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Philosophy of Technology after the Empirical Turn

1. Introduction

What are the strengths and weaknesses of contemporary philosophy of technology, and how may the field be developed and improved in the future? That is the question I will address in this paper. I will argue that in the past twenty-five years, philosophy of technology has entered a new era. This era has arrived with new and distinct issues and approaches that differ from those that came before it. Many of the new developments have been for the good. Yet, I will also argue, there are still large areas in the field that are currently underdeveloped or have been stagnant. I will identify these areas and suggest ways of moving forward in them.

To build up my argument, I will first describe, in section 2, *classical philosophy of technology*: a family of approaches, with shared characteristics, that was dominant from roughly the 1920s to the 1990s. This is the body of work formed by philosophers like Heidegger, Ellul, Mumford, Marcuse, Ortega y Gasset and others who sought to criticize the implications of modern technology for the human condition. I will then describe, in section 3, how new directions in the philosophy of technology emerged in the 1980s and 1990s that moved beyond this tradition, either by building on it, reacting to it, or operating independently from it. I will identify three such directions or approaches that have come to dominate in the 1990s and 2000s. These approaches define what I will call *contemporary philosophy of technology*.

Next, in section 4, I will critique contemporary philosophy of technology for what it is currently not doing, or not doing well. I will identify lacunae in the contemporary agenda of the field, and scrutinize areas in which work is being done but opportunities are being missed to make progress. In section 5, finally, I will point to new directions for the future that may help fill these lacunae and facilitate progress. My remarks here will necessarily be brief, as my aim is not to present a completely new approach to the field but rather to identify underdeveloped and neglected areas and to help put them on the map, with some suggestions in which they may be developed better.

2. Classical Philosophy of Technology

From roughly the 1920s to well into the 1980s, philosophy of technology was dominated by an approach, or rather a family of related approaches, that may now be characterized as *classical philosophy of technology*. Classical philosophy of technology is a tradition formed by philosophers and humanists from traditions like phenomenology and existentialism, hermeneutics, critical theory, theology, and related areas. It included philosophers like Martin Heidegger, Herbert Marcuse, Jaques Ellul, Ivan Illich, Arnold Gehlen, Hans Jonas, Lewis Mumford, and others. It had its focus on the implications of modern technology for the human condition and for society at large. It took a critical approach to this topic, and advocated the idea that modern technology was harmful in many ways. It sought to identify these harms and reflect on them, and it sought to explore how humanity might develop a better relation to technology.[1]

To properly understand classical philosophy of technology, it is best to situate it within its time period and to identify what it was responding to. Classical philosophy of technology, I claim, can best be understood as a critical response to optimistic portrayals of technology that had come to dominate modern

[1] While classical philosophy of technology was dominant in 20th century philosophy of technology, it was certainly not the only approach that existed. The classical approach falls within the scope of what Carl Mitcham has called humanities philosophy of technology (Mitcham, 1994). Mitcham distinguishes a second major approach, which he calls engineering philosophy of technology, which has a more positive outlook on technology and is predominantly practiced by engineers. I will not discuss this approach as it has not been nearly as influential for contemporary philosophy of technology as the classical approach. What I will later call engineering-oriented philosophy of technology has some of its roots in Mitcham's engineering philosophy of technology, but is a different, more contemporary version of it that is practiced by both philosophers and engineers and that has a neutral and descriptive rather than a positive outlook on technology.

thinking in the wake of the Enlightenment and its ideal of progress. When an advanced technological society started to take shape in the twentieth century, and this society turned out to have many ills that were at least in part attributable to modern technology, it seemed clear that the optimistic Enlightenment image of technology as a bringer of progress and utopia required a correction. Philosophers and humanists started responding to the new developments, and developed more critical, pessimistic images of technology and its place in modern society that countered the Enlightenment images.

The Enlightenment image of technology as a positive force emerged in the seventeenth century, more than a hundred years before the Industrial Revolution, when philosophers and scientists started recognizing and appreciating the enormous potential of natural science for the development of technology. In this century, the core ideas of the Enlightenment were formed, including its ideas of individual autonomy, of nature as dead and predictable, of the superiority of human reason, and of the superiority of the scientific method. Within this worldview, the view was developed that scientific knowledge could be applied to manipulate reality and used to the practical advantage of humanity. These days, we call such applied sciences technology. The optimism about the scope and superiority of human reason that prevailed at the time led to the belief that such applied science would mostly benefit humanity and would have few negative consequences.

We can see this optimistic vision of technology in the writings of many Enlightenment thinkers. René Descartes, for example, argued in his *Discourse on Method* that humanity can learn to know nature and control it through their reasoning and intelligence and by using scientific methodology (Descartes, 1637/1994). These ideas led Descartes to one of the first formulations of the modern idea of technological progress – the idea that humanity will have ever more control of nature as a result of the technological application of science, and thereby improve its own living conditions and well-being. Descartes enthusiastically declared that using the scientific principles that he had discovered, humanity could become master and possessor of nature, and develop an infinite number of devices with which it would be able enjoy without effort the fruits of the earth. This ideology of progress and the philosophy of control that accompanies it are also prevalent in the work of contemporaries like Francis Bacon, Hobbes and Leibniz. In this way, the 17th century yielded an optimistic view of technology that rested on the ideas that humanity can control nature by applying scientific knowledge, that this control will become increasingly successful as science and technology develop, and that this power over nature would yield predominantly positive results such as individual freedom, affluence and well-being. This optimistic vision has remained influential beyond the 17th century and still provides a framework for contemporary ideas of progress.

In the twentieth century, the advanced technological society that these Enlightenment philosophers dreamt of was finally starting to take shape. Technology was penetrating every sector of society and no one could escape its influence. There was the widespread expansion of the industrial sector, the establishment of rationalized production processes and labor patterns, rapid urban growth, the emergence of mass production and the birth of a consumer society. Along with the many benefits that these developments brought, however, there turned out to be significant downfalls as well. Technology was used on a large scale for the purpose of war and persecution, and was responsible in part for the unprecedented destruction that resulted from the First and Second World Wars, including the atrocities of Auschwitz and Hiroshima. It even made possible the threat of complete nuclear obliteration. In addition, human control over nature turned out to come at a cost. Many technological developments proved harmful to nature and created environmental problems that posed a threat to humankind. The promised improvements in the quality of life often appear to be ambiguous as well. In a technological society, labor processes were rationalized and were often monotonous, impersonal and stressful. While the consumer society brought many benefits, it was also characterized by materialism, a loss of spiritual values and a dissolution of community. These developments put the optimistic image of technology from the Enlightenment under significant pressure.

Over the course of the twentieth century, therefore, philosophers and humanists responded with alternative, more pessimistic images of technology that countered the naïve conception of the Enlightenment and that criticized modern industrial society. These thinkers criticized the Enlightenment's philosophy of control and the idea that technology was predominantly good. They emphasized the negative and destructive nature of technology and posited that rather than being liberated by technology, mankind was becoming subservient to it. They also declared that humanity had lost control of technology, which was now developing according to its own logic, and that rather than being improved, the quality of life was often worsened by processes of rationalization, uniformity, alienation and shallow consumption.

This negative characterization of technology and industrial society was found, amongst others, in Critical Theory, an influential philosophical movement and social theory that was forwarded in large part by the representatives of the so-called Frankfurt School, a group of German thinkers that, from the 1930s onwards, focused on widespread social criticism. Some of its members were Theodor Adorno, Max Horkheimer, Herbert Marcuse and (more loosely) Jürgen Habermas. In their 1947 publication *Dialectic of Enlightenment*, Adorno and Horkheimer argued that the Enlightenment led to a technical-rational philosophy in which both nature and mankind had become objects of domination, which in turn led to fascist and totalitarian societies. In *One-Dimensional Man* (1964), Marcuse argued that advanced industrial society has imprisoned mankind in a system of production and consumption in which people are held captive in monotonous jobs in order to buy ever more new products, and which has rendered critical thinking and conduct impossible. This work was one of the spearheads of 1960s counter-culture. Habermas stated in his work that the Enlightenment had led to a one-sided emphasis on instrumental, scientific-technological rationality that has harmed the environment in which people lived and limited their potential to express themselves.

Similar negative appraisals of modern technology were brought forward in approaches other than Critical Theory, like phenomenology, existentialism, hermeneutics, postmodernism and theological approaches. Martin Heidegger, one of the most influential philosophers of the 20th century and one of the originators of phenomenology and existentialism, argued that modern technology has infiltrated our entire way of thinking and feeling and had turned mankind and the world into standing reserves, commodities with a utility value. His vision was taken up in large part by neo-Heideggerians such as Albert Borgmann and Hubert Dreyfus. A similar vision is found in the work of Jacques Ellul, who portrayed technology as an unstoppable autonomous force that constructed social and political institutions according to its own logic and undermines the self-determination of humanity. Modern technology has also been portrayed as negative by 20th-century postmodern philosophers like Jean-François Lyotard and Jean Baudrillard.

3. From Classical to Contemporary Philosophy of Technology

While classical philosophy of technology is still being practiced today, it is fair to say that it no longer is the dominant approach in the field. Since the 1980s, major new developments have transformed the field. These developments were in large part a reaction to perceived shortcomings of the classical approach, that were noted by many scholars in the field. A first criticism of the classical approach was that the image of technology portrayed by it was one-sidedly negative and pessimistic and showed little interest in positive aspects of technology. While pessimistic images of technology may have had their force during and after the first and second World War and during the 60s counterculture, the mood had shifted in the 1980s and 1990s, and a different image of technology was emerging in the collective consciousness that saw technology as more ambivalent: as a force for that was used both for good and for ill.

Second, classical philosophy of technology tended to portray a deterministic image of modern technology as unstoppable and autonomous. It portrayed technology as a force that developed according to its own logic that was rooted in scientific-rational principles and did not involve true human choices, and that brought along inherent, necessary consequences for society, irrespective of the context in which it was used. This image came under attack as well. The 1980s saw the emergence of the field of science and technology studies (STS), an empirically oriented field that studied the development and utilization of science and technology. STS emphasized the contingency and social constructedness of technology, and the possibility of designing and using technology differently with radically different social outcomes (Sismondo, 2003). In their wake, philosophers of technology started developing conceptions of technology that likewise portray its development and consequences as contingent, socially shaped and contextually dependent.

A third criticism of classical philosophy of technology was that it was too general and abstract. In most studies, technology was studied in its entirety, as "Technology-with-a-capital-T". There was almost no attention to differences between technologies, nor were concrete technological practices, artefacts or decision-making processes looked at in any detail. Often, technology was defined more broadly or abstractly than it is commonly understood, to refer to techno-scientific rationality or formal-rational ways of thinking and acting. Classical philosophy of technology therefore had little to say about specific technologies and specific issues in relation to such technologies. By paying little attention to concrete developments in technology and society and to empirical studies of such developments it also had little by

which to back up its grand claims about the nature of technology and its implications for society. Moreover, its abstract and deterministic portrayal of technology did not leave the tradition with many means to make constructive proposals for the future. With an image of technology as determining and autonomous, and without a detailed understanding of how technology is developed and used and how impacts are generated, it evidently becomes difficult to make any realistic statements about how technology might be developed and used in a better way.

The empirical turn

In the footsteps of these criticisms, philosophers in the 1980s and 1990s started developing alternative approaches to technology that did not suffer from the problems of the classical approach. The resulting approaches have been described as representing an *empirical turn in the philosophy of technology* (Kroes and Meijers, 2000a; Achterhuis, 2001). As I will be arguing, though, it is more proper to speak of *two* empirical turns: in the 1980s and 1990s two distinct approaches have emerged in response to the classical tradition, that both have been claimed to involve an empirical turn. One of them retains an affiliation with the classical tradition and the topics and issues that concerned it, whereas the other represents a more radical departure from it. I will now first discuss these two approaches separately, and then describe their common features.

A first empirical turn emerged in the 1980s and 1990s, when more and more philosophers working within the classical tradition were breaking free from some of its assumptions and methods. Neo-Heideggerians, neo-Critical Theorists and post-phenomenologists started to focus on concrete technologies and issues, attempted to develop contextual, less deterministic theories of technology or started borrowing them from STS, and started to assume a less dystopian, more pragmatic and balanced attitude towards modern technology. Andrew Feenberg, for example, developed a theory of technology that stood within the tradition of Critical Theory but borrowed its conception of technology from STS, emphasizing the contextual nature of technology and the possibility for it to be developend and used differently (Feenberg, 2005). Don Ihde had been developing a less evaluative, more descriptive phenomenology of technology that did not so much study the impact of technology on human experience but rather how technology can mediate between humans and their environment in different ways (Ihde, 1990). And neo-Heideggerian philosopher Hubert Dreyfus had long been engaging concrete research programs in AI with much attention to their details.

The 1980s and 1990s also saw the inclusion of new traditions in the field like pragmatism, poststructuralism and STS-oriented philosophy, embodied by philosophers Larry Hickman, Andrew Light, Donna Haraway and Bruno Latour, that more naturally focused on concrete technologies and practices and shunned determinism and pessimism. More generally, philosophy of technology started interacting more with fields like STS, cultural studies, and media and communication studies, which led to an infusion of ideas into the field that stimulated a more empirical, less deterministic and more descriptivist or neutral stance towards technology. The result is a family of approaches to technology and its social significance that is more concrete, more empirically informed, more constructivist and less pessimistic about technology than the classical approach. In addition, the new approach places a greater emphasis on alternative ways of developing and using technologies, that is more in line with moral, social and democratic ideals. The new approach was summarized in the edited volume *American Philosophy of Technology. The Empirical Turn* (Achterhuis, 2001).

What this more empirically informed approach has in common with the classical approach is that both aim to understand and evaluate the implications of modern technology for society and the human condition. They do so by different means, but both can be characterized as *society-oriented* approaches in the philosophy of technology. The other empirical turn that I will now describe is instead *engineering-oriented*. Its primary aim is to understand and evaluate the practices and products of engineering, rather than anything that happens beyond in society. This empirical turn primarily took place in the 1990s and 2000s. It was also borne out of dissatisfaction with the classical approach, but the dissatisfaction was more radical. Its proponents, who include Joseph Pitt, Peter Kroes and Anthonie Meijers, argued that the trouble with philosophy of technology was that it was not really about technology. Its concern with social consequences made it forget about technology itself. Progress in the field, they argued, required a focus away from social consequences towards technology itself. Philosophy of technology should endeavor to carefully describe and analyze the practices and products of engineering and in this way arrive at empirically informed, descriptively adequate philosophical theories of technology and engineering. This

was held to be both an end in itself and a means to eventually engage in better philosophical research into the social consequences of technology. Important milestones in this new approach were the publication of the volumes *New Directions in the Philosophy of Technology* (Pitt, 1995) and *The Empirical Turn in the Philosophy of Technology* (Kroes and Meijers, 2000a).

Apart from being a major approach within the empirical turn, this new engineering-oriented philosophy of technology is also a new approach in itself, in part because of its focus on engineering and on philosophical description. For this reason, it will be described more fully in a separate section below. What is relevant here is what this approach has in common with the more society-oriented approach that emerged in the 1980s and 1990s, and what makes them both representatives of an empirical turn in the philosophy of technology. This is the fact that both are critical responses to classical philosophy of technology that agree that the philosophy of technology should be more empirically informed, should focus more on concrete practices, technologies and artifacts, should generally engage in description before engaging in evaluation, and should employ a less deterministic, more constructivist or contextualized conception of technology. Both approaches refer to the need to "open up the black box of technology" and reveal the diverse practices, processes and artifacts that constitute technology. These shared assumptions, embodied in quite different ways within the two approaches, define the new orthodoxy within the philosophy of technology that has been referred to as the empirical turn within the field.

The new engineering-oriented philosophy of technology

The engineering-oriented approach that I described above is not only distinct from the classical approach because of its empirical turn, but also because of its focus on engineering and on philosophical description. For this reason, I will now discuss it separately, with special attention to these two features. First, let us consider the focus on engineering. The "turn to engineering" that this approach embodies was accompanied and predated by repeated claims that the field should start focusing on technology itself rather than its social consequences. One of the first to do so was American Carl Mitcham, who in his much-quoted book *Thinking Through Technology* (1994) proposed that philosophy of technology focus on the development of sound descriptions of technology and its inner workings rather than external consequences. This plea was echoed by others like Joseph Pitt, Andrew Light, Peter Kroes and Anthonie Meijers, who all argued for two new directions: a greater focus on technology itself, and a greater emphasis on philosophical description rather than evaluation. Kroes and Meijers, who have been leading in the new approach, have argued that following research on technology in STS, philosophy must open the black box of technology and describe what it finds inside (Kroes and Meijers, 2000b). They proposed that technology be arranged more in line with philosophy of science, directed at the analytical clarification of basic concepts and theories in engineering, with an emphasis on epistemological, ontological and methodological studies.[2]

Apart from focusing on technology and engineering, Kroes and Meijers argued, the philosophy of technology should also focus on description rather than on evaluation or normative analysis. The field should not dispense with normative issues altogether, they claimed, but the focus should be on descriptive analysis with an aim of understanding modern technology and its inner organization rather than evaluating it or prescribing its direction. Engineering-oriented philosophy of technology, as practiced today, is therefore in large part a *descriptive* philosophy of technology rather than a *normative/evaluative* one. It aims at descriptive accuracy and conceptual clarity, and largely focuses on methodological, epistemological and ontological issues with respect to the practices and products of engineering.

Whereas this approach is engineering-oriented and not society-oriented, society is sometimes featured in the approach in a limited way. Many philosophers within the approach recognize that engineering is part of society, and that it both influences and is influenced by society. Philosophical accounts of engineering design, for example, frequently refer to the relation of designing engineers to firms, contractors, legal entities, and other agents. Accounts of technological artifacts often emphasize their dual nature: the fact that they both have a physical structure and a function that is dependent on the intentions and utilizations of human designers and users (Kroes, 2010). Thus, whereas social implications

[2] Admittedly, epistemology and methodology are partially normative fields. Engineering-oriented philosophy of technology therefore is not merely descriptive, it also engages in normative analysis. However, the emphasis is on description, and even much of the work in epistemology is descriptive and conceptual, concerned with describing types of technological knowledge and their role in the technical sciences.

of technology are rarely addressed directly, the approach brings into view interdependencies between technology and society, and may in this way contribute indirectly to the analysis of social consequences.

The approach came to full bloom in the 2000s. In different countries, analytical-philosophical research is now being conducted into the nature of technology and engineering sciences, and collaborations between groups are also taking place. Research is primarily undertaken at technical universities, and frequently by philosophers with a background in science and engineering, or by engineers with a developed interest in philosophy. Research themes include the structure of engineering design processes, the nature of technical artefacts and their functions, the nature of engineering knowledge, the relationship between engineering sciences and natural sciences, and the methodological structure of engineering science. Recently, developments in this area have culminated into a 1472-page handbook, *Philosophy of Technology and Engineering Science* (Meijers, 2009), with close to fifty chapters from different authors that represent the new approach.

The emergence of applied technology ethics

A third development in the field, in the 1970s and 80s, was the emergence of applied ethical research into technology. This research emerged at a time when applied ethics on the whole was on the rise, along with professional ethics. Mirroring the emergence of professional and applied ethics as two distinct yet related approaches in ethics, we can discern the emergence of two new areas of technology-oriented ethics. On the one hand, we see the rise of professional ethics aimed at engineers: *engineering ethics*. Engineering ethics focuses on assisting engineers in shaping their professional responsibility through the formulation of general ethical principles and professional codes and by providing methods and techniques for tackling the moral issues and dilemmas that engineers encounter in their work.

On the other hand, we see the rise of *applied ethical research into social-ethical problems surrounding technology*. The focus here is not on professional responsibility but on ethical issues that society in general has to deal with regarding the introduction and use of technology in society. Examples of such issues include the question whether cloning should be banned or not, or to what extent internet users are entitled to privacy. Of all the work being done in applied ethics, an increasing amount is focused on technology. This is the case, first of all, for new fields like computer and information ethics and nanoethics, which focus on ethical issues with respect to computing technology and nanotechnology, respectively. Most other fields of applied ethics do not have their main focus on technology, but issues pertaining to technology are nevertheless increasingly prevalent in them. This is true for fields like bioethics, environmental ethics and neuroethics.

Applied and professional ethical research into technology has developed largely independently from mainstream philosophy of technology. Nevertheless, it has points in common with the empirical turn as described above. This research also tends to focus on concrete practices and technologies, it tends to reject a one-sidedly negative approach to technology, and it often rejects technological determinism. On the other hand, much of the ethical research into technology does not employ contextual notions of technology used in STS and the empirical turn, and does not really open the "black box" of technology. Contemporary technology ethics has in common with classical and society-oriented contemporary philosophy of technology that it is normative and evaluative, and tends to focus on social consequences of technology. The difference is that it normally does not attempt to determine whether modern technology is good or bad and whether we should reject or embrace it. It rather tends to accept that we live in a technological culture in which the constant introduction and utilization of new technologies is a normal part of how society works. It then asks how we can deal with such new technologies in a responsible manner, and is in this way more practical and perhaps less reflective than typical society-oriented approaches in the philosophy of technology.

4. Limitations of Contemporary Philosophy of Technology

In section 3, three contemporary approaches within the philosophy of technology were presented, with two of them (contemporary society-oriented and engineering-oriented philosophy of technology) resulting from an empirical turn within the field, and one (applied technology ethics) emerging alongside the other two. These three approaches now largely define the field. The question I want to ask in this section is whether they define a complete and mature philosophy of technology that should make us all proud, or whether

there is still significant room for improvement in the field. My position is that we should be happy with all three approaches as they have emerged, and that they are an improvement over classical philosophy of technology. Yet, in spite of the wide area that they collectively cover, some important topics are currently underrepresented, whereas other topics are covered in a way that is not allowing sufficient progress to be made on them.

Philosophy of technology, I would like to claim, is a field that has been preoccupied with three major questions: (1) What is technology? (2) How can the consequences of technology for society and the human condition be understood and evaluated? (3) How should we act in relation to technology? I believe that these questions still properly define the field. The first question is the central concern of engineering-oriented philosophy of technology, although some work on it is also being done in society-oriented philosophy of technology, whereby its definitions and descriptions of technology tend to focus more on the social or anthropological role of technology. The second question is the province of society-oriented philosophy of technology, but also of technology ethics in so far as the evaluations at issue are *moral* evaluations. The third, finally, is wholly the concern of technology ethics.

My concern is that society-oriented philosophy of technology and technology ethics as they currently exist are not sufficiently equipped to provide full and cogent answers to the second and third research question.[3] Let us consider these two approaches in turn. First, technology ethics is a field with a limited normative and evaluative agenda: it is concerned with *morality*, and morality only. Technology ethics focuses solely on a *moral* evaluation of technology, and on *moral* prescriptions. But moral normativity is only one kind, and moral values constitute only one class among many types of values. I believe that the task of philosophy of technology is to evaluate the consequences of technology relative to different standards of goodness and badness, rather than merely concentrating on *moral* goodness or badness. Social consequences are not just good or bad for moral reasons, but may be so for other reasons as well.

Let me illustrate this point. Nowadays, people buy more and more products via the internet. This means that people travel into city centres less often, which has been claimed to lessen social cohesion in cities. Is this a good or a bad development? Ethics is of little help here because it only looks at whether moral principles have been violated by purchasing products online – which appears not to be the case – before concluding that this development is morally neutral. However, I would like philosophy of technology to be able to pass a normative judgment here that social cohesion and integration are important values, and that one would want technology to promote them. However, these values are not normally defined as *moral* values. Ethics only covers what is *morally* good and bad, or what is *morally* valuable, but many things are valuable for reasons other than moral ones. In addition to moral value, we have cultural, social, political, economic, ecological and prudential or personal value. We need a philosophy of technology that heeds *everything of value*, and that is able to distinguish between different positive and negative consequences of technology and provide reasons why they are good and bad. Such a philosophy of technology would be able to distinguish between the different values that play a role in social issues and problems that involve technology and weigh them up against one another.

Some may hold that what I desire is achievable within ethics as well. They will argue that ethics focuses on goodness in the broadest sense and deals with all sorts of values. And there are indeed definitions of ethics that are as broad as this. However, the fact is that this broad notion hardly plays a role in applied ethics, in which ethics is often narrowly defined as the moral evaluation of actions with a view to preventing injury to third parties and a respectful association with them, with little attention being paid to broader issues of a social nature or pertaining to the quality of life. Therefore, when I refer to the narrow agenda of ethics, I refer to the agenda as it is implemented in practice, if not in theory as well.

Contemporary society-oriented philosophy of technology evaluates technology in a manner that is broader than that of technology ethics. However, it also lacks a developed theory of value by which different values that are at stake in relation to technology may be identified and balanced against each other. There is therefore little in the way of theory by which we may, for example, assess the cultural value of indigenous knowledge that is threatened by the Internet or by biopatenting, or evaluate the social value of face-to-face friendships versus computer-mediated friendships, or balance economic against ecological value. Many evaluations that take place in the field are *ad hoc*, with little theory behind it and much appeal to intuition. Claims are made, for example, that new technologies rationalize, enframe or commodify our existence and thereby harm the quality of life, with little substantiation of these viewpoints. In my view,

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[3] Possibly, current approaches also have their limitations in addressing the first question, regarding the nature of technology and engineering. However, I am mostly concerned in this essay with technology ethics and society-oriented philosophy of technology.

the field would benefit enormously from the development of theories of value specifically geared towards technology, that distinguish different types of value relevant for evaluating the consequences of technology, that analyze how such values are promoted or harmed through the design and use of technological artefacts and processes, and that theorize how we can balance such values against each other.

A second way in which philosophy of technology still falls short is that many philosophical studies that focus on implications of technology do not involve developed theories of (aspects of) society and their interaction with technology. A lot of work is still being done that is theoretically underdeveloped. Work is being done in which implications are studied of particular technologies for culture in the absence of a developed theory of culture or of the way culture interacts with technology. Work is being done that studies the implications of computer-mediated communication for friendship in the absence of developed theories of friendship, trust and intimacy, and of the way in which technological artifacts may mediate or affect these qualities. It is hard to make any reliable claims about the significance of technology for culture or friendship without a developed and substantiated theory of what these things are and how technologies may affect them. Yet, such theories are often missing or rudimentary. Generally, what is needed in the field is a greater number of developed theories for studying how technological artifacts interact with aspects of society, and better accounts of these social phenomena themselves. Such theories can be borrowed from STS or other social sciences (in line with the empirical turn), imported from mainstream philosophy, or self-made, but we need to include more of them in our work.

Third, let me consider some limitations that are specific to current technology ethics. Most importantly, there is a lack of work in *general* technology ethics, as opposed to the applied ethics of specific technologies. Specifically, very little work is being done to advance the field of technology ethics theoretically or methodologically. The empirical turn has not yielded a *single* monograph in technology ethics that presents theories and methods for approaching the field.[4] Another, related criticism is that very little work is being done to address the question how new technology can be developed in a morally responsible manner. On the one hand, ethics of technology focuses strongly on social-ethical issues concerning technologies that already exists, and, on the other, on the general responsibilities of engineers. What is missing are effective models that will enable us to assess how we can take accepted norms and values into account when developing new technologies and how we can anticipate moral and normative issues with regard to future applications. That is, what is missing are effective models for ethical technology assessment and for the ethical development of new technology.

Finally, I want to voice some concern about the possibility that society-oriented and engineering-oriented philosophy of technology may drift apart. The two approaches obviously have a subject matter that is largely different: the first focuses on implications of technology for society, whereas the latter focuses on engineering. There is a risk that the two communities surrounding them do not interact, and thus the field is thereby divided in two. That this may happen is already noticeable, to some extent, in encyclopedia entries, introductory texts and anthologies in the philosophy of technology. Some of these focus almost entirely on one of the two approaches and largely or completely ignore the other. This is a pity, as it misrepresents the field. The fact is that both approaches can benefit from each other. Engineering-oriented philosophy of technology develops theories of technological artifacts and practices, design processes and the relation between design and use that can be used in society-oriented philosophy of technology. The latter develops theories of society-technology relations that can be used by the former to include better descriptions of the social context of engineering. So my hope is that these two approaches don't diverge but interact and blend in those areas where there are common concerns.

5. Conclusion: An Agenda for the Philosophy of Technology

What I have been arguing in the previous section is that in spite of the impressive achievements in the field over the past twenty-five years, there is still much room for progress. In what remains, I will make some suggestions of how the challenges I have posed may be taken up.[5]

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[4] This is a bold statement that I nevertheless want to maintain. There are encyclopedias, like Mitcham's *Encyclopedia of Science Technology and Ethics* (2005). There are monographs in the classical approach, like Hans Jonas' (1985) *The Imperative of Responsibility*. But there seem to be no book-length single-author studies in general technology ethics after the empirical turn, and very few even with a focus on applied forms of technology ethics.

[5] Many of the new approaches that I will be advocating can be found in the new research program of the department of philosophy of the University of Twente, called *Interpretive and Normative Investigations of Technology and Technological Culture*. I am head of both the program and the department, as its newly-appointed professor in philosophy of technology.

First, let us consider the need for applied theories of value in the field. The challenge as I see it is to develop theories that enable us to conduct broads evaluation of different technologies and technological practices on the basis of both ethical and non-ethical values. The study of different types of value is the domain of *theory of value*, which is branch of philosophy different from ethics. For the philosophy of technology we need a theory of value that considers the relation between technology and value realization. Such a theory would distinguish different types of value, such as ethical, aesthetic, cultural, social, prudential and economic value, but also intrinsic and instrumental value, that attaches to technological artifacts and processes in society. Second, we need to develop a view on how such values may be compared to each other. How can we compare the value of safety to that of privacy and determine which one is more important? How can we compare the value of a strong economy to that of a clean environment? Third, we need to consider how values are realized in, and promoted by, technology. Can technological artifacts embody values, and what factors other than technology determine whether values are promoted or harmed when technologies are used? The third of these issues has recently been taken up in theories of values in design (Nissenbaum, 1998) and value-sensitive design (Friedman and Kahn, 2003), and much of my own current research is concerned with the former two as well (cf. Brey, 2007a).

Values, as Wright (1963) has argued, are varieties of goodness. To say that something has moral value, is to say that it is morally good, and to say that something has economic value is to say that is economically good. I have argued that the two most important kinds of goodness with respect to technology are the goodness of our lives and the goodness of society (Brey, 2007a). Other varieties of goodness, such as the goodness of culture or the economy, are derivative of these values. We should therefore particularly invest in developing theories of the good life and the good society, and study how technology may positively or negatively affect these varieties of goodness. Great work is already being done in this area, both on technology and the good life (Borgmann, 1984; Higgs, Light and Strong, 2000) and on the relation between technology and a good society (Feenberg, 1995; Winner, 1986). Yet, to make further progress in these areas, we need more than a handful of philosophers who are studying these issues. We need flourishing communities of scholars who are in dialogue with each other and are pushing the envelope on these issues.

A second needed improvement in the field that identified was the development of more and better theories of the relation between technology and (aspects of) society. A rough distinction can be made of two types of such theories. *Theories of human-technology relations* are theories at the micro-level that describe how human beings relate to, and interact with, technological artifacts or engage in technological practices. *Theories of technology-society relations* are theories that describe how technological products and practices relate to, and interact with, aspects of society. These are macro- and meso-level theories that describe, for example, how technological artifacts may influence political processes or how processes of technological design interact with economic processes. Currently, there are few such theories in the field that have gained broad acceptance. There are some that are influential, such as Don Ihde's phenomenological theory of human-technology relations, Bruno Latour's actor-network theory, Langdon Winner's theory of the politics of artifacts, and Andrew Feenberg's theory of technological rationalization. However, these are theories that are geared towards specific issues and questions, and we need additional theories to cover additional issues.

To better understand human-technology relations, we need theories of the interaction between technological artifacts and practices on the one hand, and human perception, cognition, action, experience, identity, body image, moral development, moral deliberation, human nature, basic beliefs and values, and so forth. Without such theories, either developed within philosophy or borrowed from the social sciences, we can make little progress in understanding and evaluating human-technology relations. We now have some good theories in this area, like Ihde's and Latour's, but we need to do a lot more. Similarly, regarding technology-society relations, we need theories of the interaction between technological artifacts, practices and development processes on the one hand, and on the other social structures, institutions and processes (e.g., politics, the economy, higher education, globalization, friendship relations, gender issues), cultural practices and beliefs, and nature and the environment. Currently, there are few such theories in the field, and virtually none that have widespread support.

To advance our field, I would propose that we prioritize the development of two types of theories of the relation beween technology and society/humans. The first is the development of *theories of technological agency*: how do technological artifacts and practices affect ("act on") the environment in which they are introduced and used, how do they work to generate consequences, and on what other factors do these consequences depend? This is a topic on which, fortunately, several philosophers are now

working, myself included (Brey, 2007b; 2006). The second is the development of *theories of technology and modernity*: macro-level theories that relate the dynamics of technology to the basic structures and institutions of modern society. In *Modernity and Technology*, I collaborated with Andrew Feenberg and Tom Misa to put such theories more centrally on the agenda, and to forge collaborations with sociologists and historians to develop these theories to be empirically informed and applicable to individual cases (Misa, Brey and Feenberg, 2003).

The third and final challenge I will return to concerns technology ethics. In this field, I believe, there is a need for the development of theories and methods in four areas. First of all, we need better theories of the moral agency of artifacts: how do technological artifacts and processes embody moral values and norms, and how are these expressed in action? This issue connects to the broader issue of values that I discussed earlier, and there I already mentioned some relevant existing approaches. Second, and relatedly, we need to have ethical theories of technologically mediated agency by humans. We need to understand how the use or presence of technology influences the moral dimensions of human action and individual responsibility. The seminal work of Hans Jonas (1985) is valuable for this purpose, but we need theories after the empirical turn that address this issue as well. Third, we need to develop theories and methods of ethical technology assessment, by which I mean the study and evaluation of the ethical consequences of new technology. Currently, such theories hardly exist, and this makes it difficult to for ethicists to have a constructive role in the assessment and development of new and emerging technologies, since assessments of expected ethical issues are now often speculative. Part of what we need to do is work on methods for developing ethico-technical scenarios, which allow us to make reasoned predictions about which normative and ethical issues will or could arise with regard to new technologies. Fourth and finally, we need better methods for the ethical analysis and guidance of social and political debates surrounding the introduction of new technology that assess how such debates can be held in a way that involves relevant stakeholders and allows for a honest consideration of relevant moral arguments (cf. Swierstra and Rip, 2007).

These are exciting times to be working in the field. Much progress has been made in recent decades, and the field is maturing well. Now is the time to take the field to the next level, however, and to strengthen both theory and application. To grow further as a field, we need to show that we have more to offer than a series of interesting theories and viewpoints. We need to show that we are a field in which people work together on joint problems and issues, in which there is constant dialogue about the best way to approach them, and in which people are aware of and build on each other's work. I hope that my analysis of the contemporary situation as well as my agenda for the future can in a modest way contribute to these goals.

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