of the differing commentaries tends to be rather divergent, with some authors focusing on one or another angle of the two theories. However, a wider agreement seems to exist on that both theories would benefit from a degree of cross pollination, as they seem to address each other's weaknesses rather effectively.

My interest in the reconciliation effort is mainly motivated by the fact that the critiques of each theory focus on some side of the disconnect between industry, society, and philosophy of technology. As such, as a first step towards the next step in philosophy of technology, I believe that taking a closer look at the contemporary discourse on the topic may be a good starting point.

Approaching Reconciliation

Differing focus

The analysis of the case of Internet, Social Media, and Facebook unveils the differing focus of Critical Constructivism and Postphenomenology. Both theories agree on the Foucauldian idea that subjectivity is constituted both by process and mediations, but they each choose to focus on the two poles of that statement (B. de Boer, 2020). Feenberg mainly focuses on the politics of technology and the competing rationalities that contribute to the process of its development, while Verbeek turns his attention mainly towards individual subjectivity mediated by technology (Bantwal Rao et al., 2015).

Let's take the example of the political repercussions of Facebook as a communication platform. From a CC perspective, the way the platform itself is built is biased towards the interests of certain actors. The fact that the platform allows for widely accessible one-to-many and many-to-many private and semi-public communication means that inherently it suits the needs of "the community model" (Feenberg, 2017) more than it would the needs of an oppressive government. According to Feenberg however, this is not an inherent trait of the platform itself but reflects a wider rationality that is dominant on the internet due to its origins, that is biased towards communal needs (ibid.). Compared to this line of argumentation, PP does not concern itself with the larger context, but focuses on unpacking the specific interactions individual users

have with the individual technology. Instead of viewing the 'users' as a monolithic group and ascribing to them a common rationality, PP focuses on the way that the people themselves choose to relate to the platform in their unique ways to address their unique needs.

The CC analysis of this example points out the social biases in the technology itself (Bantwal Rao et al., 2015), underlining the "invisibility of context" of the "political constellation hidden in the use of technology" (Van Den Eede, 2020). The analysis illuminates the competing rationalities and the "vertical tension" between them (ibid.) – at the cost of generalising and reducing otherwise heterogenous groups into a theoretical homogeneity. PP on the other hand provides an experience-oriented analysis of the technical mediation of technology (Bantwal Rao et al., 2015)., shining light on the "invisibility" of how users relate to the technology and how it forms their individual experience and perception of the world (Van Den Eede, 2020). This brings forward not a "vertical tension" between social groups, but rather a "horizontal tension" present in specific user contexts.

Overall, it could be said that the impact that technology has is resolved at a different level in each theory: CC looks at what is in the background, searching for a larger context; PP analyses design as an individual process with social consequences (Feenberg, 2020). Ultimately however, both theories share a common desire for technologies to take down systemic barriers instead of replacing them or erecting new ones where they did not previously exist (Ihde, 2020). Due to this differing resolution, but agreement in point of departure and overall vision, one could say that CC and PP are not in reality competing theories that attempt to describe the same phenomena. This observation has been the basis of the focus of contemporary analysis on reconciling or unifying the two – focusing on their complementarity rather than their differences.

Shared Principles

Despite their apparent differences, historically speaking both theories are an attempt to overcome shortcomings of 'Classical Philosophy of Science' and STS by combining elements of both in their project (B. de Boer, 2020). While their 'answer' to what they perceive as a shortcoming of previous theories is seemingly different, they both answer the same 'questions' while making the same assumptions.

Both CC and PP depart from an explicit rejection of Instrumentalist and Substantivist ideas of 'First Generation' Philosophy of science: They both reject the modernist dichotomy of subjects and object, pointing out that meaning is both inherently bound- and meaningless without context (Feenberg, 2002, 2017, 2020; Verbeek, 2005, 2011, 2013). They support that this

inseparable subject/object complex is in direct causal relationship with the co-constitutive dynamic between society and technology (Feenberg, 2002, 2017, 2020; Verbeek, 2005, 2011, 2013).

As such, in addition to the rejection of instrumentalism or subjectivism, both CC and PP agree on the rejection of determinism – both believing that neither the 'trajectory' of technological development, nor the way technology impacts society is pre-determined and inevitable. Even if they seem ideologically divergent, in this case Verbeek's Liberal Democracy and Feenberg's Socialism are not that different: subjects shape and transform the technically mediated subjectivity, they cannot nor should escape relating to the world through technology, and they are in a position to negotiate the detrimental effects that they suffer by technological developments (Bantwal Rao et al., 2015).

Due to this dynamic understanding of how technology is created, both theories have a similar concept of how different uses of the same technology can exist. The fact that the chat functionality of Facebook can be used both for organising a protest and to support sales would be described by PP as a "multistability" of the technology – while at the same time CC would refer to it as "ambivalence" of the technology (Ihde, 2020; Rosenberger, 2020). This argument of course also stems by the basic anti-essentialist argumentation that rejects the idea that technology has pre-determined impacts, due to the capacity of its subjects to relate to it with some degree of freedom (ibid.). As such, both agree that while not all technological mediation is desirable (Feenberg, 2020; Verbeek, 2013), conceptualizing the relationship between humans and technology as an oppressive one is misleading (Bantwal Rao et al., 2015), since this multistability/ambivalence can just as much contribute to the change of social hierarchies, as much as it can potentially contribute to their conservation (Rosenberger, 2020).

CC and PP also agree on their overall basis of what should be the goal when developing technologies: neither of them conceptualize intervening into technological development as an action of protecting society from technology (Gertz, 2020). Instead, in both cases the direction suggested towards the improvement of technology in the future focuses on engaging humanity in the decision-making process (ibid.). Since technology can re-define political stances (Coeckelbergh, 2018), such technical action is inherently political in itself (Feenberg, 2020; Verbeek, 2020). However, despite the agreement in the overall sentiment, the two theories dramatically diverge at the point of understanding specifically how can humans engage with the development of technology. Most of this disagreement can be traced to a central site where special reconciliation between CC and PP is necessary: the question of power relations within society.

Power

Possibly the biggest normative difference between how CC and PP relate contribute to 'the gap' is the question of conceptualisation of power relations. CC clearly describes technology in terms of a power struggle between different actors, where technological development is dictated by the competing interests of different actors. Verbeek with PP on the other hand rejects this pre-conceptualization of a power structure and declares that his interest lies in looking at observing the specific use of an artefact without pre-conceived notions of wider power relations and that the users are (or at least should be) fundamentally free to relate to technologies in any way they would like, even in cases where the designers of the technologies have specific intentions with their designs.

Axes of Discrimination

However, many scholars have questioned this idea of "freedom of relation" (Verbeek, 2020). For example, Rosenberger writes that some level of discrimination is enacted through design – no matter if it is an intentional effect or just in the form of unforeseen side-effects (Rosenberger, 2020). For example, Rosenberger agrees with Verbeek that encouraging different uses/"mediations" can be designed into artefacts to some extent. However, while the wider implication in Verbeek's work is that users are free in their way of relating to technology, or at least should be free not to relate to it, Rosenberger points out another potential mode of discrimination along an "axis of usage" (Rosenberger, 2020).

In this case, closing off specific usage of an artefact is achieved not as an unintended consequence, but rather as a purposeful design choice. For example, while in theory the Facebook "community standards" state that anything outside of what they deem "Objectionable content" (ex. Hate Speech, Violent and Graphic content, Adult nudity, etc.) (*Community Standards*, n.d.) is allowed on the platform due to their belief in upholding the right to free speech, due to a recent disagreement with the Australian government Facebook banned the sharing of news content in the country (Are, 2021). The ban came as a response to the Australian government pressuring Facebook and other online platform owners to pay a fee to news companies who are losing advertising revenue due to their content being published on Facebook. As such, it can be said that an active design decision removed the possibility of "freedom of relation" between the platform, the news organisations, and the users.

This "axis of usage" discrimination towards using the platform to share certain types of content to 'retaliate' against the news companies and the Australian government also had discriminatory repercussions on some users in a different way. For example, multiple NGOs and

other Civil Organisations who has used the platform in the past as their central hub of fundraising and organising have been categorised as "news organisations" and have been banned from sharing their content on the platform (Are, 2021). Rosenberger calls this discrimination along an "axis of difference" (Rosenberger, 2020).

As such, even if we accept that Facebook is a platform that supports free speech and is non-discriminatory, it can relate in significantly different ways to different people by design. Users who previously relied on the platform as a public forum to inform themselves, share news, and publicly discuss issues have now lost the access to this functionality. While previously all of these users were free to relate to the platform in their way of choice, this design decision resulted in a dramatic curbing of freedom. As Rosenberger puts it "The design is discriminatory not only because of the comparative inconvenience a [user] may experience, but in the device's implication that [it] is not for [them]" (Rosenberger, 2020, p. 15).

Competing Rationalities

As such, this interaction and outcome is a good example of the limitations of PP, as the pre-supposed freedom of relation is being infringed upon an externality that PP does not account for. It is at this point of limitation where CC connects well with the localized perspective of PP (Rosenberger, 2020). A CC analysis of the situation provides us with insight that completes this analysis. Looking at the rationality driving the development of the platform as a "hybrid rationality" that is constantly formed by negotiation between competing rationalities (Feenberg, 2017), we can start unpacking who the different actors are and how their interests are represented in this situation – and see how this relates to closing the gap between them.

Once we start thinking about the system of competing rationalities, some distinct actors and their motivations emerge. On the one hand, the users themselves are the ones in a relatively powerless position, with their interests being mainly ignored during this controversy. Furthermore, the government through the ban attempts to enforce its own interests and rationality: to support the domestic businesses in their competition with tech-giants that have changed the news-media landscape dramatically. Last, but not least, the central clash here happens due the rationality and interests of a commercial nature.

This is the point where the CC analysis itself benefits from an increase in fidelity that PP can provide. By recognising that more is at stake in this relation than just distribution of power and that by taking account that these power relations can still support free relation to technology in some ways, PP can provide a more nuanced edge to the CC analysis (Verbeek, 2013). This allows us to see that the struggle in this case is not only between a "commercial" and "communal" model

of the Internet, but it rather takes place through the way Facebook mediates the relationships of users with the news. This means that even if one accepts that overall a dominant capitalist rationality dominates the creation of technical codes (Feenberg, 2020), there is more to uncover in the relationships between actors through understanding how artefacts mediate their relationship to the world in different ways. As de Boer puts it (B. de Boer, 2020, p. 3):

> *"… developing an 'empirically informed' normative philosophy of technology requires to both recognize how technologies constitute particular forms of subjectivity as well as the rational processes through which such technologies are designed."*

To conclude, it is important to accept that there is more to conceptualizing technological mediation as a part of a power struggle than just serving pre-conceived notions of social justice and equality. Technology has the power to change the way humans view the world, clearly reaching beyond its instrumental functionalities while directly changing not only the individual, but society and culture in general (Coeckelbergh, 2018). As such, addressing these divergent views on relating to rationality in a way that brings their conceptualization within a single framework is an important step towards creating a theory that can address a wider spectrum of stakeholders.

Democracy

Potentiality

Accepting that discrimination through technological design can both solidify or challenge existing power structures points to the importance of technology within democratic systems (Rosenberger, 2020). The technically mediated subjectivity of the demos materialises itself in many forms that have direct effect on the way democracies operate; economies, laws, and bureaucracies are informed and formed by technical progress even where they themselves are not subject to a specific technical mediation (Bantwal Rao et al., 2015). Continuing the previous example, the way Facebook mediates the relationship of people to the news does not directly involve News Agencies or Governmental actors. However, by proxy, through its mediation the platform has been the cause of political controversy. While Facebook as of April 2021 has reverted the policy, criticisms of the platform have characterised this very idea as "undemocratic" (Clayton, 2021).

Both Feenberg and Verbeek recognise the role of Social Media platforms as a public space. However, neither CC nor PP could give a satisfactory account of this controversy. PP's methodological focus on the individual mediations that the technology contributes to loses sight of the grander-scale narratives that happen around the artefact (Coeckelbergh, 2018). Focusing

on how Facebook as a platform mediates the experience of getting news or engaging politically, the struggle between the News Corporations, Facebook, and the Government remains out of sight. At the same time the CC analysis gives hints on the power struggle between the different 'large actors'. It can successfully identify that the corporate interest here is infringing on a communal interest, but it does not account for the heterogeneity of the stakeholders – flattening the business interests and the interests of different users into monolithic and single-dimensional rationalities.

It is also important to recognise that CC is capable to identify the democratic potentialities (Gertz, 2020) by identifying the communal interests that Facebook as a platform can provide for: a space for the polis to unfold in a fair, open, and accessible manner. However, Feenberg pre-supposes that functionalities such as anonymity, freedom, and accessibility can only positively impact the democratic potentialities that for example Facebook carries. This kind of monolithic view of society through the communal model blinds CC to the potential that the very same values can be appropriated by anti-democratic elements, as many examples such as the rise of right-wing populism and the proliferation of conspiracy theories on the platform shows (Allcott & Gentzkow, 2017; Allington, 2021; Groshek & Koc-Michalska, 2017).

As such, despite its ability to recognise the "democratic potential of technological mediation" (Gertz, 2020), CC runs into its limitation when trying to understand a more complex "democratic actuality of the Internet" (ibid.). If a more holistic picture is to be drawn, CC may benefit from the theoretical account that PP can give on the ways that individual users experience the world through technology. Combining the two perspectives can provide a better view of what technology can become to fulfil its democratic potentiality, while at the same time avoiding an idealisation of the stakeholders involved.

Resistance

Verbeek's conception of PP embodies the Post-Modernist aversion to grand narrative in its avoidance of a political philosophy, focusing on the "technical" issues, ignoring the political/cultural struggles that technology can catalyse and mediate (Coeckelbergh, 2018). He does agree however, that democratizing the politics of technology should accompany technological developments, but would rather prefer to focus on productive democratic involvement instead of conceptualizing a struggle (Verbeek, 2013). However, the example of social media and how it mediates a qasi-public sphere for political engagement shows us that the individualistic, consent-based approach that PP represents (Coeckelbergh, 2018) in itself is not enough to conceptualize a resistance that can propel this democratization process. Short of a boycott of the platform, PP would have trouble with pointing the way forward in cases when

Facebook restricts what can and cannot be posted based on it's platform based on commercial interests.

CC represents an antipode to this individualistic conceptualization of resistance: Feenberg takes a communal approach and focuses on participation and communal innovation (Coeckelbergh, 2018). In pointing to democratic interventions as the embodiment of resistance to oppressive behaviours (Feenberg, 2017), CC reinforces its 'social-struggle view' of technology. Organising resistance along these lines of 'social struggle' make some basic presumptions: on the one hand that the "communal model" serves some monolithic single-minded "society" that represents a stable set of values that are unchanging and widely agreed upon; on the other hand, that the modes and opportunities for participating in these democratic interventions are universally achievable by all 'oppressed' stakeholders. As such, CC recognizes the ambivalence of technologies for different social classes but is somewhat blindsided by how the technologies can be just as ambivalent within a certain social class. For example, to preserve the idea that the "communal model" of the internet for example is unequivocally a overall democratically positive development, Feenberg dismisses civic activity that detracts from democratic processes (Allcott & Gentzkow, 2017; Allington, 2021; Groshek & Koc-Michalska, 2017) as the result of a "few bad apples" (Gertz, 2020).

Conceptualizing resistance might benefit from drawing upon both perspectives to cover the shortcomings of each – all while becoming more relevant to all stakeholders. First of all, since both Feenberg and Verbeek agree that technological development is inherently political (Feenberg, 2020; Verbeek, 2020), it should be a public matter subject to democratic processes and not left to "private" actors to steer (Coeckelbergh, 2018). At the same time, Verbeek points out that instead of a modernist "steering to protect the public", one should focus not on imposing a specific "good life", but rather allowing a "rich-plural context to answer questions of the technologically mediated good life" (Verbeek, 2013). Creating that "rich-plural" context however, often seems to necessitate organised resistance – but keeping in mind that if technologies shape values, the stability and nature of these values also must be challenged and not taken as an unchanging standard (B. de Boer, 2020).

Reflection on describing or facilitating resistance should not focus purely on the power relations between the 'controlling corporations' and the 'democratic society'. Technology is more complex than the clash of a "community model" that supports democracy and is 'good', and a "commercial model" which is against democracy and slowly encroaches on the community centric nature of the internet (Feenberg, 2017) . In order to not perpetuate the "blackmail of the Enlightenment" that "whoever is not with us is against us" (Verbeek, 2011), society could

concentrate on what kind of mediated subject does one want to be and how humans co-shaping their subjectivity with technology functions as a political act (B. de Boer, 2020). The added nuance could uncover for example detractors of the democratization process within 'communities', as well as underline and praise local progress made by 'business interest' where it indeed serves democratic values.

Organising resistance around the shared desires for specific technological mediations should at the same time conserve a critical perspective. Departing from the idea that equating business interest with oppression and free public participation with emancipation is misguided should not mean that power imbalances between stakeholders should be ignored. Facilitating resistance can benefit from concentrating on the mediations – but that cannot happen without examining the rationalities of the stakeholders who influence the development of the technology (B. de Boer, 2020).

Action

Both Feenberg and Verbeek agree that Post-factum resistance is only part of the picture. Feenberg's call for "democratic intervention" for example adds an additional dimension to resistance by sketching out the outlines of modes of social involvement in technological governance through public participation (Feenberg, 2017). Due to his more individually-oriented philosophy, Verbeek focuses more extensively on examining the design process and suggesting modifications that would support the anticipation and design of mediations that would align technological progress with societal requirements (Verbeek, 2005, 2011). Where both authors agree however is the notion of a "democratization" of the way technology is developed is a necessity (Feenberg, 2017; Verbeek, 2013).

Doing and talking

In his eleventh "Theses on Feuerbach", Marx expressed his opinion that "The philosophers have only interpreted the world, in various ways; the point is to change it." (Marx, 1845). In developing their theories, both Feeneberg and Verbeek have seemingly embraced a similar stance – both attempting to integrate empirically-informed perspectives. Furthermore, both authors appear to be concerned with a 'practical application' of their theories. Where Feenberg talks about democratic interventions and builds blueprints on how to integrate technology into society (Feenberg, 2002, 2017), Verbeek advises designers on how to improve their designs such as to allow for the freedom of the user (Verbeek, 2011).

In order to really be able to approach an 'actionable' take on the Philosophy of Technology and promote its impact on the democratic potentialities of technology, one must start by understanding what "doing" vs "talking" about technology means (Van Den Eede, 2020)

Yoni van den Eede claims that in the process of trying to leave behind instrumentalist and substantive approaches of the past, both CC and PP focus on what is there to be explicitly *done* (Van Den Eede, 2020). He questions this stance, and poses the question of how can one "do" without tacit assumptions on values and rationalities? According to him, the answer to this question is in trying to re-think technology not only in the sense of having agency, but also returning to the question of purpose in the form of a "purposive structure" (ibid.). CC and PP can provide two perspectives that can be utilized to synthesize such purposive structures.

Drawing the two together is possible and must be encouraged if we aim to create a more actionable framework (Van Den Eede, 2020). Since real-world technological situations are fundamentally goal-oriented, approaching design with the goal of maximizing the democratic potentialities of technology should start with "talking" about the mechanisms that shape the contexts within which the designer, the users, and the technology is operating; but then also focus on "doing" at the local sites where purpose is both created by and acted upon by technological mediations. In such a framework all stakeholders would gain a seat at the table, and could actively engage in the design process.

Design

Possibly the most influential site of action when it comes to technological development is the design process. Both Feenberg and Verbeek agree in the importance of focusing on design. In analysing the potential of different democratic interventions to promote democratization, Feenberg clarifies that while post-facto democratic action has shown great promise in issues such as environmental protection, addressing the issues 'pre-factum' in the very design of an artefact is the optimal solution (Feenberg, 2017). Albeit with a different focus, Verbeek also concludes that even though previous PP authors such as Ihde have questioned the possibility of "designing in" mediations to artefacts, he believes that anticipating and addressing mediations in the design stage is an important step towards enhancing democracy (Verbeek, 2020).

In discussing design, the main difference of focus between the two theories yet again becomes apparent. CC focuses on political participation as the tool for democratization, while PP almost exclusively addresses the provisions that the designers themselves can enact (Bantwal Rao et al., 2015). Where CC finds the limits of democratic design as being set by a social hegemony, PP sees the limitation as being dictated by the capacity of the designer to imagine and foresee the

impacts of the artefact. As a result, by focusing on the CC perspective one might underestimate the capacity of the users to transform technologies in a way that their original design ignores – or even lose sight of the technology itself in favour of the social structures around it (Cressman, 2020). On the other hand, the PP focus highly "restricts agency to the professional class", making democratic involvement the responsibility of the designer themselves (ibid.).

Where both CC and PP agree is that one of the key elements and challenges of design work the "translation of layman terms to technical specification" (Feenberg, 2020). In both cases there is an agreement that technologies embody values and political ideals, and as such increased democratic involvement in design is a necessity (B. de Boer, 2020). A way towards achieving this goal without resorting to the "hubristic desire to design our way out of problems" (Cressman, 2020) might also be in the combination and selective use of the CC and PP perspectives on design. As such, developing specific design methodologies that incorporate the critical perspectives and suggestions on democratic interventions from CC with the empirically informed and pluralistic analysis of PP could be the first step towards a better technological system.

The Internet Revisited

Having established a theoretical basis for the complementarity of Critical Constructivism and Postphenomenology, a re-analysis of the seminal case of the Internet taking into consideration the new observations would be beneficial as a showcase of how the two theoretical perspectives together could provide us with a holistic picture. This analysis is mainly based on Feenberg's analysis of the Internet, since it presents a larger scope than the specific case of Social Media and Facebook that Verbeek has concentrated on. The goal of this analysis is to attempt to conceptualize what are the areas that the existing literature has made successful contributions to the development of a 'unified' CC-PP perspective, while at the same time investigate what are the areas that are lacking.

Origins of the Internet

Accepting that technology and society are co-constituted points to the argument that technological development is an ongoing process that is based on both past technologies and social structures. As such, the historical context of the development of the Internet is an important source of information towards understanding both the current state of the technology, as well as predict future developments.

The origins of the infrastructure that ultimately led to the development of what we currently understand as 'the Internet' are a good example of the complex interplay between large-scale interests and localised appropriation. Initially, the technology was intended to serve the interests of the US military (Mowery & Simcoe, 2002). The technogram contributing to the technical code of the pre-Internet consisted of technical elements appropriated from pre-existing radio and telecommunications technologies (Feenberg, 2017). Since the project was funded by the military, the original sociogram was dominated by the military interest and the rationality towards serving them.

Early Rationalities

The military's rationality was driven by the belief that the infrastructure must be open and distributed for two reasons. The physical distribution of the infrastructure would be better suited for defensive purposes than an easy-to-attack centralised system. At the same time, the military recognised that computer-related technologies will be the future key for military superiority, and supporting the development of this communicational infrastructure for academic and civilian uses was a necessity (Mowery & Simcoe, 2002). It could be said, that from their position of power as the driving rationality behind the technical code of the early Internet

(Feenberg, 2017), the military attempted to foresee and explicitly design the 'artefact' with promoting specific mediations in mind.

The original intended functionality of this network was to "support shared use of the scarce computing resources located at a few research centres" (Mowery & Simcoe, 2002). Extending access in such a way meant that the infra structure of the pre-Internet itself would facilitate an embodiment relation (Verbeek, 2005), where the researchers could utilize far away computing resources as if they were local. Ideally, this would have meant that the infrastructure itself would be as "transparent" as possible, and the experience of interacting with the computing resources would not differ whether they would be in the same room or across the continent.

The users were free to relate to the technology in the way that they chose – since the infrastructure and protocols were explicitly designed to be flexible and adaptable instead of being reliant on the telecommunication monopolies of the USA at the time (Mowery & Simcoe, 2002). Groups of users were quick to take advantage of the near-instantaneous and low-cost communication platform that the internet provided, and developed the "first killer application", the electronic mail (Mowery & Simcoe, 2002).

Expanding Rationality

This development was significant for a number of reasons. First of all, it can be seen as the demarcation of the definition of a new group with their own interests and rationalities: the userbase consisting by engineers and scientists who had access to the network – independent from the directly military-funded project. The true 'hybridization' of the system originates from this point, since the same technology starts to serve different rationalities (Feenberg, 2017). On the other hand, this early development is a great example of a case where the mediation that a specific technology provides increases personal freedom.

The technology has been "inscribed" with this distributed-democratic nature in mind (Verbeek, 2011), with the users themselves taking responsibility for what they were to do in relation to this technology. As such, the Pre-Internet was a technology that while being defined by larger interests, allowed its users to 'democratically intervene' by taking responsibility and appropriating elements of the system accordingly to their own rationality. At the same time, one might point out that this was only possible because of the unique userbase that was comprised of people who were technically capable of moulding the technology to their needs.

This pattern of unexpected appropriations of the infrastructure repeated itself several times, and it is one that continues to our very day. However, it is easy to see that with the exponential increase of the userbase the proportion of these designer-users within the general userbase

dramatically drops. This means that over time the way the technology mediated the users relation to the world also changes, since the userbase itself is qualitatively different. In parallel with this change in userbase, one must also note the increasing business interest in the platform. While the pre-internet circumvented the established telecommunication companies, with increasing demand the infrastructure was then built out by the very same telecommunication companies (Feenberg, 2017; Mowery & Simcoe, 2002). Even more significantly however, the ever growing userbase and the different ways they appropriated the network inevitably drew the interest of a wholly new player: the business interest. As such, the technical code that defines the Internet is undergoing a change that alters the previous 'stability' of the system – as well as changes the way it mediates the relationship of humans with the world and the impacts that it has on its environment.

Contemporary Actualities

On a general level, it could be said that the Internet as an infrastructure still carries the original vision of mediating an embodiment relationship: the infrastructure is the 'invisible' medium through which users can interact with the world – possibly even more so with the less technically inclined userbase. Amongst others this might be thanks to a certain inertia present in large systems as such – changing infrastructures takes time and large investment after all. What has drastically changed over time however is the mixture of competing interests that form the technical code of the process of developing new functionalities. This shift has great significance in how the Internet as a general technology will develop, and in turn what its impacts on human and nature alike might be.

To understand the elements and pressures that contribute to the development of the technical code of the Internet at large, it is not enough to present an analysis based on some generalized idea of cohesive social groups. Ideology and different rationalities are dispersed not only 'vertically' between varying social strata, but also 'horizontally' amongst members of different strata. To uncover the rationalities present within the system, one needs to first observe how different individuals relate to the technology in their own specific ways. While these differing rationalities are represented to some extent in all technology, possibly the best site to observe them are controversies and disagreements – situations where the 'cracks' in the system already exist, that one could pull apart to see inside.

Democratic Potentialities

Taking the example of the impact of the Internet at large on public participation in politics and as an extension democracy in general, this dynamic can be well observed. In this regard, the

technical code based on which the current Internet is built conserves values that are closely related to what one could readily identify in their relation to a democratic rationality: social hierarchy is less prominent as everyone gains access to mass-communication, anonymity exists to protect the oppressed, and freedom to share information can inform the users in ways previously reserved for the few. There is empirical truth to these characteristics of the system being utilized in ways that support public participation – but taking a closer look one could see that this participation is not necessarily in the service of democracy. The contribution of the Internet in emancipatory action such as the Arab Spring (Salem & Mourtada, 2011) is undeniable, but so is its enabling role in the proliferation of explicitly anti-democratic movements and conspiracies (Allington, 2021; Groshek & Koc-Michalska, 2017).

This is not to suggest a return to an instrumentalist view of technology, where its neutrality is appropriated by humans for their ends. Quite the contrary, this example comes to show how technology has the potential to change society by mediating the relationship of individuals with the world. At the same time however, it goes to demonstrate that increased public involvement should not be automatically equated with the promotion of democratic values, since 'the public' is not a homogenous mass with a single shared set of beliefs. At the same time, this phenomenon can also act as a refutation of deterministic approaches, since even though the technology could be understood as being pre-disposed to support a democratic rationality, the users found ways to appropriate it to the opposite effect.

Corporate interventions

Further pulling at the seams of this controversy, the ambivalent position of the business interests of the platform owners also emerges. As of February 2021, the likes of Twitter, Facebook, and Youtube have banned groups deemed to be involved in far-right wing and clearly anti-democratic activity (Estes, 2021). On the one hand this action could be likened to the banning on public hate-speech; in reality in Germany hare speech online is considered exactly under the same legal terms as public hate speech would since 2017 (Illing, 2021). On the other hand however, it does uncover a potentially dangerous power position that the platform owners enjoy: while the problematic nature of some online groups has been well established for years (Groshek & Koc-Michalska, 2017), these platform owners were both able to and chose not to previously ban these elements from their platforms.

Bans like this and the systems that are designed to enact them (by community-supported means such as a "report" functionality, or even by machine-learning based moderation bots) as such actively remove a type of freedom of relation to the platform while supporting an "axis of difference" type of discriminatory policy (Rosenberger, 2020). In other words, this action

introduces inconsistency to the way the system treats different people. While one might arguably say that this kind of inconsistency is not problematic, it would be hard to deny that its existence raises some difficult questions regarding who is responsible for the actions of self-organizing citizens on an online platform?

The citizens themselves are of course, at least partially responsible; however, if we accept that their actions have been mediated by the technology, then responsibility could also lie with the platform developer. If the platform developer bears responsibility and is liable to moderate political discussions on their platform, then based on what rationality and guidance do they decide what kind of policies to enact? Arbitrarily enforcing policies on political engagement based on the ideology and rationality of the governing body of a private entity would be inherently undemocratic. At the same time, extending governmental oversight to these platforms is not a perfect solution either – especially since democratic political insurrections online often target the very same government and as a result such oversight would curb the democratic potentialities of the internet even further.

This analysis is by no means intended to be all encompassing, and I do not attempt to answer any questions. It is clear however that on their own, neither a power struggle between the 'democratic' "community model" and the "commercial" model that is in implied antithesis with democratic interests (Feenberg, 2017); nor an individual-minded "freedom of relation to the mediation" perspective (Verbeek, 2011) can fully account for the nuances of a complex and rich technologically mediated reality.

Conclusion

What Works

This short demonstration of how one could approach a case by combining perspectives from CC and PP might support the merit of the suggestions regarding their reconciliation and combination. I believe that it is especially interesting that the two theories seem to mesh in ways that can address the critiques of each to some extent. For example, the tendency of CC to view larger groups in a monolithic way that arguably pre-defines what the interests of each group are (B. de Boer, 2020) can be very well supplemented by the local-analytical approaches of PP. At the same time, this connection also provides a critical perspective to a PP which can be often preoccupied with not making normative judgements – to the point of implying a conservative and protective stance towards the societal status-quo (Bantwal Rao et al., 2015).

One of the key motivators of both Verbeek and Feenberg is the understanding that there is a necessity to account for the co-constitutive nature of technology and society. Ultimately

however, both end up focusing on one end of the spectrum – with CC being concerned with more structural questions, while PP concentrating on local mediations. As such, the attempt to find a bridge between the two frameworks allows us to provide a picture where one can 'zoom in and out' of the different layers of society. I believe that this ability to move 'vertically' between the interaction of the individual with technology and how that mediates their relationship to the world, while at the same time being able to contextualize these individual relationships in a larger structure is the key towards the next step in understanding this dynamic relationship.

In other words, I see this combination of perspectives as "different tools in a toolbox" (Van Den Eede, 2020). If we view the co-constitutive nature of society and technology as an immense spider's web of interconnections that form the system, by employing the tools that the two theories provide we may be able to have a better understanding of how the system is impacted by the pulling of each individual strand – but also what kind of overall forces are there within the web and how the individual strands are affected by the tensions. In this sense, the goal of a holistic understanding of the relationship between individuals, society, technology, and the world maybe has to include both the perspectives that CC and PP provide.

This added holism in turn is an important contributor to the robustness of the theoretical offering of philosophy of technology. By addressing the perspective of all stakeholders within a single framework allows the theory become the basis for discourse between the different rationalities. Instead of being biased towards specific stakeholders, a theory based on both CC and PP perspectives could be fertile ground to develop technologies that contribute to the betterment of technology in ways relatable to all stakeholders.

Missing Pieces

While the summary of existing literature on the topic seems to point towards the notion that the co-use of CC and PP is a beneficial idea to consider towards making philosophy of technology more approachable for more stakeholders, I do not believe that my concerns about the disconnect that currently exists are fully resolved this way. I believe that in order to overcome the gap between users, industry, legislation, etc, future steps in philosophy of technology must address a number of specific issues.

Political Theory

In the previous chapter focus was mainly afforded to the elements of the two theories that present little to no contradiction. However, the question of the Political Theory inspiration and backing was mainly avoided – or at least brushed aside. The reason for this lies in the fact that probably the biggest disagreement between the two theories is a normative one: Feenberg

takes his political inspiration from an undoubtedly socialist school of thought (Feenberg, 2002, 2017), while Verbeek takes a liberal democrat stance (Verbeek, 2005, 2011).

While seemingly divergent, the way the two authors incorporate their political stances into CC and PP respectively results in a conceptualization of resistance that is not fundamentally different: the users shape and transform their technically mediated experiences, they neither can nor should escape the meaning-giving power relations, and social groups take an active part in negotiating the cultural underpinnings of technical action (Bantwal Rao et al., 2015). I believe that this points to the possibility of there being a political-theory framework that could encapsulate the parallel use of CC and PP perspectives in a coherent way – it might just not be either the Critical Theory basis that Feenberg supports, or the Liberal Democratic/Libertarian adjacent ideology of Verbeek.

Consensus on the inherently political nature of technology exists across the bord, and as such the disconnect between the underrepresented stakeholders and the groups who are most influential in the decision-making process of technological development needs to be addressed. As such, I do think that one this direction of finding a theory that allow for both theoretical perspectives to 'co-habit' is an important step in closing the disconnect between the different stakeholders by providing a scaffolding for their power-interactions.

Design Democratization

An area that both Feenberg and Verbeek seem to be somewhat lacking is tools that can guide different stakeholders such as designers, users, management, etc. towards cross-disciplinary collaboration. They both agree that increasing public participation in the design process is a central goal towards future development of technology, but yet again their respective focuses turn to different angles of the topic. Feenberg talks about Democratic Interventions, and calls on the users to organise and demand that their input is heard (Feenberg, 2017); Verbeek on the other hand almost exclusively addresses designers (Verbeek, 2011). Even Rosenberger's suggestion that I have put forward is not in on itself one that is able to incorporate the dual focus of the CC/PP combination.

I firmly believe that in order to truly be able to "do" and not only "talk" about technology (Van Den Eede, 2020), there is a necessity to develop actionable frameworks that account for more than just advising one or other party on how to act. Instead, I stand by the notion that developing frameworks that encourage and facilitate interdisciplinary action could be the way to facilitate conversation when there is willingness form the design perspective for public involvement – as well as provide the public with means of making their demands more tangible in a language

understandable to designers and other stakeholders. As such, I believe that in parallel to developing the framework through embellishing it's theoretical underpinnings, there exists a methodological vacuum in tools informed by a joint CC/PP mentality.

Addressing this methodological vacuum is equally important with establishing a more satisfying theoretical framework around the new theory. After all, I would argue that no matter how 'good' a theory is, if it's adoption by the different stakeholders does not happen, it shall forever be stuck in the 'ivory tower' of observational academic interest. Based on my experience, stakeholders such as industry and users often lack the tools to communicate, and I believe that a philosophy of technology that aims to have practical impact must be concerned with providing these tools and frameworks.

Importing inspiration

The creation of a comprehensive theory, even if heavily borrowing from previous theories, is by no means a simple task, and not one that I attempt to undertake in the constraints of this thesis. The previous analysis of CC, PP, and the discourse on their comparison and reconciliation points to the ways in which the two theories can help to bridge the gap between the various stakeholders however underlines some directions towards which future work in the field could move. In this chapter I take up the task of making two suggestions that each address the disconnect between industry, society, and academia in a different way.

Firstly, in order to build the next step of philosophy of technology, I believe that it is important to address the political philosophy disagreements between CC and PP. Spurred on by the opinion of scholars that the two theories share more than what they disagree in (Bantwal Rao et al., 2015; Ihde, 2020), in this chapter I dip into anarchist thought on technology as a possible 'wrapper' to a philosophy of technology based on ideas inherited from both CC and PP. The reason for this choice is that I see anarchist philosophy to sit between Feenberg's socialist requirements, and Verbeek's more liberal/libertarian individualistic tendencies. Basing future efforts on a political philosophy that fulfils the requirements of both perspectives is an important step to build a consistent and solid theoretical framework that can provide the normative basis for interventions of the future into our technological system.

Secondly, I argue that if the goal is to develop theories that have tangible impact on the world, ways of closing interdisciplinary and inter-stakeholder gaps is one of the most crucial elements of a theoretical framework. As such, I believe that the future development of the field must take engaging with design methodologies as a central consideration with an equal importance with a political theory underpinning. Towards this end, in this chapter I also touch upon an example of a methodology that could provide the basis of communication between groups with different perspectives, interests, and expertise.

Anarchist Inspiration

I argue that discourse on power, democracy, and resistance is an inherently political discourse, and as such merits an explicit political-theory discussion (Bantwal Rao et al., 2015). It is not surprising that Feenberg's approach for example heavily draws from political theory in the form of its Critical Theory roots (Feenberg, 2017). Even Verbeek, who explicitly rejects grand-scale narratives (Coeckelbergh, 2018), has explicitly addressed the political aspects of his theory by

referring to a “libertarian paternalism” (Verbeek, 2020) in addition to his explicit Liberal Democratic ideology (Verbeek, 2005).

However, if one is to accept the premise of using CC and PP in a synergistic manner, it might be necessary to consider what kind of political-theory ‘wrapping’ supports the resulting perspective. If the next step in philosophy of technology would be one in an explicitly application-oriented direction, such a theory should be able to not only describe, but also to prescribe the forms that power relations take between the different stakeholders. On the one hand, taking a prescriptive normative stance preserves a critical angle that I believe to be necessary for the betterment of our technological system. On the other hand, I also find the descriptive angle to be critical as to remain open to nuance and fidelity – and not get lost in pre-determined ideological analysis that may not correspond to reality.

As such, it must also account for both the larger scale systemic dynamics, but also for the individual impacts and contributions to that greater system. The theory should conceptualize the struggle between competing rationalities - not only on the interface of different groups of stakeholders, but also allow for analysis of the competing interests within a group of stakeholders.

I believe that an interesting perspective to consider is the way Anarchist philosophers of the past have thought about technical action. I see Anarchist philosophy as a meeting point of the perspectives of CC and PP, since it allows for both he social and individual perspectives that CC and PP take respectively to operate as a part of the same system. In the following sections I explore some of the basic principles of Anarchist philosophy and explain how they relate to CC and PP. Furthermore, I present some existing thought on technology from contemporary anarchist philosophy and see how they compare to the unified CC-PP perspective. Finally, I shortly evaluate whether I believe that an Anarchist inspiration would be a possible good fit for the next step in philosophy of technology.

Anarchist Principles

I would argue that introducing an Anarchist-oriented perspective must start with the discussion of the basic anarchist principles that sit at the heart of most existing flavours of anarchism: self-management, non-domination, and empowerment. I believe that these principles resonate well with both CC and PP, and as such could be the link between anarchist thought and contemporary philosophy of technology.

For starters, Verbeek talks of “paternalistic libertarianism”, in essence describing a protection of the right of the individual to freely choose how they relate to technology – even if it is

designed in a way to promote a specific mediation (Verbeek, 2020). He believes that technology creates availability that can lead to freedom of choice; a freedom that each individual should be able to enjoy and utilize to achieve what they believe to be "the good life" (Verbeek, 2005). Feenberg focuses on a societal level, talking about the oppressors and the oppressed, but essentially his suggestion is not in a different vein to that of Verbeek. In fact, Feenberg recognises the similarity, and suggests that it is easy to switch out a collective perspective for that of the individual that Verbeek takes (Feenberg, 2020). Essentially the belief that users should be free to decide for how technology impacts their lives is not different from the first 'tenet' of anarchism: striving for self-management (Martin, 2015).

Feenberg's conceptualization of self-management however happens against a background of oppression by a hegemony (Feenberg, 2002). Verbeek rejects the idea that there is an elite who's power should be broken (Verbeek, 2013), but at the same repeatedly reinforces his belief in Liberal Democratic values – specifically expressing his belief that neither technology nor society at large should strive to actively limit the freedom of the individual to interact with the ways technology mediates their experiences(ibid.). However, at their core both Feenberg and Verbeek agree that we should move away from any kind of coercive practices in relation to the development of technology. This apparent disagreement could also be viewed as a slightly different reading of the second tenet of anarchism, non-domination (Martin, 2015). Even though Feenberg finds domination in the existing class system (Feenberg, 2017), while Verbeek argues that the site of oppression is the technical restriction of freedom of relation (Verbeek, 2020), in both cases the essence of the non-domination tenet is the guiding ideal.

Finally, through their calls for democratization, both CC and PP embody the third tenet of anarchism: empowerment – the right of individuals to be given maximum support to develop their capacities (Martin, 2015). Feenberg calls for technology to be created with the collective involvement of the 'people' through "democratic interventions" (Feenberg, 2017). Seemingly in contradiction, Verbeek's notes that democratization should mean the creation of a realm of public deliberation instead of artificially giving power to the people that was taken away (Verbeek, 2013). I would argue however that the creation of these 'realms of public deliberation' and 'democratic interventions' are in reality one and the same: the creation of mechanisms that empower the individuals to make their demands heard.

Looking at the compatibility between the anarchist principles and both CC and PP, I believe that we can state that anarchist philosophy is a good candidate for functioning as the theoretical basis for a future philosophy of technology. More importantly however, I believe that the anarchist perspective could contribute positively to the effort of closing the gap between theory

and the different stakeholders. Its principles would ensure that this new generation of philosophy of technology would be one that sits closer to the different stakeholders by emphasising self-management and empowerment. Furthermore, by enshrining non-domination in the heart of the philosophy, the democratic potentialities of technology can be defended.

Anarchist views on Technology

According to Anarchist Theorist Uri Gordon, the outlook that anarchist movements historically took to technology parallels the 'First Generation' Philosophy of Technology (Gordon, 2009). On the one hand, anarchists have viewed technology with a substantivist suspicion akin to Heidegger - ranging from branding new technological developments as inherently oppressive to a direct primitivist rejection of what they perceived as 'technology' at large. On the other hand, taking an instrumentalist route, others have touted technology as inherently progressive. Similarly to Marx, they believed that upsetting the existing social hegemony would itself be enough to stop technology from being the tool of the oppressor. As such, class struggle would emancipate technology to reach its maximum democratic potentiality.

As anarchists of the past have mirrored the instrumentalist and substantivist outlooks of other philosophies, contemporary anarchist thought on technology follows the ideological developments of the past decades in the recognition of the co-constitution of society and technology. For example, Gordon draws extensively on Langdon Winner's work on the politics of artefacts as the basis of establishing a contemporary anarchist view on the politics of technology (Gordon, 2009). In doing this, he goes through paces that definitely ring familiar to Feenberg and Verbeek's work.

He starts creating this basis for a contemporary anarchist take on technology by quoting Winner in that "technologies are not merely aids to human activity, but also powerful forces acting to reshape that activity and its meaning" (Winner, 1980); a sentiment equally echoed by CC and PP. Furthermore, he highlights issues such as the intentionality of design in how technology can be biased towards one or another function – yet again a field of argumentation that we have previously seen both Feenberg and Verbeek touch upon in their work. He draws on three "general maxims" that Winner proposes to inform the development of technology.

First, technologies should be understandable on a "human scale", meaning that they should be "immediately intelligible to nonexperts" (Gordon, 2009). While neither CC nor PP directly presents such a criterion, I believe that in both cases the necessity to fulfil this criterion is implied. No democratic intervention could function without the demos being able to understand the artefact at least conceptually. At the same time, free relation to the way it mediates the

relationship to reality cannot be achieved without the ability to 'read' the capabilities of the artefact itself.

Secondly, Gordon calls for technology to be created with a high degree of "flexibility and mutability" (Gordon, 2009). In other words, the artefacts should allow the user to appropriate them in a wide range of ways – be that finding alternative uses or physical modification. This maxim also rings true in a unified CC/PP framework. No matter if we are talking about the individual or the social, the mutability of artefacts is an essential characteristic of democratization of technology. On an individual level, the openness of an artefact to be modified or used in ways that the user wishes is the material embodiment of Verbeek's 'free relation'. On a societal level, achieving elegant artefacts with high levels of concretization that Feenberg calls for can be greatly supported by allowing said artefacts to be locally modified and re-interpreted.

Lastly, Gordon stipulates that technical systems should be judged based on "the degree of dependency they tend to foster (less is better)" (Gordon, 2009). High degrees of dependency on an artefact could be seen as a major limiter to the democratic pressures that the individual or groups of individuals are able to express. It could be said that high dependency on an artefact creates power imbalances in a system, in a way that both CC and PP reject.

As such, we can see that the anarchist perspective on technology not only runs parallel to the CC and PP perspectives, but also could contribute to importing a perspective into them that would support the goal of making the next step in philosophy of technology one that would bring closer theory with practice. Gordon's effort to bring technology and its development closer to the users fits this goal – all while at the same time not contradicting the freedoms that PP demands, or the normative stance that CC sets.

An Anarchist take on the Internet

With some theoretical basis established on an anarchist outlook on technology, how would an anarchist analysis look like in relation to the previously described combined CC/PP perspective? In addition to Gordon, Brian Martin in his article "Anarchist shaping of technology" (Martin, 2015) also offers a short take on the Internet as a communication tool from an anarchist perspective, that I will shortly summarise and relate to the CC/PP discourse here.

Martin departs by addressing the history of the infrastructure of the Internet. He points out that despite the fact that the development of the technology has been mainly in governmental and corporate hands, as a communication tool it is useful for the development of participatory politics. While there is no direct allusion to why this is the case, this analysis rings similarly to

Feenberg's CC analysis of on how the military origins of the internet preserved a rationality of decentralization, even in face of corporate encroachment (Feenberg, 2017).

As such, in a similar vein to Feenberg and Verbeek, Martin recognises that the Internet has become site of conflict between free communication and control (Martin, 2015). He points out that the very nature of communication has fundamentally changes by the pluralistic nature of social media and its highly interactive nature. Compared to the "easy to control narratives" that the one-to-many model of communication that traditional media offers, the Social Media allows for "knowledge [to be] pooled together" (Gordon, 2009).

The ease with which users can form these knowledge pools is often used as the best example of how the Internet can foster anarchist action. For example, both Gordon and Martin point out the Open Source community as probably the greatest example of anarchist ideology in action in our days. By taking parts of the Internet to function as "electronic commons" (Gordon, 2009), the "hacker ethics" (ibid.) of free manipulation, circulation, and use of information, align with the overall goal of radical democratization that anarchist philosophies, similarly the PP notion of free relation to mediation, demand. Furthermore, even in the design process, Open Source represents a radical democratization that not only aligns well with anarchist philosophy, but one that reminds one of the democratic interventions that CC demands.

Limits of Self-Governance

The potential of Internet to function as the centrepiece of radical democratization and non-violent struggle (Martin, 2015) is only part of the story. In addition to recognising the positive potentialities that such an artefact has, we must also strive to recognise the limitations that any system presents. In order to uncover the limits, such considerations should focus on both process and product in equal measures.

Taking the example of Open Source development, despite its idealistic outlooks, the current model is not entirely ideal. For one, while contribution is theoretically free, and the technical elements are open to scrutiny, only those with specific technical know-how can truly understand and contribute to the communal decisions made in the steering of development (Martin, 2015). The danger of system lies in that the majority of decisions is made by a minority of the community – often without further consultation or effort to facilitate involvement by non-technically knowledgeable segments of the user base (ibid.).

This limitation reflects limitations also present in CC and PP. On the one hand, Feenberg's pro-factum democratic interventions are in theory not limited in the case of Open Source, as anyone interested is invited to contribute. However, the fact is that sans special facilitation of wider

outreach and involvement, such public participation is still limited to specific segments of the public. As such, while the intent is good, we run into the same issue with Verbeek's 'benevolent designer' by relying on this specific segment to make the decisions that lead to general emancipation. One could argue that since the process is open and transparent, one could potentially become technically informed to participate in the process in ways that adds to the benefits of the resulting artefact according to their own interests. However, this privilege is still limited by several factors, such as socioeconomic standing or physical ability.

The limitations of already existing artefacts while distinct from the limitations of the developmental process, are not entirely dissimilar. Using the example of the Internet, Gordon points out that despite its immense emancipatory potential due to its distributed nature, one must remember that the infrastructure is far from being decentralized (Gordon, 2009). On the one hand, the physical infrastructure is still greatly run by large corporations that could theoretically impose restrictions as they will – and are currently held back only by governmental regulation. On the other hand, the fact that most contemporary platforms are not developed in an Open-Source fashion due to the economics of the cost of upkeep and development must be kept in mind when talking about their emancipatory potential. As we have seen previously, the influence that a company such as Facebook has on the politics of the world is immense. What is allowed or prohibited on the platform can make revolutions, silence critiques, or spur insurrection. As such, Gordon suggests a "disillusioned approach" to utilizing the Internet as a tool for radical democratization: "employing it for subversion while remaining aware of its being a temporary anomaly" (Gordon, 2009).

Conclusion

What does this short detour into anarchist-inspired philosophy of technology tell us about the potential of utilizing anarchist ideologies as a wrapper for a unified CC/PP theory? I believe that there is potential in such an endeavour, as I find that the anarchist viewpoint often fulfils the criteria of both CC and PP – providing a basis of unification of the two 'tools' into a singular toolkit.

Many parallels exist between how CC, PP, and anarchists see technology. In addition to the topics on which there is universal agreement between the three in some way, I believe that the most significant site where the anarchist perspective can contribute to the combined use of CC and PP perspectives is that of conceptualizing the importance of both process and product. I believe that this 'dual focus' of anarchist philosophy lends itself to acting as the 'glue' when using the CC and PP perspectives as "different tools in a toolbox" (Van Den Eede, 2020).

Wrapping the analysis into this anarchist-inspired wrapper allows us to overcome the limitations on what "invisibility" CC and PP each focus on. I believe that contextualizing technology within an anarchist framework could allow us to overcome the predisposition of CC and PP to steer our attention to the "vertical" and "horizontal" tensions, respectively. Instead, contextualizing tension and impact to the process and the product creates a framework that allows us to use concepts from CC and PP at the sites where their strengths can be utilized best. For example, the CC perspectives on larger narratives and structural thinking might be better suited to the discussion of process, while the more localized understandings of PP could better explain the relationship of users with an existing artefact.

On a political level, the anarchist-inspired wrapping is effective in addressing the concerns of both Feenberg and Verbeek to some extent, while not 'sacrificing' ideological standpoints of either. For example, the socialist sensibilities and concerns about hegemony that Feenberg bases his analysis on are expressed in the basic tenets of anarchism: non domination is an essential driving moral. However, by focusing on self-determination, an anarchist-inspired philosophy of technology could overcome some of the critiques that Feenberg received. For one, by focusing on self-determination instead of the enforcement of a specific rationality the questionable 'monolithic' way that CC on its own views the relations between 'oppressors and oppressed' is recontextualized and resolved with higher fidelity. This also operates well with the PP focus on freedom instead of the enforcement of specific ideals. On the other hand, such a framework is still able to provide an outlook to the oppressive nature of parts of the system, and strives to their solution – instead of accepting them and trying to operate passively within their limitations as PP has been critiqued to do.

Lastly, I believe that the self-identified limitations of the anarchist understanding of technological development are also applicable as a summary of the shortcomings of CC and PP. CC calls for radical democratization and democratic interventions – but does not consider questions of expertise; PP calls for designers to act in the interest of the user – but is not concerned with the motivations and rationalities that they must operate under. The anarchist perspective underlines that even when we assume that any kind of 'radical democratization' by providing access and possibility of involvement on its own is not enough. Furthermore, it reminds us that limitations exist even if all human individuals can influence processes and utilize artefacts to their interest: the rationalities of some 'silent masses' are still easy to ignore.

As such, I believe that there is basis to borrow anarchist perspectives in future endeavours of further developing philosophy of technology. However, at the same time I believe that the shortcomings of the provisions for public participation by all CC, PP, and Anarchist theorists is

another topic that necessitates further integration into future theories. I am convinced that if philosophy of technology indeed wants to escape the realm of 'talking' and wants to firmly enter the realm of 'doing', integrating guidelines that can serve as the basis for developing provisions for public participation is an integral part of the 'next step'.

Translating Rationalities

I believe that an important part of taking the next step in practical application of any contemporary empirically rooted Philosophy of Technology is facing the challenge of translating the demands of the public into actionable data that can be incorporated into the development progress of technologies. I believe that neither CC nor PP provides a solid basis of suggestions when it comes to actually 'doing' the transformation of Technology that they suggest.

Since both theories accept 'democratization' as a necessary step forward towards the betterment of technology, I believe that providing some concrete guidance on how interdisciplinary communication can happen between various actors is necessary. Such mechanisms could provide the platform to translate the ideas of 'the public' into specific design terms, and as such would be a key contribution at bringing theory closer to practice. Public participation can only truly be impactful if it happens through a methodology that allows for the individual expertise and rationality of each actor to be presented in a medium that could be understood by other actors.

Such methods could provide the basis of communication between different actors and rationalities, aiding the development of highly concretized technologies that serve as many rationalities as possible. Furthermore, an important question might be about the limitation in the representation of non-human rationalities. Most notably the interests of non-human animals and the environment can be hard to represent without them being fully contingent on the willingness of the human participants of the developmental process to act as their proxies.

From user centred to participatory design

The democratization of design through increased user involvement is a venture not limited to CC, PP, or Anarchism. During the last decades a movement from the traditional approach of design being "user centred", to an approach where the user is an active part of the process has been steadily gaining traction(Sanders & Stappers, 2008). While this shift in the design world was driven by experience and not by ideology, it is widely recognised that the adoption of these more participatory policies threatens the existing power structures that support the hegemony of specific types of expertise (ibid.). Participatory design methodologies as such fulfil the wish of

CC for pre-factum democratic interventions, as well as the calls for participatory modes of design of anarchist ideologies.

By its very nature, participatory design aims to create a platform to allow different perspectives to communicate with each other (Bødker & Christiansen, 1997). Towards this end, participatory methodologies such as co-creation have focused on attempting to create platforms where the traditional notions of expertise and role in the design process are exchanged for translation mechanisms that facilitate direct communication between stakeholders. In such environments, the researcher stops being a translator of user demands towards the designer, but rather strives to become a facilitator of conversations (Sanders & Stappers, 2008). By doing so, the responsibility that for example PP ascribes to the designer to make decisions based on their imagination is mitigated – while the decision making is decentralised and opened for debate on an open forum.

Boundary Objects - Prototypes

Design inherently lives on the boundaries of different communities (Bødker & Christiansen, 1997). Designers receive directives and attempt to communicate progress to management, attempt to learn more of their users and field in various ways, as well as act as the conduit of a far-reaching cultural imprint that they carry through the ethical, moral, and aesthetic choices they make.

The wide range of stakeholders in any design process necessitates the development of mechanisms that allow for the flow of information between people of different dispositions, viewpoints, and motivations. One way this can be facilitated in the past is by the creation of "boundary objects" (Star & Griesemer, 1989). Boundary objects are artefacts that act as a surface of communication between different groups of people. As such, they must be able to collect and 'translate' different viewpoints in ways that all stakeholders understand, they must be "robust enough to maintain common identity at different sites" (ibid.) they might be placed in, holding the 'meaning' of the information they carry across disciplinary borders. At the same time, they also must be "plastic enough to adapt to local needs and constraints" (ibid.) – meaning that they must be able to contain a wide range of localised types of expertise, while at the same time provide actionable guidance towards the embodiment of the various needs that the artefact in design must fulfil.

One of the most widely methods to "provide means for examining design problems and evaluating solutions" (Houde & Hill, 1997) comes in the form of prototypes. While prototypes exist in a wide variety of forms, they always serve the purpose of communicating a specific

aspect of development across disciplines. They can focus on showcasing the role of a planned artefact, how it will be implemented, or the final look and feel. By creating prototypes, traditionally designers and engineers have been able to present their work in a form that is easy to relate to by non-technical stakeholders such as management. On the other hand, prototypes have been used as a tool for user-centred design methodologies as a means to collect feedback about the specifics of an artefact in design.

Prototypes to date have been mostly utilized in the context of traditional "user-centred design", where a researcher acts as the intermediary between the designer and the userbase (Sanders & Stappers, 2008). I believe however that there is great potential in using prototypes as a platform for two-way communication – where prototypes can serve as true boundary objects through which citizens can themselves freely express their perspectives on technology both pre- and post-factum. Methodologies such as various design games and workshops that aim at the creation of different types of prototypes do exist, yet they carry the major shortcoming that they are often contingent on some institutional co-ordination that provides a specific material or topical framework.

Democratization of Prototyping

Nonetheless, I believe that by suggesting prototyping methodologies that do not require the frameworks that traditional prototyping necessitates might be a way to facilitate intra-disciplinary conversation. Giving citizens tools to express their perspectives in ways that could be the basis for public discourse might be a way to support the wider democratization that a unified CC/PP theory calls for. Prototyping methods that could fulfil these requirements must focus on maximalising accessibility for the widest possible range of people. As such, they should come at little or no material cost, they should not require specific technical knowledge, and at the same time provide insights that can be translated into technical specification down the line.

A method of prototyping that I am particularly fond of and one that could fulfil these requirements is that of "Science Fiction Prototyping" (Johnson, 2011). This methodology is inspired by how Science Fiction (SF) as a genre has inspired technological development in the past. From flip phones, to tablets, SF presented futuristic technological artefacts in ways that defined the form of their real counterparts in the future (ibid.). Furthermore, one of the biggest strengths of SF is that the artefacts that it presents are always presented within a context, with their broader ramifications often being in the focus of the works. From the automation-based utopia of humanity in Iain Banks' "Culture" series, through the often ambivalent role of technology in Isaac Asimov's works, to the more sinister dystopia of Aldous Huxley's "Brave

New World", SF provides opportunity to 'experiment' with the role of artefacts by exploring the positive and negative outcomes that they might bring to society at large.

SF prototyping as a wider methodology calls upon the citizenry to express their worries, visions, and ideas towards technological development through the creation of SF works of art, including but not limited to writing, visual illustrations, or film. Such works can be created with potentially very low material requirements: at the absolute minimum following the age-old tradition of oral story telling does not require any materials at all. The 'prototypes' created can serve multiple functions. On the one hand as a post-facto tool of protest they can become the medium through which the problematic impacts of technological artefacts can be expressed in a way that contextualizes them in a way relatable to designers and other users alike. Furthermore, such scenarios can also act as pictures of visions of how technological development should follow by presenting utopian visions of the future and how specific artefacts and systems at large contribute to their operation. Lastly, debates on the ambivalence and ethics of technological artefacts may also be presented through the lens of such scenarios – presenting a world were technologies currently in early development have reached maturity in a variety of ways. As such, questions on issues such as the development of human gene modification could be discussed pre-factum, with the resulting conversation guiding the development of the real-life technologies.

Conclusion

Boundary objects such as prototypes have been used for a long time now as a means of communication between stakeholders involved in design. They have served the purpose of exploring how different aspects of an artefact in design operate within the real world. On their own, traditional prototyping can be seen as a part of the design process that Verbeek envisions when talking about the responsibility of designers to use their foresight to understand how the artefacts they are working on will mediate the relationship between the users and the world (Verbeek, 2011).

However, I believe that boundary objects such as prototypes are also useful when trying to escape the technical control of the designer. As a tool of democratization, prototypes can help non-technically inclined citizens to voice their concerns. Methodologies such as SF prototyping can give a platform to explore the impacts of the proliferation of technologies that are on the market today, as well as address longer-term conceptual directions of development. By giving a voice that can be then translated into technical specification like any other prototype, they can be the site of democratic interventions in the manner that Feenberg envisions.

SF prototyping and prototypes in general are of course only one specific methodology that could be compatible with a CC/PP Philosophy of Technology. I believe that there is ample space for work to happen towards integrating other collaborative design methodologies with Philosophy of Technology. The "gap" between Philosophy of Technology and Design Methodology is already on a trajectory of closing, with contemporary design methodology often 'instinctually' adopting CC/PP-adjacent inspiration to their work (Bowker, 1997). As the same time, theoreticians such as Ferbeek and Veenberg have in turn made allusions to specific design methodologies that they deem compatible with their philosophy. As such, I believe that an element of the 'next step' in philosophy of science must be recognizing and explicitly addressing this convergence between philosophy and design of technology.

Conclusion

The Post-Modern Prometheus

Humanity has recognized early on the importance of technical actions and its ramifications on the search of the good life. Pre-industrial notions of technology were largely connected to religious beliefs – meaning that they often involved inherently moralistic characteristics. The different interpretations of the story of Prometheus for example are all steeped in the moral and ethical beliefs of the time. No matter which version of the story we consider, there is a clear message: technology is either a curse or a blessing, but in all cases it modifies what humans are and how do they relate to the gods – and ultimately nature.

Seeing the trajectory of thought on technology ever since then – and especially since the industrial revolution – I seem to find a great parallel with the way Marx or Lukács viewed capitalism's effects on the worker. As capitalism-driven technology ushered in probably the greatest change in the ecosystem of the earth that has been caused by a singular species at a break-neck speed, the alienation of the 'worker' did not stop at alienation from the fruits of their labour or their community. Alongside with all other ethical and moral judgements on technical action, the fragmentation of moral and ethical communities also led to the fragmentation and disconnect between the different stakeholders in technological development.

I believe that this lack of a holistic perspective is truly one of the most crucial obstacles to overcome towards improving our contemporary technological systems. It is not by accident that despite the radically different route that Feenberg and Verbeek take to construct their '3rd generation' philosophy of technology, they arrive to some version of this argument. In both cases, the suggested solutions revolve around the idea of democratization; trying to re-connect parts of the technological system that have been disconnected since the times when creation myths were used as the guidelines to thought on technology. By inviting in the opinions of the most 'disconnected' stakeholders, both CC and PP attempt to bridge the chasm between decision makers such as designers, engineers, legislators, and management; and other parts of society who effectively are the subjects of technology and often bear the negative consequences. While having the benefit of the 'first' and 'second' generations of philosophy of technology, CC and PP fail at mending the gap.

Focusing on emancipating the subjects of technology that are typically disregarded, CC provides a vision of empowerment and resistance. However, it talks almost exclusively to these masses who are currently invisible in the technological system. Its weakness of not connecting to the rationalities of the decision-makers in any other way than resisting them may lead to at

theoretical framework that fails to be adopted by many key actors who have no incentives to change their ways. If the suggestions revolve around resistance through "democratic interventions" (Feenberg, 2017), how could designers and engineers who directly benefit by fulfilling the rationalities of the establishment contribute to change?

PP approaches the issue from the opposite direction and addresses mainly decision makers and specifically designers. Instead of trying to find ways that the gap should be truly bridged, PP relies on the goodwill of designers to engage with the public and take decisions that would benefit them. The ways these decisions would be beneficial also remain undefined and are delegated to the personal freedom of choice of each users (Verbeek, 2011). As such, in a sense PP also fails in an opposite way to CC. Giving guidance mainly from the viewpoint of the decisionmakers, it ignores the fact that many of these decision makers have had the power to improve the experience of the users in the first place. As such, it turns a blind eye to inequality and systemic oppression, while offering little more in a normative stance than 'live and let live'.

Bridging the gap

In philosophy of technology

I believe that the recently growing effort for the reconciliation of CC and PP is a direct response to this sense of fragmentation. The focus of contemporary authors revolves vaguely around the same points: fx. CC and PP are complementary and not mutually exclusive, they would both benefit from adopting ideas from each-other, the two together might be more than the sum of their parts, etc. However, there also exists a general sense that 'just' employing the two theories in tandem is not enough on its own, and that further work is necessary. Discussing democracy and finding ways to conceptualize power relations between the various stakeholder is a popular topic (Bantwal Rao et al., 2015; Gertz, 2020; Verbeek, 2013), while at the same time others focus on questions of connecting theory with action (Feenberg, 2020; Rosenberger, 2020; Van Den Eede, 2020).

Improving the 'integrity' of the theoretical scaffolding through the importing of political philosophy that is in line with the notions of both CC and PP allows us to start building the new theory based on these works and inherit the strength of their unified perspective. My suggestion of an anarchist inspiration is an effort towards this end. Anarchist philosophy could be viewed with sympathy from both the CC and PP perspectives, as it provides a framework where personal freedom and resistance to systemic oppression are considered not as competing rationalities, but as different sides of the same ideological coin. Furthermore, existing anarchist

thought on technology has paralleled that of CC and PP in many ways that could act as the 'hook' between 3rd generation philosophy of technology and anarchist political philosophy.

The importance of theoretical robustness however should not overshadow more practical and tangible ways of bridging the gap. Even though CC and PP both make some effort to suggest specific methodologies that could contribute to the development of technology in accordance with their respective ideologies, I believe there is still an unfulfilled space in making the theoretical insights of philosophy of technology accessible and actionable. To truly fulfil this goal, philosophy of technology in the future will have to engage with design methodologies more directly, translating the observations and normative prescriptions into guidance towards decision makers and users alike.

One approach to this is finding methodologies such as the Science Fiction Prototyping that I have suggested. In this case, focus is on the transfer of expertise, demands, and experience across disciplinary and interest lines. Such communicational tools could contribute to closing the gap by giving voice to the users to express their needs and desires in a way that can be heard and translated in actionable ways to decision makers. As such, instead of waiting for the goodwill of the designer, or the initiative of the public, ideas can be expressed, exchanged, and debated in a form that is accessible for a wide and diverse range of citizens.

Alternative Routes

While a lot of emphasis has been put into focusing on 'closing the gap' between decision makers and the subject of technology - all while criticising contemporary philosophy of technology for being too distant from application – the ironic truth is that this thesis may reproduce the very same detachment due to its theoretical nature. Talking almost entirely on a philosophical level and only occasionally engaging with the empirical side of the discourse runs the risk of being blinded to the empirical realities of our contemporary technological system. As such, I believe that there is merit in exploring alternative routes towards addressing the disconnect between the different stakeholders and rationalities in the technological system.

For example, I believe that instead of moving in the direction of philosophy of technology and reaching out to design methodology, the issue could be approached from the opposite direction. Extensive and rich literature that exists on design methodologies such as co-design and co-creation (Sanders & Stappers, 2008) could be used as the baseline that could then be subsequently enriched with a more philosophical flavour. The central stage in such a project would be taken by discussions on prototyping (Houde & Hill, 1997; Johnson, 2011), provotyping (L. Boer & Donovan, 2012), design games and dialogues (Brandt et al., 2008), etc.

The strength of this approach would be that by being based on existing design methodologies, it could provide a better interface with the design/engineering perspectives. By engaging more closely with these methodologies, a better understanding of the current discourse on participatory methodologies could inform the creation of a better theoretical scaffolding; instead of the movement from theoretical scaffolding to design methodology that I suggest in this thesis.

Alternatively, the issue could also be approached from a perspective more in line with the decision makers, such as management or legislation. For example, inspiration could be taken from works that discuss how scientific interest could be translated into commercially viable endeavours (Juhl, 2016), with the goal of possibly emulating these strategies towards communicating the benefits of 'closing the gap' to profit-driven stakeholders. This more 'entrepreneurial' perspective could interface with philosophy of technology ideas such as Verbeek's self-governance of technological development (Verbeek, 2005, 2011), or Feenberg's goal of fulfilling multiple rationalities through concretization (Feenberg, 2017).

To conclude, another example of an alternative routing would be to focus on a more user-driven perspective. Attempting to close the gap from this direction could start from the basis of work on ideas such as "Horizontal Innovation Networks", where users are front and centre in the development process (von Hippel, 2007). Further, more ethnographically inspired directions could include working with action research with the goal of developing a clearer view on how communities themselves can work towards achieving their demands (Bloch-Poulsen & Kristiansen, 2014). Projects from this perspective would on the one hand benefit from 'being close to the field'; while at the same time could achieve 'real world' impact that other projects may not be able to on the same timescale.

What is next?

On May 3rd 2021, temperatures in my hometown of Nicosia, Cyprus hit 40 °C for the first time this year – following May 15th 2020 and May 28th 2019 as the earliest day for this event to occur on the island (Kitas, 2021). A couple of months earlier on September 3rd 2020, at the same weather station the highest ever temperature in the country was measured at 46.2 °C (Costa, 2020). Over the 20th century the average temperature of the island has gone up by up to an estimated 1.5 °C– with the increase being estimated an additional up to 2 °C between 2021 and 2050 (*Climate Change in Cyprus*, 2021). The weather has not only gotten hotter, but also significantly drier. Compared to the start of the 20th century a nearly 20% loss of annual

precipitation has been observed, with projections forecasting up to another 18% drop between 2021 and 2050 (ibid.).

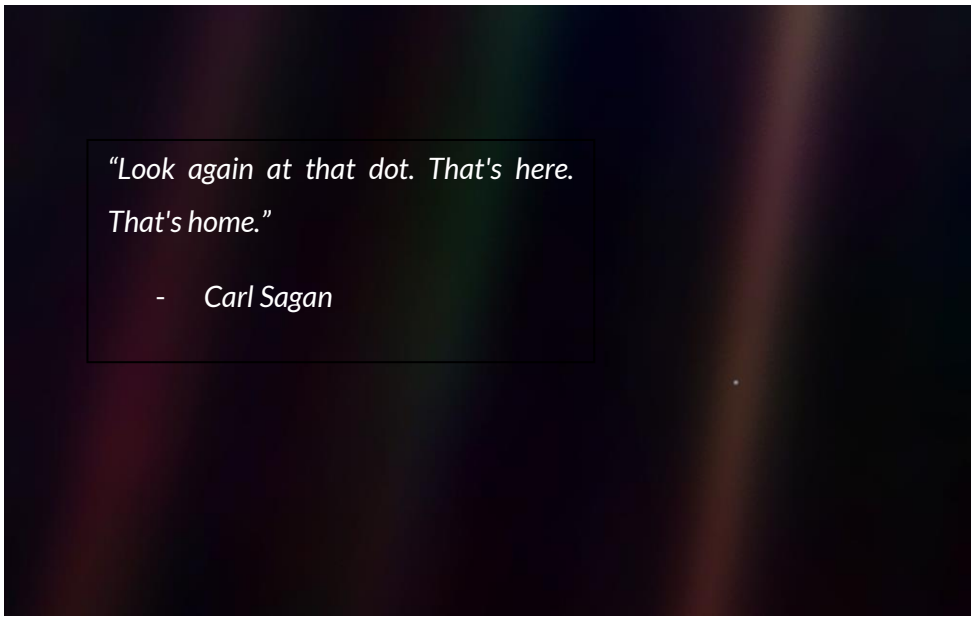
The impacts of climate change in areas such as Cyprus is not some distant fiction anymore. Just within my personal living memory the conditions on the island have changed – from a pleasant hot summer between June and August to unliveable heat and dry spells from May to October. As a result, crop yields have fallen around 40% between the period of 2013-2020 compared to the period of 1980-2009 (*Agriculture and Horticulture in Cyprus*, 2021). Despite this fact, major areas of the island have been developed as water-intensive golf-courses for the pleasure of rich foreigners (CyprusNet, n.d.), while the water supply of the island is under huge pressure and is currently supported by exploding governmental investment in resource intensive de-salination plants (*Water Development Department CY*, 2017).

Examples such as this and ones like the destruction of some of the most uniquely pristine environmental protection areas in the whole Mediterranean region for the development of luxury resorts (Browne, 2021) are great micro-level showcases of the tension between different rationalities and stakeholders. Even when doom is not only knocking on the door, but has already moved in the front room, the contemporary socio-technical configuration favours singular, profit-driven technical codes. The fire of Prometheus is driven by greed and disregard not to provide light in the darkness, but to burn everything it touches for the sake of the few.

As a Techno-Anthropologist, I believe that it is our responsibility to contribute to reclaiming the flame of Prometheus for the sake of human and nature alike. In order to do this, work must be done towards developing what I have been calling the 'next step in philosophy of technology' on multiple fronts. On the one hand, strengthening the theoretical framework and building structures that could support the inclusion of alternate rationalities in the development cycle and decision making process is a key element of this progress. Providing the normative standpoints that can act as the benchmark of decisions taken and technologies developed would be the first step towards connecting philosophy of technology to the political system. On the other hand, mechanisms that allow stakeholders to communicate effectively amongst each other would provide the key to cementing the theoretical standpoints into practice. Methods to express concerns – as well as ones that teach us how to listen to them – are the necessary bridge that philosophy of technology must build between different interests.

Our pale blue dot might be just a speck in the grand scale of the universe; however, understanding it requires unpacking complexity that spans time and scale from small local actions to planet-wide systems. To understand technology is to understand humans and nature

alike. Due to this interconnectivity human problems are technical problems as much as they are environmental problems. As such, human solutions must account just as much for the technical as for the natural – while the next step of philosophy of technology must be able to come closer to humanity and nature alike.



References

Aeschylus. (n.d.). *Prometheus Bound*. https://www.greek-language.gr/digitalResources/ancient_greek/library/browse.html?text_id=132

Agriculture and Horticulture in Cyprus. (2021). Climate Change Post. https://www.climatechangepost.com/cyprus/agriculture-and-horticulture/

Aless, S. L. P.-, & Rosa, ro L. (2019). *Facebook condemned to compensate Mediaset for the publication of audiovisual content through the publication of links | Lexology*. https://www.lexology.com/library/detail.aspx?g=55022c22-7446-46bf-ad0b-eff69e19a5cd

Allcott, H., & Gentzkow, M. (2017). Social Media and Fake News in the 2016 Election. *Journal of Economic Perspectives*, *31*(2), 211–236. https://doi.org/10.1257/jep.31.2.211

Allington, D. (2021). *Conspiracy Theories, Radicalisation and Digital Media*. Global Network on Extremism & Technology. https://gnet-research.org/wp-content/uploads/2021/02/GNET-Conspiracy-Theories-Radicalisation-Digital-Media.pdf

Apostolidis, C., & McLeay, F. (2016). Should we stop meating like this? Reducing meat consumption through substitution. *Food Policy*, *65*, 74–89. https://doi.org/10.1016/j.foodpol.2016.11.002

Are, C. (2021, February 22). *Facebook's free speech myth is dead – and regulators should take notice*. The Conversation. http://theconversation.com/facebooks-free-speech-myth-is-dead-and-regulators-should-take-notice-153119

Bantwal Rao, M., Jongerden, J., Lemmens, P., & Ruivenkamp, G. (2015). Technological Mediation and Power: Postphenomenology, Critical Theory, and Autonomist Marxism. *Philosophy & Technology*, *28*(3), 449–474. https://doi.org/10.1007/s13347-015-0190-2

Bimber, B. (1990). Karl Marx and the Three Faces of Technological Determinism. *Social Studies of Science*, *20*(2), 333–351. https://doi.org/10.1177/030631290020002006

Bloch-Poulsen, J., & Kristiansen, M. (2014). *Participation and Power In Participatory Research and Action Research*. https://openresearchlibrary.org/content/23830242-525d-4a9e-b6f1-eb47933a4a17

Bødker, S., & Christiansen, E. (1997). Scenarios as Springboards in CSCW Design. In G. C. Bowker (Ed.), *Social science, technical systems, and cooperative work: Beyond the great divide*. Lawrence Erlbaum Associates.

Boer, L., & Donovan, J. (2012). Provotypes for participatory innovation. *Proceedings of the Designing Interactive Systems Conference on - DIS '12*, 388. https://doi.org/10.1145/2317956.2318014

Bowker, G. C. (Ed.). (1997). *Social science, technical systems, and cooperative work: Beyond the great divide*. Lawrence Erlbaum Associates.

Brandt, E., Messeter, J., & Binder, T. (2008). Formatting design dialogues – games and participation. *CoDesign*, *4*(1), 51–64. https://doi.org/10.1080/15710880801905724

Browne, B. (2021, March 21). Fight continues over future of Akamas | Cyprus Mail. *Https://Cyprus-Mail.Com/*. https://cyprus-mail.com/2021/03/21/fight-continues-over-future-of-akamas/

Brunet, J. (2019). Pollinator Decline: Implications for Food Security & Environment. *Scientia*. https://doi.org/10.33548/SCIENTIA371

Cassel, D. (2020, November 8). Millions of Remote Workers Are Now Thinking About Moving. *The New Stack*. https://thenewstack.io/millions-of-remote-workers-are-now-thinking-about-moving/

Clayton, J. (2021, February 23). Facebook reverses ban on news pages in Australia. *BBC News*. https://www.bbc.com/news/world-australia-56165015

Climate change in Cyprus. (2021, May 2). Climate Change Post. https://www.climatechangepost.com/cyprus/climate-change/

Coeckelbergh, M. (2018). Technology and the good society: A polemical essay on social ontology, political principles, and responsibility for technology. *Technology in Society*, *52*, 4–9. https://doi.org/10.1016/j.techsoc.2016.12.002

Community Standards. (n.d.). Retrieved 13 April 2021, from https://www.facebook.com/communitystandards/misrepresentation/

Costa, K. (2020, September 4). *Ιστορική θερμοκρασιακή καταγραφή—Καταρρίφθηκε το παγκύπριο ρεκόρ των 45.6 βαθμών Κελσίου—CYPRUS WEATHER*. https://www.kitasweather.com/news/forecasts/istoriki-thermokrasiaki-katagrafi-katarrifthike-to-pagkiprio-rekor/

Cressman, D. (2020). Contingency and Potential: Reconsidering a Dialectical Philosophy of Technology. *Techné: Research in Philosophy and Technology*, *24*(1), 138–157. https://doi.org/10.5840/techne202027114

CyprusNet. (n.d.). *Cyprus Golf Developments* [Text]. Cyprus Golf Developments. Retrieved 28 May 2021, from https://www.cyprusgolfdevelopments.com/

de Boer, B. (2020). Discovering Subjectivity in the Technosystem: Developing a Critical Position Towards Contingent Forms of Rationality. *Techné: Research in Philosophy and Technology*, *24*(1), 62–82. https://doi.org/10.5840/techne202026112

Ellis, M. (2014, July 17). The Evolution of the Internet and Its Impact on Retail Spaces. *Wired*. https://www.wired.com/insights/2014/07/evolution-internet-impact-retail-spaces/

Estes, A. C. (2021, February 2). *How neo-Nazis used the internet to instigate a right-wing extremist crisis*. Vox. https://www.vox.com/recode/22256387/facebook-telegram-qanon-proud-boys-alt-right-hate-groups

Facebook. (n.d.). Retrieved 9 April 2021, from https://www.facebook.com/legal/terms

Facebook Ads Manager. (n.d.). Facebook for Business. Retrieved 9 April 2021, from https://en-gb.facebook.com/business/tools/ads-manager

FAO. (2020). *Climate change: Unpacking the burden on food safety*.

Feenberg, A. (2002). *Transforming technology: A critical theory revisited*. Oxford University Press.

Feenberg, A. (2017). *Technosystem: The social life of reason*.

Feenberg, A. (2020). Critical Constructivism, Postphenomenology and the Politics of Technology. *Techné: Research in Philosophy and Technology*, *24*(1), 27–40. https://doi.org/10.5840/techne2020210116

Franssen, Maarten, Lokhorst, Gert-Jan, van de Poel, & Ibo. (2020). Philosophy of Technology. In *Stanford Encyclopedia of Philosophy*. https://plato.stanford.edu/archives/fall2020/entries/technology

Gertz, N. (2020). Democratic Potentialities and Toxic Actualities: Feenberg, Ihde, Arendt, and the Internet. *Techné: Research in Philosophy and Technology*, *24*(1), 178–194. https://doi.org/10.5840/techne2020214119

Gordon, U. (2009). ANARCHISM AND THE POLITICS OF TECHNOLOGY. *WorkingUSA*, *12*(3), 489–503. https://doi.org/10.1111/j.1743-4580.2009.00250.x

Groshek, J., & Koc-Michalska, K. (2017). Helping populism win? Social media use, filter bubbles, and support for populist presidential candidates in the 2016 US election campaign. *Information*,

Communication & Society, *20*(9), 1389–1407. https://doi.org/10.1080/1369118X.2017.1329334

Helland, J., & Sørbø, G. M. (2014). *Food Securities and Social Conflict* (CMI Report). https://www.cmi.no/publications/5170-food-securities-and-social-conflict

Hern, A. (2015, November 2). *Facebook relaxes 'real name' policy in face of protest*. The Guardian. http://www.theguardian.com/technology/2015/nov/02/facebook-real-name-policy-protest

Herrero, M., Thornton, P. K., Mason-D'Croz, D., Palmer, J., Benton, T. G., Bodirsky, B. L., Bogard, J. R., Hall, A., Lee, B., Nyborg, K., Pradhan, P., Bonnett, G. D., Bryan, B. A., Campbell, B. M., Christensen, S., Clark, M., Cook, M. T., de Boer, I. J. M., Downs, C., … West, P. C. (2020). Innovation can accelerate the transition towards a sustainable food system. *Nature Food*, *1*(5), 266–272. https://doi.org/10.1038/s43016-020-0074-1

Houde, S., & Hill, C. (1997). What do Prototypes Prototype. In *Handbook of human-computer interaction*. Elsevier. http://www.sciencedirect.com/science/book/9780444818621

Ihde, D. (2020). Almost a Critical Theorist. . . *Techné: Research in Philosophy and Technology*, *24*(1), 15–26. https://doi.org/10.5840/techne2020319121

IHS Markit & OMDIA. (2020). *Broadband coverage in Europe 2019: Mapping progress towards the coverage objectives of the Digital Agenda : final report*. European Commission. Directorate General for Communications Networks, Content and Technology. https://data.europa.eu/doi/10.2759/375483

Illing, S. (2021, April 20). *The First Amendment has a Facebook problem*. Vox. https://www.vox.com/policy-and-politics/22356339/free-speech-facebook-twitter-big-tech-first-amendment

International Data Base. (n.d.). Retrieved 13 April 2021, from https://www.census.gov/data-tools/demo/idb/#/country?YR_ANIM=2021

Introduction—Messenger Platform—Documentation. (n.d.). Facebook for Developers. Retrieved 13 April 2021, from https://developers.facebook.com/docs/messenger-platform/introduction/

Johnson, B. D. (2011). *Science Fiction Prototyping: Designing the future with Science Fiction*. Morgan & Claypool.

Juhl, J. (2016). Innovation science: Between models and machines. *Engineering Studies*, *8*(2), 116–139. https://doi.org/10.1080/19378629.2016.1205593

Kitas, E. R. (2021, May 3). *Μόλις καταγράφηκε το πρώτο 40άρι του 2021—CYPRUS WEATHER*. https://www.kitasweather.com/news/genika/molis-katagrafike-to-proto-40ari-tou-2021/

Lacroix, K., & Gifford, R. (2019). Reducing meat consumption: Identifying group-specific inhibitors using latent profile analysis. *Appetite*, *138*, 233–241. https://doi.org/10.1016/j.appet.2019.04.002

Latour, B. (1990). Technology is Society Made Durable. *The Sociological Review*, *38*(1_suppl), 103–131. https://doi.org/10.1111/j.1467-954X.1990.tb03350.x

Leeming, D. A. (2010). *Creation myths of the world: An encyclopedia* (2nd ed). ABC-CLIO.

Leger, H. S., February 23, S. R., & 2021. (n.d.). *Best streaming service 2021: Netflix and more TV compared*. TechRadar. Retrieved 9 April 2021, from https://www.techradar.com/best/best-tv-streaming-service-cord-cutting-compare

Marshall, A., & Weiner, S. R. (2020, July). *Design Ideas for the Post-Pandemic Public Library | Dialogue Blog | Research & Insight*. Gensler. https://www.gensler.com/blog/design-ideas-for-the-post-pandemic-public-library

Martin, B. (2015). Anarchist shaping of technology. *Faculty of Law, Humanities and the Arts - Papers (Archive)*, 11–15.

Marx, K. (1845). *Theses on Feuerbach*. Marx/Engels Internet archive. https://www.marxists.org/archive/marx/works/1845/theses/theses.htm

Meyer, K., & Newman, P. (2020). The Science of Anthropogenic Climate Change. In K. Meyer & P. Newman, *Planetary Accounting* (pp. 11–33). Springer Singapore. https://doi.org/10.1007/978-981-15-1443-2_2

Mowery, D. C., & Simcoe, T. (2002). Is the Internet a US invention?—An economic and technological history of computer networking. *Research Policy*, *31*(8–9), 1369–1387. https://doi.org/10.1016/S0048-7333(02)00069-0

Nagaoka, L., Rick, T., & Wolverton, S. (2018). The overkill model and its impact on environmental research. *Ecology and Evolution*, *8*(19), 9683–9696. https://doi.org/10.1002/ece3.4393

Parry, R. (2020). Episteme and Techne. In *Stanford Encyclopedia of Philosophy*. https://plato.stanford.edu/archives/fall2020/entries/episteme-techne/

Pinch, T. J., & Bijker, W. E. (1984). The Social Construction of Facts and Artefacts: Or How the Sociology of Science and the Sociology of Technology might Benefit Each Other. *Social Studies of Science*, *14*(3), 399–441. https://doi.org/10.1177/030631284014003004

Raggio, O. (1958). The Myth of Prometheus: Its Survival and Metamorphoses up to the Eighteenth Century. *Journal of the Warburg and Courtauld Institutes*, *21*(1/2), 44. https://doi.org/10.2307/750486

Reydon, T. A. C. (2021). *Philosophy of Technology*. IEP. https://iep.utm.edu/technolo/

Román-Palacios, C., & Wiens, J. J. (2020). Recent responses to climate change reveal the drivers of species extinction and survival. *Proceedings of the National Academy of Sciences*, *117*(8), 4211–4217. https://doi.org/10.1073/pnas.1913007117

Rosenberger, R. (2020). "But, That's Not Phenomenology!": A Phenomenology of Discriminatory Technologies. *Techné: Research in Philosophy and Technology*, *24*(1), 83–113. https://doi.org/10.5840/techne2020210117

Rupietta, K., & Beckmann, M. (2018). Working from Home: What is the Effect on Employees' Effort? *Schmalenbach Business Review*, *70*(1), 25–55. https://doi.org/10.1007/s41464-017-0043-x

Salem, F., & Mourtada, R. (2011). Civil Movements: The Impact of Facebook and Twitter. *Arab Social Media Report*, *1*.

Sanders, E. B.-N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *CoDesign*, *4*(1), 5–18. https://doi.org/10.1080/15710880701875068

Signal Foundation. (n.d.). Signal Foundation. Retrieved 9 April 2021, from https://signalfoundation.org

Star, S. L., & Griesemer, J. R. (1989). Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social Studies of Science*, *19*(3), 387–420.

Stiegler, B. (1998). *Technics and time*. Stanford University Press.

Tankovska, H. (2021, February). *Facebook MAU worldwide 2020*. Statista. https://www.statista.com/statistics/264810/number-of-monthly-active-facebook-users-worldwide/

Tian, J. (Jingxin), Bryksa, B. C., & Yada, R. Y. (2016). Feeding the world into the future – food and nutrition security: The role of food science and technology. *Frontiers in Life Science*, *9*(3), 155–166. https://doi.org/10.1080/21553769.2016.1174958

Van Den Eede, Y. (2020). The Purpose of Theory: Why Critical Constructivism Should "Talk" and Postphenomenology Should "Do". *Techné: Research in Philosophy and Technology*, *24*(1), 114–137. https://doi.org/10.5840/techne202027115

Verbeek, P.-P. (2005). *What things do: Philosophical reflections on technology, agency, and design* (2. printing). Pennsylvania State Univ. Press.

Verbeek, P.-P. (2011). *Moralizing technology: Understanding and designing the morality of things*. The University of Chicago Press.

Verbeek, P.-P. (2013). Resistance Is Futile: Toward a Non-Modern Democratization of Technology. *Techné: Research in Philosophy and Technology*, *17*(1), 72–92. https://doi.org/10.5840/techne20131715

Verbeek, P.-P. (2020). Politicizing Postphenomenology. In G. Miller & A. Shew (Eds.), *Reimagining Philosophy and Technology*, *Reinventing Ihde* (Vol. 33, pp. 141–155). Springer International Publishing. https://doi.org/10.1007/978-3-030-35967-6_9

von Hippel, E. (2007). Horizontal innovation networks—By and for users. *Industrial and Corporate Change*, *16*(2), 293–315. https://doi.org/10.1093/icc/dtm005

Water Development Department | Desalination Plants. (2017). Water Development Department of the Republic of Cyprus. http://www.moa.gov.cy/moa/wdd/wdd.nsf/page23_en/page23_en?opendocument

What forms of ID does Facebook accept? | Facebook Help Centre. (n.d.). Retrieved 9 April 2021, from https://www.facebook.com/help/159096464162185?helpref=faq_content

What names are allowed on Facebook? | Facebook Help Centre. (n.d.). Retrieved 9 April 2021, from https://www.facebook.com/help/112146705538576?helpref=faq_content

Wheeler, M. (2020). Martin Heidegger. In *Stanford Encyclopedia of Philosophy*. https://plato.stanford.edu/archives/fall2020/entries/heidegger

Wikipedia:About. (2021). In *Wikipedia*. https://en.wikipedia.org/w/index.php?title=Wikipedia:About&oldid=1013393289

Winner, L. (1980). Do Artifacts Have Politics? *Daedalus*, *109*(1), 121–136.

Wrangham, R. W. (2009). *Catching fire: How cooking made us human*. Basic Books.