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The 'Empirical' in the Empirical Turn: A Critical Analysis

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Abstract
During the second half of the twentieth century, several philosophers of technology argued that their predecessors had reflected too abstractly and pessimistically on technology. In the view of these critics, one should study technologies empirically in order to fully understand them. They developed several strategies to empirically inform the philosophy of technology and called their new approach the empirical turn. However, they provide insufficient indications of what exactly is meant by empirical study in their work. This leads to the critical question of what counts as an empirically informed philosophy of technology in the empirical turn. In order to answer this question, we first elaborate on the problems that the empirical turn philosophers tried to address; secondly, we sketch their solutions, and, thirdly, we critically discuss their conceptions of empirical study. Our critical analysis of the empirical turn contributes to new efforts to engage in an empirically informed philosophy of technology.

Keywords Empirical turn · Philosophy of technology · Postphenomenology · Critical theory of technology · Analytical philosophy of technology

1 Introduction

During the second half of the twentieth century, several philosophers, such as Heidegger and Ellul, were criticized for reflecting too abstractly and too pessimistically on technology. These philosophers, also called the traditional philosophers of technology, rather than studying actual technologies, studied the technologies too much from the perspective of their own presuppositions. It was assumed that the empirical study of technologies would result in a better understanding and nuanced image of them (Achterhuis, 2001a; Ihde, 2009; Kroes & Meijers, 2000; Verbeek, 2015). This led to the empirical turn in the philosophy of technology at the end of the 1990s. During this turn, several strategies were proposed. Some philosophers started to study technologies in engineering practice, others in their social context (Kroes & Meijers, 2000; Verbeek, 2005; Feenberg, 2017).

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We agree with these philosophers that it is inevitable that a philosophy of technology will incorporate some sort of empirical material, for, as philosophers, we need to know the object of our studies. However, the notion of empirical study is not self-evident and therefore the debate about empirically informing studies on the philosophy of technology is obscured. Although empirical turn philosophers have written extensively about their approaches, their descriptions of empirical study remain implicit. This can be illustrated by two quotations: "[i]ts primary aim is not empirical adequacy, but the clarification of the conceptual frameworks used in empirically adequate descriptions of technology" (Kroes & Meijers, 2000, xxi) and "a more empirically oriented approach, one that investigates the role played by specific technologies in specific contexts" (Verbeek, 2005, 7). Even though these philosophers elaborate on their empirical approach, these quotations still raise questions like: when is a description empirically adequate? How should specific technologies be studied in specific contexts so that their study can be called empirical?

In addition, several philosophers have criticized the empirical turn for becoming too focused on analyzing technologies on the concrete level (Zwier et al., 2016), whereas empirical turn philosophers persist in their argument that technologies need to be analyzed on the concrete level. This is clearly visible in a discussion from 2015 (Lemmens, 2015b; Verbeek, 2015). Verbeek first argues that Lemmens does not study technologies at the micro level and therefore his approach is not empirical. Lemmens disagrees and subsequently defends his approach (Lemmens, 2015a). These philosophers have different understandings of what empirical means and therefore cannot agree on how to empirically inform a philosophy of technology. However, as long as their meanings of empirical remain implicit, such discussions remain open ended.

This brings us to the main research question of this paper: What counts as empirical study in the empirical turn of the philosophy of technology? The aim of this paper is to reconstruct the meaning of empirical in the empirical turn in order to make explicit what philosophers regard as empirical study. What is the object of their empirical studies? How do they conduct their empirical studies? How do they relate the empirical to the theoretical? The results contribute to a systematic discussion on the methodology of an empirically informed philosophy of technology.

In our analysis, we apply a critical hermeneutic methodology. This consists of a hermeneutic analysis of key texts of the empirical turn in order to get a deeper understanding of what empirical study means. Subsequently, we reflect critically on these texts in order to make their assumptions explicit. The empirical turn happened during the 1990s, and, in those days, philosophers from three different philosophical subdisciplines were involved: phenomenology, critical theory, and analytical philosophy. Our focus is on those philosophers. Discussing these three branches will enable us to understand what empirical study means in a broad sense in order to see whether or not empirical turn philosophers have a unified notion of empirical study. As it is not our aim to evaluate these branches as a whole, we limit our discussion to key representatives of each branch. Moreover, we discuss them in separate subsections to ensure that their philosophical differences do not obscure the analysis.

The paper is structured as follows. In Sect. 2, we elaborate on the empirical turn and its critics in order to situate this paper in the ongoing discussion. In Sects. 3 and 4, the empirical study concept is analyzed. In order to negatively identify what is seen as non-empirical by empirical turn philosophers, Sect. 3 focuses on the problems found by empirical turn philosophers in the studies of the traditional philosophers of technology. Section 4 focuses on the solutions offered by empirical turn philosophers, thereby enabling us to positively identify what empirical turn philosophers see as empirical and to describe what empirical

turn philosophers regard as an empirical study. In Sect. 5, we reflect critically on these findings. From these reflections, conclusions are drawn about the opportunities and limitations of these conceptualizations. Moreover, suggestions are made for future debates about the scope of the empirical turn.

2 The History of the Empirical Turn

Before the 1970s, several philosophers had already reflected on technology, but mostly in the context of broader issues. Heidegger, for example, started with a study of the nature of Being and incorporated technology into his studies, as he regarded modern technology as the determinant of Being in this age (Heidegger, 1954). Hardly any philosophers those days focused solely on the study of technology. Moreover, the focus was mainly on the problematic impact of technologies (e.g., Ellul, 1964; Marcuse, 1964). In the 1970s and the 1980s, several philosophers argued that modern technology had a major impact on human lives and therefore that philosophers should study it in order to make people ponder on technological developments or to propose solutions to specific problems (Bunge, 1979; Jonas, 1979; Mitcham, 1979; Rapp, 1981). Philosophers' focus thus shifted from the study of technology in general to that of concrete technological developments and to finding solutions to the problems that they found.

This shift of focus also led to critiques of the traditional philosophers of technology, leading to the empirical turn. The argument was that, precisely because the traditional philosophers of technology did not discuss concrete technologies, they did not understand them fully and were not able to see possible solutions. Therefore, according to empirical turn philosophers, studying concrete technologies helps to understand technologies fully and to be less pessimistic (Feenberg, 1999; Verbeek, 2005). In response to this turn, several philosophers have argued that, even though it is indeed important to study concrete technologies, this turn has become too focused on concrete artifacts, also called the micro level, and, because of this, they have lost sight of structural issues (e.g., Misa, 2009; Zwier et al., 2016). Most of these philosophers do not reject the empirical turn, but search for ways to broaden it.

Several solutions have been suggested to do this. These solutions can be categorized into three types. First, some philosophers argue that the criticism of the traditional philosophers of technology is not (fully) justified and argue for their rehabilitation (Cera, 2020; Winner, 1993). A concrete way to do this would be to adopt the approach of the traditional philosophers of technology as a framework while studying concrete technologies (Son, 2004). Second, other philosophers have argued that the focus on the micro level is too limited and either that the focus should be on another level or that micro-level studies should be related to studies at other levels (Misa, 2009; Heikkerö, 2012; Zwier et al., 2016). Third, in the empirical turn, the approach of the traditional philosophers of technology has been called a transcendental approach (Verbeek, 2005). In recent years, much attention has been given to the rehabilitation of the transcendental notion. Most of these philosophers try to do this by relating the transcendental to the empirical. This means that, according to these philosophers, a turn toward the empirical does not imply a turn away from the transcendental (Coeckelbergh, 2017; Lemmens, 2021; Romele, 2020; Smith, 2015, 2018). Van den Eede takes it a step further and tries to rehabilitate the transcendental by arguing, on the basis of object-oriented ontology, that everything is related to everything else. This would

mean that there is no gap between the transcendental and the empirical, as they are interrelated (Van den Eede, 2021).

Many interesting points are contained in these suggestions. However, some obscurities in the debate complicate their evaluation. One such obscurity is the exact understanding of the transcendental in the empirical turn. Because of this, critics can disagree about whether the transcendental is fully excluded from postphenomenology or not (cf., Lemmens, 2021; Romele, 2021). This difference matters for the question of how to rehabilitate the transcendental. In the same way, it is unclear what empirical turn philosophers mean exactly by empirical. To be able to evaluate the arguments for the empirical turn as well as the suggestions to broaden the empirical turn, such basic notions must first be clarified. Therefore, in this paper, we set other critical discussions of the empirical turn aside and concentrate on clarifying the meaning of empirical study in studies on the empirical turn.

3 Problems in the Traditional Philosophy of Technology

3.1 Early Criticism

Criticism of the traditional philosophers of technology started a few decades before the empirical turn. The early critics had two main points of critique. First, during the 1979s and the 1980s, it was argued that their theories are not sufficiently related to concrete reality. The critics do not regard the abstractness of the theories of the traditional philosophers of technology as a problem, but they argue that they should have related their theories to social, cultural, and historical aspects too. By doing so, they could have seen not only how technology changes society and culture, but also how these contextual factors change technology (Diemer, 1983; Margolis, 1983; Mitcham, 1979; Ropohl, 1983; Zandi, 1979). The second critique relates to their pessimism. The critics agree that modern technology is problematic in certain respects, but, if the traditional philosophers of technology had been less pessimistic, they could have offered solutions or inspired a new generation of political philosophers (Svensson, 1979; Zandi, 1979). The traditional philosophers of technology are also criticized for being too romantic, for example by arbitrarily favoring the experiences of rural societies (Bunge, 1979; Margolis, 1983). These points of criticism were adopted by the empirical turn, but in various ways in the various branches of the empirical turn. We discuss the differences in the following three subsections.

3.2 Postphenomenology

The focus on the human–technology relation and how they constitute each other is central in postphenomenology (Verbeek, 2005). Postphenomenology is a combination of phenomenology, pragmatism, and technoscience. Experience is important in both phenomenology and pragmatism. However, Ihde argued that pragmatism enabled him to turn away from the essentialist perspective on technologies of the traditional philosophers of technology. Instead, he argued that technologies can be perceived from multiple perspectives and can be incorporated into various cultures in various ways. Moreover, he used pragmatism to embed experience in the material world and to be able to educe its cultural-social dimensions. In order to further embed his studies of technologies in the material world and to be able to study concrete technologies and their various characteristics, Ihde added

technoscience to postphenomenology (Ihde, 1993, 2009). Verbeek made this last step more concrete by using ideas from social constructivism to study concrete technologies (Verbeek, 2005).

In postphenomenology, both points of critique of the early critics are incorporated in its argumentation. The first point was intensified in the sense that not only was it regarded as problematic that the traditional philosophers of technology did not relate their studies to societal and cultural aspects, but also the abstraction in the traditional philosophers' theories became a problem. Critics argued that the traditional philosophers of technology abstracted technologies from their contexts and reduced the world to something that is handed down to technology. Technology is placed over against nature, natural things, and humanity, and is regarded as an autonomous force that would unidirectionally change culture and society. This is called Technology with a capital T (Achterhuis, 2001a; Ihde, 1990, 2010). More specifically, the traditional philosophers analyzed technologies not at a concrete or ontic level, but from an ontological perspective. This perspective aims to identify the conditions of the possibility of concrete or ontic technologies, like Enframing (*Gestell)*, mass production, and so on. In postphenomenology, this is regarded as problematic for three reasons. These are: 1) if the ontological perspective is negative, then technologies on the ontic level can no longer be assessed positively. This would mean that the first and the second point of the early critics are related. 2) The result of the analysis of each technology is basically the same. 3) Aspects that fall outside this conception will be overlooked and concrete technologies become merely illustrations of that broader conception (Achterhuis, 2001a; Ihde, 2006, 2010; Rosenberger & Verbeek, 2015; Verbeek, 2005). Consequently, the traditional philosophers of technology were not able to see any solutions. In postphenomenology, it is stated that some traditional philosophers of technology did try to find solutions, like applying the precautionary principle to technological developments, but these attempts are regarded as unfinished or unsuccessful (Achterhuis, 2001a; Dorrestein, 2015; Ihde, 1979).

3.3 The Critical Theory of Technology

Feenberg analyzes technologies from a political perspective, namely, critical theory. Following the empirical turn, he regards the analysis of concrete technologies as inevitable – always, however, in combination with his political theory, for he argues that case-studies cannot be understood if they are not placed in the context of modernity (Feenberg, 1999, 2010). Feenberg describes his aim as follows: "Critical theory of technology is concerned with the threat to human agency posed by the technocratic system that dominates modern societies" (Feenberg, 2017, 635). In contrast to the traditional philosophers of technology, he is focused on finding solutions to the problems that he finds.

Consequently, Feenberg's critique of the traditional philosophers of technology is focused only on the second point of critique of the early critics, namely, that they did not try to find solutions. According to him, the only hope that traditional philosophers like Heidegger, Ellul, and Marcuse offer is too abstract to be useful in practice. The reason that they did not offer usable solutions originates, according to Feenberg, in their essentialist and deterministic conceptions of technology. The difference with postphenomenology thus is that Feenberg does not regard traditional philosophers' abstraction, but rather the content of their views, as the cause of their pessimism.

Regarding their essentialist conceptions of technology, traditional philosophers of technology have argued that the essence of technology is the root cause of the main

problems of modern civilization and that the link between modernity and modern technology is indissoluble. Hence, if there is a fundamental problem with modernity, technology is just as problematic. It does not matter what kind of technology one is dealing with, what the context is, or what new developments there are in history. Technology becomes destiny and there is no way to reform it. Marcuse tried to find solutions as he did not take the essence of technology as how things are actually established, but as a potentiality, i.e., not as what technology *is* but what it *could be*. According to Feenberg however, Marcuse did not elaborate enough on his solutions to really challenge the pessimism of Heidegger and Ellul (Feenberg, 1991, 1999, 2010).

The second problem is the deterministic conceptions of the traditional philosophers of technology. Determinism regards technology as something that develops unidirectionally and makes social institutions adapt to it. Technology is a decontextualized, self-generating phenomenon that is universal in scope, according to this view. This means that different forms of technology express the same kind of modernism. Feenberg argues that Heidegger came to his deterministic view partly because he analyzed technology from the perspective of the people who are in power. Consequently, technology becomes a system of control (Feenberg, 2005).

3.4 The Analytical Philosophy of Technology

Whereas the early critics, postphenomenology, and the critical theory of technology are all interested in technology in its social and historical context, analytical philosophers of technology are interested in technology in its engineering context. This focus on the engineering phase is regarded as important for two reasons. First, it is the phase in which technologies get their shape. It would help to see the factors that influence change in the design of artifacts (Baird, 2000). Second, in comparison to the philosophy of science, it is argued that engineers are comparable to scientists and design is comparable to the scientific method (Pitt, 2000b). The main concern of analytic philosophers of technology is to find ways to become more relevant to society, engineering, and philosophy as a whole. An important aim of their empirical turn, therefore, is to find ways to collaborate with engineers and to have more impact on technological developments (Kroes & Meijers, 2000; Kroes, 2000; Franssen & Koller, 2016; Kroes & Meijers, 2016; Pitt, 2016).

As analytical philosophers of technology study technologies in a different context than the other branches, their criticism of the traditional philosophers of technology differs too. It is interesting that they seem to add philosophers such as Winner, Ihde, Ferré, and so on to the list of traditional philosophers of technology (Kroes, 2000; Pitt, 2000a). An important point of critique is that the traditional philosophers of technology analyzed technologies too abstractly, meaning that they did not study technologies in detail in their engineering context. They had studied technology from the outside, as a black box, instead of the design, development, production, and maintenance of artifacts. Because of this, they did not see that technology is also a collection of artifacts, a form of knowledge, a form of human action, or a social process. Technology is treated by them as an undifferentiated whole (Kroes & Meijers, 2000; Kroes, 2000).

Analytical philosophers of technology are also critical about the pessimism of the traditional philosophers of technology. Their explanation of why they were so pessimistic is that they had a normative/evaluative stance toward technology and their topics

were restricted to the discussion of moral values. They therefore came to the negative conclusion that technology would be a threat to human existence (Kroes & Meijers, 2000, 2016).

3.5 The Problems that the Empirical Turn Tried to Solve

The discussion in the previous three subsections shows that, on a superficial level, the critique of the traditional philosophers of technology remained similar to that of the early critics. However, if we dig deeper, then we see that there are important differences between the various branches. In both postphenomenology and the analytical philosophy of technology, the very abstractness of the theories of the traditional philosophers of technology became a problem. They explain this in different contexts, so they regard abstraction as a problem for different reasons. In the critical theory of technology, abstractness is not regarded as a problem and therefore Feenberg can relate his studies of technologies to an abstract theory, i.e., critical theory. They all explain the pessimism of the traditional philosophers of technology in different ways. Postphenomenology points to abstraction as the cause, the critical theory of technology points to the contents of their theories, and analytical philosophers point to the normative stance of the traditional philosophers.

So even when the early critics and the various branches of the empirical turn share some basic arguments about what is problematic in the work of the traditional philosophers of technology, their arguments differ on a deeper level. In the next section, we shall see that, as a result, their solutions seem similar at a superficial level, but, as they were not unanimous in the problems that they needed to solve, their solutions differ on a deeper level. This also affects what they regard as empirical study.

4 The Solutions Offered: Empirical in the Empirical Turn

In the 1980s, in the science and technology studies (STS) discipline, social constructivist approaches were developed in which it was argued that scientific and technological developments are not linear developments, but influenced by social factors. Scientific and technological findings that are regarded as true facts in society are actually social constructs as the result of contingent social processes. Social constructivist approaches offer ways to unpack the black box of this process of 'fact' construction (Latour, 1987; Pinch & Bijker, 1984). Empirical turn philosophers saw in these approaches a refutation of the flaws in the theories of the traditional philosophers of technology and started to incorporate them. As these approaches were developed through the description of historical case-studies, empirical turn philosophers also incorporated case-studies in which technologies are described in detail. These case-studies are sometimes conducted by the philosophers themselves, and sometimes they rely on other scholars' case-studies.

4.1 Postphenomenology—Solutions Offered

Ihde wrote a justification for a turn to the concrete or ontic level of analysis in 1979. He distinguished between two views on the relationship between philosophy and technology. In the first view, technology is regarded as the application of science. In the second view, which Ihde supports, it is argued that technology is historically and ontologically prior to

science, as instruments are basic to the knowledge gathering of humans. Ihde argued that, from this perspective, it follows that technology is an interesting phenomenon to study and that it should be approached from the context in which concrete technologies function. Furthermore, Ihde argued that, as these two views contain a different ontology, the difference between them is more than just a difference of focus. In the first view, knowledge precedes action and concepts precede practice, but the second view turns this around so that practice precedes theory. Therefore, according to Ihde, it becomes very difficult to reconcile the two (Ihde, 1979, 1983). This argument goes hand in hand with his arguments against the traditional philosophers of technology, namely, that abstraction itself is a problem.

From this it easily follows that empirical in postphenomenology means the movement from case-study—the description of a concrete technology—to theory. The function of case-studies in this view is to form a solid basis for an adequate understanding of technologies and to avoid pessimism, as case-studies help to identify possibilities for further development (Verbeek, 2010). It is argued that, based on descriptions on this concrete level of cases, it is possible to theorize and to develop macro-level (e.g., political) theories (Verbeek, 2015). The reason for this is that the particularities of concrete technologies can be found at the micro-level. Consequently, by analyzing technologies bottom-up, philosophers can fully appreciate these particularities, and subsequently, let technologies challenge their theories and conceptions. This opens possibilities to reconsider our ideas about the relationship between humans and technologies. The opposite movement, applying pre-existing theories to concrete technologies, is regarded as not empirical, as in that case technologies are reduced to that theory and their richness and complexity are overlooked (Ihde, 1979; Verbeek, 2005).

An ambiguity in this understanding of empirical is that postphenomenology philosophers argue for this movement from case to theory, but that they nevertheless apply their own theories to specific cases. In 'Transcendence in Technology', for example, Aydin and Verbeek (2015) study the relationship between science/technology and religion. They use their mediation theory to study this relationship and "leave for future research the systematic and differentiated application of the proposed framework on particular technologies" (Aydin & Verbeek, 2015, 296).

It is argued in postphenomenology that technologies are inextricably related to humans and therefore their focus is on *cases* that are close to people's experience, like obstetric ultrasound, cell phones, and smart technologies (Ihde, 2014; Verbeek, 2008, 2011). Case-studies can thus refer to philosophers' personal experiences, case-studies conducted by philosophers, or case-studies borrowed from the social sciences (Aydin, 2013; Rosenberger & Verbeek, 2015; Verbeek, 2005). Using a lot of examples is sometimes called empirical (Achterhuis, 2001b; Rosenberger & Verbeek, 2015; Smiths, 2001), but, as it is also argued that examples can be used too fleetingly or to extrapolate speculatively (Ihde, 2004, 2010), the use of examples alone cannot suffice to call an approach empirical, from the postphenomenology perspective.

The focus of this meaning of empirical is thus on the relationship between empirical case and theory. The main methodology for an empirical study is to describe concrete human–technology relations in their contexts, and postphenomenology philosophers use their combination of phenomenology, postmodernity, and pragmatism to do that (Ihde, 1993; Rosenberger & Verbeek, 2015). This methodology can be clearly found in their case-studies. This has raised many interesting ideas, for example about the importance of understanding the relationship between humans and various kinds of scientific imaging (Rosenberger, 2011; Verbeek, 2008). However, a basic assumption is that empirical necessarily follows the direction from case to theory. This is also called studies from within, whereas

theories are from outside (Verbeek, 2015). This, however, raises the question of whether a perspective from outside cannot help to better understand a technology. Let us compare this to cultures. When we know our culture from within, then we have a good understanding of it. However, if we meet other cultures and thus also develop a view from outside, we can learn even more about our own culture. So, even though analyses from within generate interesting understandings, the question is why empirical would need to exclude a view from outside.

4.2 The Critical Theory of Technology—Solutions Offered

In the critical theory of technology, the only problem to be solved is the essentialism and determinism of the traditional philosophy of technology so that it would become possible to offer solutions to problematic aspects of technological developments. Feenberg tries to solve this problem by incorporating STS approaches in his critical theory. As abstraction is not regarded as a problem, in this branch, theorizing goes back and forth between the empirical and the theoretical and thus Feenberg tries to show how society-wide factors shape technologies (Feenberg, 1995, 1999). He calls his approach "a synthesis of theoretical and empirical approaches" (Feenberg, 2005, 62).

In order to find a synthesis between critical theory and social constructivism, Feenberg replaces concepts with which he does not agree in each approach with insights from the other. As a result, he uses broad theoretical constructs like rationality, class, and culture, but, following social constructivism, he does not regard them as universals. He regards rationality, for example, as a cultural and therefore as a context-specific phenomenon (Feenberg, 2003, 2010, 2017). Consequently, he is able to combine theoretical insight in modernity with socially constructed 'facts'. Out of these ideas, Feenberg developed an approach that he calls instrumentalization theory. In this approach, theory and constructed facts are two stages of analysis that together should avoid falling into one of the two extremes of remaining strictly descriptive or of a priori reasoning (Feenberg, 2003, 2005).

The function of case-studies in the critical theory of technology is, on the one hand, to generate new avenues in his theory. On the other, they enable him to make concrete proposals about how to make technologies more democratic. The methodology of case-studies enables Feenberg to unravel, what he calls, the *technological code* of technologies. This code refers to hegemonic values and believes of several social groups as captured in the design of a technology. If a technology contains undemocratic values and believes, a case-study of that technology can disclose them. This shows why broader theories and case-studies are both inevitable in Feenbergs studies, for he needs theories to either find hegemonic values and believes of certain social groups, or to make sense of them (Feenberg, 1995, 1999).

Democratizing technology is most important to him and therefore he takes a political stance in his analyses; but, instead of arguing against certain technological developments, he suggests how technologies can be redesigned so that they respect a broader range of democratic interests or societal values. He calls this a democratic transformation from below (Feenberg, 2009, 2017). Feenberg thus tries to be less pessimistic than the traditional philosophers of technology. Case-studies are often conducted by Feenberg himself, but are sometimes based on the work of other scholars, such as psychiatrists (Feenberg, 1995).

Feenberg's notion of empirical is methodological, as it refers to the incorporation of concrete approaches into his own approach. Unlike in postphenomenology, in this approach

there is no need to start from the micro level, the opposite direction can also be called empirical, as long as it entails some social constructivist analysis of a concrete technology. This approach leads to very interesting understandings about how the design of technologies can be either democratic or discriminating. Moreover, in the videotex technology case, Feenberg shows how democratic processes can overrule rationalistic codes built into technologies by designers (Feenberg, 1995). However, it still raises some questions; first, about the distinction between the theoretical and the empirical. In instrumentalization theory, the theoretical and the empirical are two stages of analysis. Of course, these are not fully distinct stages of analysis for Feenberg, but this raises the question of whether we should even see them as two stages of analysis—for one thing, because descriptions of technologies are also theory laden. Critical theory is already on Feenberg's mind when he describes a technology, just as multistability is on the mind of a postphenomenology philosopher who describes a technology. Maybe, because of this, we cannot see them as distinct stages of analysis. Another question is whether the empirical analysis needs to be social constructivist, a question that has already been raised by an analytical philosopher of technology (Bos, 2000). Maybe there are other forms of empirical study that can generate understandings about technologies.

4.3 The Analytical Philosophy of Technology—Solutions Offered

The criticism of analytical philosophers of technology is that technologies should be studied in detail in their engineering context. Empirical in this branch therefore became both a term that refers to the movement from case-study to theory and a contextual term. Unlike the previously discussed branches, analytical philosophers of technology do not regard technology as a social phenomenon. The social context is therefore unimportant in their case-studies (Houkes et al., 2011).

Case-studies in the analytical philosophy of technology are studies of concepts and conceptual frameworks concerning concrete artifacts in engineering practice. Thus, these philosophers expect to obtain new inspiration and insights for philosophical theories. In order to achieve this, they study both the objects themselves and how engineers communicate about them. In this way, they have, for example, come to the understanding that technologies both have a physical structure and a function. This gave rise to a project in which analytical philosophers conceptualize this structure and function and how they relate to each other in order to understand what makes a certain object a technological artifact. Just as in this example, case-studies in this branch of the empirical turn are meant to turn their insights about empirical practices into new theories about artifacts, as they argue that their efforts should remain a philosophical endeavor. Consequently, after analyzing a case, analytical philosophers of technology do not stay close to the empirical (Houkes & Meijers, 2006; Kroes, 2000; Meijers, 2000).

Overall, they have argued that their cases should contain empirically adequate descriptions (Kroes & Meijers, 2000). More specifically, three criteria have been described for what is regarded as a good case-study: 1) it needs to help clarify concepts, methods, and practices, rather than functioning as an illustration; 2) its description should contain relevant details about the case; 3) it does not need to be a representative case, given that the aim is to clarify concepts, not sociological or historical constructs. At the same time, the case should not be non-significant either (Meijers, 2000). These studies are conducted by observing engineering practice, as well as by studying engineering literature or by

borrowing case-studies from other disciplines (Kroes & Meijers, 2000; Houkes & Vermaas, 2009; Vermaas, 2016; Zwart & De Vries, 2016).

The focus in the analytical philosophy of technology is mainly theoretical. This explains why, in the event of inconsistencies in empirically adequate descriptions of technologies, attempts are made to resolve this at a logical level (Kroes, 2000). In order to ensure that justice is done to the empirical, it is suggested that empirical studies should be related to philosophical theories by means of the concept of coherence. This means that philosophical theories need to be coherent with the empirical (Kroes & Meijers, 2016).

Empirical in this branch thus refers to descriptions of concrete artifacts based on observations in the engineering context. Philosophers apply their analytical background to concrete technologies, meaning that they analyze conceptual frameworks. Thus, they have, for example, conducted many case-studies to describe how the physical and the functional aspects of technologies relate to each other, which they call dual-nature theory (Houkes et al., 2011). Such theoretical understandings can help to elucidate the differences between analyzing a technology when it functions and when it malfunctions. This branch thus also generates important understandings for the philosophy of technology. This conception of the empirical relates both to the direction of the analysis and to the context in which the analysis is performed. Of course, it is interesting when certain philosophers dedicate themselves to understanding technologies in their engineering phase. The world of technology is very broad, so the philosophy of technology should be too; but, as the other branches have shown, technologies can have a very different social impact than the engineers intended. Therefore, we challenge the idea that all empirical studies need to be conducted in the engineering or any other predetermined context.

4.4 Empirical Study According to the Empirical Turn

In the previous subsections, it is shown that the empirical turn has given rise to a variety of approaches that all analyze technology from different perspectives and in different contexts. The empirical turn has not led to a unified conception of empirical—more than that, the approaches even contradict one another in certain respects. Nevertheless, there are several ideas that they do share. Their shared understanding of empirical can be reconstructed as follows.

Social constructivism has been important in each branch. In postphenomenology and the critical theory of technology, it helped philosophers to find a way to conduct detailed case-studies of technologies and to be less pessimistic. In the analytical philosophy of technology, social constructivism was used mainly to argue that the black box of technologies must be opened by means of detailed descriptions. Generally speaking, we can conclude that empirical turn philosophers regard the descriptive case-study approach as the solution to the problems found.

This is confirmed by the fact that all empirical turn philosophers have related their work to practice in one way or another: postphenomenology to human–technology relationships, the critical theory of technology to situations of inequality, and the analytical philosophy of technology to engineering practice. Analytical philosophers of technology abstract most from practice, but their theories remain limited to theories about artifacts. In postphenomenology and the critical theory of technology, philosophers remain closer to practice, but, in the former, theories are applied only to technologies developed from case-studies, whereas, in the latter, a pre-existing theory is applied to technologies.

In addition, they share an understanding of case-study that differs from that in the social sciences. In social science cases, the methodologies have clear procedures, because, if a case-study meets certain predetermined criteria, scientists can transcendent their personal experiences and base their conclusions on solid evidence. It is important to realize that in case-study research an investigator bias exists too. Values and assumptions of the researcher can become incorporated in the case-study, and consequently, in the results too (Baškarada, 2014; Cronin, 2014; Yin, 2014). For that reason, it has been argued by a social scientist that when a researcher does not determine how the validity of the research can be measured, the case-study can unwillingly function to confirm the preconceived notions of the researcher (Yin, 2014). The systematic procedures of case-study research therefore need to be followed meticulously so that the results are reliable. In case of interviews, for example, this concerns considerations as: whom to interview, the type of interview, the length of the interview, what data analysis strategy to use, etc. (DeJonckheere & Vaughn, 2019). The cases that are conducted by empirical turn philosophers themselves do not meet these criteria and therefore there is no reason to think that by conducting case-studies, philosophers transcend their personal experiences to the same extent as social scientists do.

This comparison with the social sciences does not mean that we think that philosophers should apply the criteria of the social sciences. It does not mean either that we see no point in philosophers doing cases. It has been shown in the previous subsections that cases of philosophers do disclose important insights about technologies that have led to interesting new theories. The advantage of cases done by philosophers themselves is that they get an impression of the case and that can lead to new insights. However, such cases do not lead to the kind of empirical knowledge as social science cases do, since the risk of biases is much greater. Therefore, the term case-study, when conducted by philosophers of technology themselves, can better be framed as an *impressionistic* case-study in contrast to a *methodological* case-study of the social sciences. As mentioned in the previous subsections, several empirical turn philosophers regularly make use of social sciences cases in order to build their theories upon them. This is an interesting way to reduce the risks of biases. By being aware of the difference between impressionistic and methodological cases, philosophers can choose what fits a concrete study best.

We can thus conclude that the empirical turn represents a turn to common practice in which concrete technologies are studied. In general, an empirical study can be described as an impressionistic case-study (by philosophers) or methodological case-study (borrowed from the social sciences) of a concrete technology in common practice. As mentioned in the previous subsections, this meaning raises some questions and these are discussed in the next section. The commonalities and differences in understandings of the empirical turn are summarized in Table 1.

5 Discussion: Various Meanings of Empirical

In Sect. 4.4, we concluded that, according to the empirical turn philosophers, an empirical study means a study of a concrete technology in common practice. These studies are sometimes based on a philosopher's impressionistic case-study and sometimes on a methodological case-study conducted by social scientists. This meaning has raised some questions that can be reformulated into three assumptions that are at the foundation of the empirical turn.

The first assumption is that describing technologies on a concrete level will generate the most reliable understandings of them. In Sect. 3, it is shown that, in postphenomenology,

Table 1 Summary of the commonalities and differences between the understandings of empirical in the various branches of the empirical turn philosophy of technology

	Postphenomenology	The critical theory of technology	The analytical philosophy of technology
What is empirical?	The movement from case to theory	The incorporation of science and technology studies approaches	- The engineering context - The movement from case to theory
Direction of analysis	From individual technology to a new theory	Back and forth between individual technology and a pre-existing theory	From individual technology to a new theory and back to practice in order to see whether it coheres with the resulting conceptual frameworks
What is qualified as case-study?	Undefined	Undefined	1. To help clarify concepts, methods, and practices instead of functioning as an illustration. 2. It must contain many relevant details. 3. It does not need to be representative but also not irrelevant
Who conducts a case-study?	- Philosophers (impressionistic cases) - Other scholars (methodological cases)	- Philosophers (impressionistic cases) - Other scholars (methodological cases)	- Philosophers (impressionistic cases) - Other scholars (methodological cases)
Methodology	- Observations by the philosopher - Social constructivism - Literature study about the technology (e.g., Verbeek, 2008) - Other methodologies when cases are conducted by other scholars	- Observations by the philosopher - Social constructivism - Literature studies to complement both contemporary and historical studies (e.g., Feenberg, 2010) - Other methodologies when cases are conducted by other scholars	- Observations by the philosopher - Studying engineering literature
Function of the empirical	- To understand the particularities of technologies in order to challenge theories and conceptions - To form a solid basis for an adequate understanding of technologies - To show possibilities for further development	- To disclose hegemonic values and believes of social groups in technologies - To generate new understandings - To make concrete proposals about how to make technologies more democratic	Derive new topics and concepts for philosophical study
Focus of inquiry	Human–technology relations	Social struggles, inequality between groups	Engineering practice

Table 1 (continued)

	Postphenomenology	The critical theory of technology	The analytical philosophy of technology
Philosophical movements as inspiration	- Postmodernism, - Phenomenology - Pragmatism - Social constructivism	- Modernism - Frankfurt School - Social constructivism	Analytical philosophy

abstraction became a problem. The critical theory of technology only problematized the failure of the traditional philosophers of technology to offer concrete solutions. It is further shown that, in the analytical philosophy of technology, the argument is that the traditional philosophers of technology did not study concrete technologies in their engineering context. Somehow, they all concluded that detailed descriptions of concrete technologies would solve these problems. But the question is why. Studies of individual phenomena will indeed generate different understandings than those at a general level. At a general level, broader issues of phenomena will be shown, whereas studies of individual phenomena will disclose their complexity (Baškarada, 2014; Cronin, 2014). Studies of empirical turn philosophers have indeed given rise to many interesting understandings. However, this does not mean, that understanding technologies in their complexity is the best way to understand them. If a research question is about a general issue, such as digitalization or surveillance capitalism, then this complexity could even disturb the analysis by introducing irrelevant details. This also goes for finding solutions. If the solution to some problematic technological development has to be found on the macro level, then it does not make sense to search at the micro level. It is clear that empirical turn philosophers do not support some kind of naive realism. Social constructivism is important in all their approaches and that is incompatible with naive realism. Therefore, it remains unclear why the turn to descriptions of concrete technologies would generate a better understanding of technologies or would help to more easily see solutions to the problems found. Consequently, it can be argued that, whereas the traditional philosophers of technology were criticized for having a bias toward a broad and abstract perspective, empirical turn philosophers can be criticized for having a bias toward describing the concrete, as the added value of this focus is unclear. We frame this bias of the empirical turn philosophers as a descriptive bias.

The second assumption is that there is a division between the empirical and the theoretical. In Sect. 4.2, it was stated that case descriptions are theory laden. Understandings from the social sciences can help to further explore how the theoretical and the empirical are intermingled. Case- studies in the social sciences are related to theory in an integrated way. One of the criteria for conducting a case-study is a literature review in order to embed the case-study in existing theory. This will show what theories and issues are relevant to the case. This means that, in the social sciences, the concrete focus on case-studies cannot be seen apart from a structural theoretical focus (Baškarada, 2014; Gerring, 2004; Yin, 2014). A case-study is thus usually not a case on its own, but a case of something, of a larger construct. Cases are therefore not unique but share one or more structural features that can be seen only from a structural perspective. A literature review functions to find out what structural features are relevant to the case.

In postphenomenology and the analytical philosophy of technology, no external theories are applied to technologies. New theories are built or old ones based on empirical data are adapted and applied to technologies. In the critical theory of technology, one pre-existing theory is used to study technologies, meaning that the theoretical level is reduced to only one theory, namely, Feenberg's political theory. However, to fully understand certain cases, Feenberg's aim to democratize technology may require structural features that are not part of this theory. As empirical turn philosophers incorporate only one or even no pre-existing theories in their analyses of technologies, there is a huge risk that they will overlook structural features, such as underlying patterns and assumptions. Or, as mentioned in Sect. 4.1, theories from outside can generate important understandings about technologies. However, as the theoretical underpinnings in the empirical turn are limited, the understanding of cases will also be limited. This can be further illustrated by means of the example of Twitter.

In postphenomenology, it can be studied how social media mediates our understanding of friendship, in the critical theory of technology it can be studied whether Twitter contributes to more or less democracy, and in the analytical philosophy of technology the conceptual frameworks that engineers used to (re)design Twitter can be analyzed, but a description of this concrete technology alone will not reveal that Twitter shares an underlying pattern with many other contemporary technologies that run on algorithms. In this sense, Twitter is related to other digital technologies like social media, mobile phones, the search engine Google, Google assistant, automated trades on the stock market, self-driving cars, and so on. Most users are unaware of the amount of data gathered by means of such technologies and how firms use these data to influence people. Moreover, algorithms can work automatically and thus they can influence people without the intermediation of other people. Because of this, humans relate differently to technologies that run by algorithms than to technologies that do not (Karppi & Crawford, 2016; Zuboff, 2015). Algorithms thus form an underlying pattern that needs to be taken into account in studies of technologies that are run by them. Otherwise, only a limited understanding of such technologies will be acquired, in the sense that the concrete technology itself will be only partly understood, as also the ontological level of the issue of algorithms.

This means that, in some studies, a theory about algorithms needs to be integrated into studies on technologies in order to fully understand them. In other studies, other theories are relevant. So, if the theoretical is reduced to something that is secondary to an empirical analysis or reduced to only one theory, then only a limited understanding of technologies will ensue. This raises the question of whether the empirical turn philosophers' approaches enable them to study to develop theories that are not reducible to concrete artifacts. This leads to the third assumption.

The third assumption is that structural issues can be resolved by means of studies of concrete technologies. However, a single example that seems to contradict a theory is not conclusive proof that the theory is incorrect. This can be illustrated by Verbeek's argument against Karl Jaspers, a traditional philosopher of technology. Jaspers claimed that mass-produced products have no meaning for people. Verbeek tries to refute this argument by claiming that people can indeed become attached to mass-produced products, for example when they build memories around them (Verbeek, 2005). However, later on in his book, Verbeek describes how certain products are designed and marketed in such a way that it is expected that they will not be thrown away so easily. Consequently, these products would be more eco-friendly. This would mean that Jaspers was right that people throw away mass-produced products easily. In his argument against Jaspers, Verbeek overlooks the fact that something can be true at a concrete level but not at a structural level. Indeed, people can feel attached to concrete mass-produced artifacts; however, mostly they do not. They have therefore become used to throwing things away easily. In other words, there is a structural feature that objects become disposable that cannot be refuted by means of examples in which people do become attached to single mass-produced objects. That objects have become disposable can be seen in the fact that many mass-produced objects are designed in such a way that they are not meant to last for 20 years (built-in obsolescence), or by the fact that new versions are developed every few years so that people need to replace them. This is part of an economic process also called the consumer economy in which people act on the drive to consume without any clear aim. The alternative that Verbeek mentions would be part of a libidinal economy, as conceptualized by Stiegler, in which the aim is to make people desire the objects they consume (Stiegler, 2011). What Verbeek suggests thus is interesting, but it implies a change in the economy, and he needs theories about this to make explicit what exactly he is aiming for. Studies of concrete technologies alone thus

cannot be used to make structural claims. Therefore, the approaches in postphenomenology and the analytical philosophy of technology—which build on empirical data alone—cannot study phenomena that are not reducible to concrete artifacts, such as the system of mass production, digitalization, or the Anthropocene.

One would expect philosophers in particular to make explicit all kinds of underlying patterns and assumptions about technologies and subsequently theorize about them. In the example in the previous paragraph, one would expect philosophers to make explicit the structural problem of disposable objects and subsequently theorize further about what this means for both society and the design of the objects, instead of focusing on the exceptions. Empirical turn philosophers have thus criticized the structural focus of the traditional philosophers of technology but have subsequently turned to the other extreme of a focus on concrete technologies. Describing concrete technologies would enable philosophers to understand them better than their predecessors and therefore to generate relevant analyses and theories. However, they have not shown why such studies would generate better understandings of technologies. We agree that it is necessary to understand technologies while theorizing about them and that means that we need to incorporate empirical information in some form into our studies. In order to do so however, we need to define what to expect from the incorporation of the empirical into philosophy and how to meet those expectations. Moreover, a definition of empirical studies also needs to include a clear description of how the empirical and the theoretical relate to each other. By incorporating structural features, empirically informed studies of technologies will be able to make explicit underlying patterns and assumptions, and consequently gain in philosophical relevance.

6 Conclusion

In this paper, we have analyzed the problem that empirical turn philosophers saw in the work of the traditional philosophers of technology and the solutions that they proposed. We showed that these solutions have led to a broad variety of approaches that study technologies from various perspectives. Not only did the empirical turn thus bring philosophy closer to concrete technologies, it also broadened the philosophy of technology. However, we are critical of philosophers' notions of empirical study. We have argued that, by empirical study, philosophers mean an impressionistic case-study (by philosophers themselves) or methodological case-study (borrowed from other scholars) of a concrete technology in common practice. However, the three branches differ in how they relate their work to common practice and what they regard as common practice. This means that empirical is an ambiguous term in the empirical turn. In our discussion, we identified three main assumptions of the empirical turn philosophers that we questioned: 1) descriptions of concrete technologies lead to a more solid basis to theorize upon than studies conducted from a structural perspective; 2) there is a distinction between the empirical and the theoretical so that underlying patterns are excluded from empirical analyses; 3) structural issues can be solved by means of studies of concrete technologies. We criticized these assumptions and argued that the empirical and the structural are both inevitable in a philosophical understanding of technologies, and interrelated.

We argued that an approach is needed that incorporates both a concrete and a structural focus. Such an approach is not necessarily bottom-up, as top-down studies can also generate valuable understandings about technologies. This does not imply a new turn. In the past few decades, there have been suggestions for many turns (e.g., Briggle, 2016; Kroes

& Meijers, 2016; Verbeek, 2016). However, several philosophers have pointed out that turning toward something also means turning away from something else (Romele, 2020; Smith, 2018). Our suggestion is that the empirical notion needs to be further developed so that it also comprises the embodied underlying patterns and assumptions. Or, in other words, we need to explore the scope of the empirical in an empirically informed philosophy of technology. For example, one could argue that technological objects are inextricably linked to the sociotechnical system in which they function (Simondon, 2017). But how can the notion of empirical be described when certain aspects of the artifact exceed the concrete object? Moreover, contemporary philosophers of technology have called for ontological reflections on the contemporary context in which technologies appear, such as the Anthropocene or the digital age (Lemmens et al., 2017). Can such studies be confirmed by an empirical study? If so, how can this be done, on the one hand, without reducing the ontological to concrete technologies, and, on the other, without using concrete technologies merely as illustrations of a predetermined ontological view? For example, Heidegger discussed various technologies—a windmill, a hammer, electrical engineering, nuclear technology, and so on (Heidegger, 1954, 1967). However, his approach was ontological rather than empirical. The difference between Heidegger's approach and an empirically informed study at the ontological level needs to be studied. This difference must entail more than the difference between a top-down and a bottom-up approach. In order to do this, we need to rethink what the empirical turn really is about. If we argue that it is essentially about taking technologies seriously, about writing philosophical analyses that contribute to finding the best ways to implement new technologies, then the empirical turn does not need to be bound to the analysis of concrete technologies and not to a bottom-up approach.

This all shows that, even though empirical turn philosophers have written extensively about their approaches and even though this turn has given rise to many different kinds of approaches that generate interesting understandings about technologies, the notion of empirical itself needs more exploration. What to expect of empirical studies and how these relate to structural issues need to be described. This is open to further research. In Sect. 2, several proposals to broaden the empirical turn were discussed. One suggested solution was to focus on a research level other than the micro level or to combine levels. However, in some studies, social aspects are important and, in others, ontological aspects. These are various levels, so one focus for all studies on the philosophy of technology is still too limited. Our expectation is that an elaboration of the various research levels will not lead to a strict methodology, but that several of the proposed solutions in Sect. 2 will help to broaden the notion of empirical, each for a different type of research question. Another issue that needs further development is the observation that empirical turn philosophers are not unanimous about what is problematic in the work of the traditional philosophers of technology. In order to be able to find proper solutions, it is important to re-evaluate the work of the traditional philosophers of technology and to further elaborate on what is problematic in their work. Maybe it will turn out that their work can provide some guidance in our development of such an empirically informed philosophy of technology. This was also suggested by Winner (1993), Cera (2020), and Son (2004), as mentioned in Sect. 2. The last issue that needs further consideration is the assumption in the empirical turn that its approaches lead to less pessimistic views on technologies. However, the pessimism of the traditional philosophers of technology could be a result of the age in which they were living: the rise of industrialism, the role of technology in both World Wars. This leads to the question of whether empirical turn philosophers will remain optimistic if certain technologies become a main cause of a major crisis. The question of the relationship between pessimism and empirical studies of technologies is thus also open to research.

Declarations

Conflict of Interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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