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From Reflective to Constructive Philosophy of Technology

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Introduction

If we look back at the 20th century, we see an era in which large-scale social and technological changes took place, changes that no-one could have predicted a century earlier. The difference between the world of 1901 and that of 2000 is astronomical in every respect and primarily attributable to a ceaseless series of innovations that has taken place in the Western world. Technological, social, ideological and political innovations have induced dramatic changes in society, which have not only created significant wealth and prompted substantial improvements, but have also brought about ever-deepening social problems. Our challenge for this 21st century is to develop and introduce innovations that enable us to solve these social problems and to prevent new ones from emerging. It is technological innovations, in particular, that promise great transformations: nanotechnology, new biomedical and genetic technologies, advanced information technologies, and others. But how can we develop and implement new technologies so as to solve social problems, prevent new ones, and help improve the quality of society and human life?

This question should be, I think, a central question for 21st century philosophy of technology. My claim is that where the 20th century saw the emergence of a *reflective philosophy of technology*, one that attempted to understand technology and its implications for society, our focus in the current century should be on a *constructive philosophy of technology* that actively seeks to change technology and its implications for society. Reflective philosophy of technology sees as its task the study, analysis and evaluation of technology and its relation to society and the human condition. It is largely an academic exercise in the sense that its main results are academic studies of technology that are published in academic journals and books. Sometimes, these works may gain a broader readership, but even then, the general aim of understanding and evaluation remains the same.

A constructive philosophy of technology, in contrast, sees as its task the development of philosophical ideas and approaches that come to guide and transform the practices of those actors in society that are responsible for the development, regulation and use of technology. It is focused on the problems of our times, develops constructive and workable solutions, and engages in collaborations with non-philosophical and non-academic actors to make these solutions come true. Constructive philosophy of technology is thus activist and interventionist in a way that reflective philosophy of technology is not. It is not merely calls or proposals for change that make a study in philosophy of technology constructive rather than reflective. Constructive philosophy of technology goes beyond mere calls and proposals to contain specific, extended, and workable ideas for change and proposals to connect these changes to practices of various societal actors that actors develop, use and regulate technology. It also engages in collaborations with such actors and positions its ideas so as to stimulate and enable these actors to actually use them.[1]

[1] In arguing for a *constructive* philosophy of technology, I by no means want to argue that it should also be (socially) *constructivist*, in the sense that it should hold that knowledge, technology and reality are the product of social meanings and processes, and that the physical world plays a small or nonexistent world in shaping and

The distinction between reflective and constructive philosophy of technology is different from some other major distinctions that have been made in discussions of the philosophy of technology. It is different, first of all, from Carl Mitcham's distinction between engineering philosophy of technology and humanities philosophy of technology (Mitcham, 1994). Twentieth century philosophy of technology has known two broad philosophical traditions, Mitcham has argued: *engineering philosophy of technology*, which is focused on technology as an activity of engineers and other technology professionals and which attempts to understand and analyze their activities and the products resulting from them, and *humanities philosophy of technology*, which is mostly interested in understanding the philosophical implications of technology for human life and society at large. These traditions have both largely been reflective, yet they are not necessarily so, since both traditions can give rise, and have given rise, to constructive approaches in the philosophy of technology.

The distinction between classical and empirical philosophy of technology (Kroes and Meijers, 2000; Brey, 2010a) is also different from the one I am proposing here. Classical philosophy of technology was the dominant approach until the 1980s, during which the empirical approach made its ascendancy. Classical philosophy of technology tends to look broadly at technology and its implications for human kinds, often not focusing on specific technologies or technological practices, but on technology in general. It tends to have a deterministic conception of the evolution of technology and the impacts it generates, and tends to be overly pessimistic or optimistic about its implications. It is an approach that does not generally include attention to empirical detail or collaboration with other, more empirical disciplines. The empirical turn in the 1980s and 1990s brought a more multidisciplinary, empirically informed philosophy of technology that tends to focus on specific technologies, practices and issues in society, and that sees technological change and technological impacts not as deterministic but as contingent on all kinds of social actors and influences of society.

Constructive philosophy is more closely aligned with the empirical approach than it is with the classical approach. This is because a constructive approach requires a more applied and multidisciplinary orientation, which is lacking in the classical approach. However, an empirical approach need not be constructive: it is very well possible to do empirically informed reflection on particular technologies without using the results of such reflection to work towards interventions in society. While a constructive philosophy of technology thus presupposes an empirical approach, it also moves beyond it in forging constructive collaborations with other fields and non-academic actors, and in developing not just analyses and evaluations of technology, but constructive tools for intervention.

In the remainder of this essay, I will make the case for a constructive philosophy of technology, and I will try to sketch what such an approach will look like. I will do so by first observing the major role of technology in both contributing to and being able to help solve the major social problems of our time. I will then outline how philosophy of technology is well-positioned to make a major contribution to a better development, use and regulation of technology and thereby contribute to a better society with less social problems. Finally, I will argue that a constructive philosophy of technology will be able to rise to this challenge, and that there are actually good prospects for the philosophy of technology to play this constructive role.

Technology and Social Problems

If technology is a major determining factor in society, as I claimed in the introduction, how can we ensure that technologies are developed and introduced in such a way that they help to solve the problems of the 21st century, and how can we prevent them from contributing to

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defining them. The notion of a constructive philosophy of technology is supposed to be wholly neutral towards this position.

these problems at the same time? To answer these questions, we have to look at how technology features in social problems. First of all, technology can contribute to and deepen the existence of social problems. I call this the *negative role of technology*. A negative role in social problems can manifest itself in three ways. Firstly, it occurs when technology has significant negative side effects that contribute to a social problem. Secondly, a negative role can also occur when the technology is misused on a large scale or with considerable consequences. Thirdly, even if technology is utilised correctly, it may be done so too intensively or on too large a scale, thereby creating problems.

Second, technology can also help to solve or reduce social problems. I call this the *constructive role of technology*. The greenhouse effect is partly caused by CO_2 emissions, and this is caused in part by the use of technology. But new technology can ensure that the CO_2 is captured or processed, or that machinery no longer produces it. Negative social, cultural or economic factors can often be counteracted by technology in that technology can control or even create behaviour and can be used to inform and influence thinking. In this way, CO_2 emissions can be reduced by introducing speed restrictors or CO_2 meters that advise drivers about their driving. The negative and constructive roles that technology plays in social problems are not a given, they are the result of choices made individually and collectively whenever we develop and use technology. The challenge we are faced with is to ensure that the role of technology in the key issues of the 21st century is as constructive as possible.

I will now outline five of the most pressing social issues of the 21st century, and show how technology plays a vital role in all of them. I will then argue that at present, we lack the knowledge to be able to thoroughly understand the role of technology in these problems, knowledge that we need to be able to effectively tackle such problems. This will be followed by an argument in which I will show the importance of the part philosophy of technology can play. However, to play this role, the profession must develop in a certain way, towards a *constructive* philosophy of technology.

The first of five pressing social problems of our times is the *environmental problem*. This problem is assuming alarming proportions in the 21st century, especially the specific problems of climate change and global warming as a result of the emission of CO_2 and other greenhouse gases. As a result of global warming, sea levels rise, weather conditions become unpredictable, ecosystems become eroded, fauna and flora become extinct, agricultural productivity decreases and the spread of disease increases. Economic damages could run into the trillions world-wide. Technology is a key factor in the emergence of the environmental problem. Greenhouse gases originate largely from the burning of fossil fuels used to generate electricity and motorised vehicles. Industrial production and intensive farming only add to the problem. However, technology will have to also play a key role in solving the problems relating to the environment. Technology can contribute to the development of sustainable energy and transport systems, production processes and agricultural methods as well as to directing and influencing consumers towards adopting a more sustainable lifestyle.

A second social problem that can be linked to the environmental problem is the *shortage of resources*, by which I mean basic economic commodities such as raw materials, energy, water and food. These resources are under immense pressure at the moment due to large-scale production and consumption patterns in modern society, advancing industrialisation and modernisation in more and more countries, and the growth of the global population. The demand for many resources is greater than the supply, prompting shortages and increased prices. These shortages lead to lower living standards, economic losses and an increased risk of conflict. Technology can contribute to reducing these shortages. It can help to replace resources with alternatives that are more abundant and sustainable, extract and recycle raw materials more effectively and efficiently, improve the crop yield, enable agricultural crops to grow in more places and effectively distribute, purify and save water.

A third social problem is that of *social safety*, by which I mean the protection of society against external dangers and risks. Social safety is a difficult and urgent problem in the 21st century due to the many and often complex risks we are faced with. These risks are often linked to globalisation and the use of advanced technology. There are problems of high-tech crime and cybercrime, international terrorism, the vulnerability of vital infrastructure, and increasingly complex risks to public health and the environment due to the increasing complexity of technology, production processes and society that make risks more difficult to assess. The challenge in increasing social safety is further complicated by the need to do this without causing more harm to civil rights and freedoms than is necessary. Increased social safety demands the effective application of technology. This could take the form of improved information and communication technology in the maintenance of law and order or disaster management, automatic warning systems, or new technology for measuring, determining and combating environmental and health risks.

A fourth social problem is that of *social cohesion and integration*, which refers to the extent to which citizens in a society are capable of working and living together successfully. Social cohesion assumes mutual solidarity and common identities, norms and values. In the 21st century, social cohesion is under extreme pressure because of globalisation, immigration, individualization and the diminishing importance of existing social ties such as the family and the neighbourhood. Technology, especially information and transport technology, has greatly contributed to these developments. A key challenge for the future lies in the application of technology that can promote social cohesion and integration. How can information and communication technology be utilised in the future such that it strengthens the communication between groups and encourages social participation? And how can the spatial layout and the development of an infrastructure be realised in a way that the 'we feeling' counterbalances social exclusion?

A fifth and final problem is posed by *healthcare*, which is also an area that will present us with unprecedented challenges in the 21st century. The most important of these is the preservation of an adequate health care system. As many politicians have observed, if we do not act now, the increased shortage of personnel and rising cost will plunge many countries into a health care crisis in which the economic costs become unbearable. Technology is partially responsible for this crisis due to its success in lengthening people's lives and thereby increasing the demand for care. This situation would only appear to be salvageable with the help of technologies that increase the efficiency of the care system and relieve the workload. This could take the form of electronic patient files or robots that can carry out operations, for example. More attention could be paid to prevention and early diagnosis – areas in which technology can play a crucial role. There is also the significant challenge in terms of combating epidemics of infectious diseases such as HIV/AIDS, SARS and new multiresistant bacteria, which present an increased risk for a myriad of reasons.

Naturally, this overview of 21st-century social problems is by no means exhaustive. There are other, equally important problems such as poverty, social inequality, war and conflict. And technology contributes to and can help solve these problems as well. We can, therefore, conclude that technology plays a key role in many contemporary social problems, be that a negative one, a constructive one or a combination of the two. This brings me to the next step, which concerns the demand for the knowledge that is necessary to understand the role of technology in contemporary social problems and the ability to apply it constructively in the future.

The Unique Position of the Philosophy of Technology

Because technology is key to many social problems, one might expect that substantial amounts of time and money are being invested in more effectively attuning technological

developments so as to avoid or help solve social problems, and that there is an abundance of knowledge regarding what factors make new technologies successful in society. In practice however, the opposite is true. All too often, the problem is over-specialisation. Technical scientists know all there is to know about technology but often lack scientific insight into social processes and human behaviour. By contrast, social and behavioural scientists often know little about technology. This creates a rift between the sciences (natural sciences and engineering sciences) and the social sciences.

This rift is augmented by the lack of a common language to link technological and social developments. There is little interdisciplinary or transdisciplinary knowledge that goes beyond the sciences and the social sciences and that can utilise an unambiguous vocabulary to discuss technology, society and the interaction between the two. There is a similar lack of effective models for successful multidisciplinary collaboration between natural and technical scientists and social scientists. This is one of the reasons why large-scale technological innovation projects fail, why the social consequences of technology are misjudged, and why opportunities in solving social problems are missed because those responsible do not know what the technological possibilities actually are.

We need, therefore, to develop more knowledge in the area of overlap between the natural and technical sciences and the social sciences. Knowledge that will enable us to discuss the relationship between technology and society, technology and culture, technology and norms and values, technology and human behaviour, and technology and social needs, knowledge that can give direction to the development and application of technology. Although it is not the only field that generates such knowledge, philosophy of technology does develop this knowledge over a broad spectrum and can help reconcile this gap between social science and engineering.

Philosophy of technology has several powerful philosophical methods to its disposal to contribute to the solution of social problems that centrally involve, or could involve, technology. A first method is *synthesis*. Philosophy investigates the relationship between fundamental and often abstract issues that cannot be easily investigated using empirical means, such as the relationship between language and reality and between science and religion. The method of synthesis enables the philosopher of technology to investigate technology with a sweeping eye and a broad agenda and to identify the cohesion between technological phenomena as well as between technology and society. It enables him or her to zoom out to see the larger social context and then zoom in again on specific technologies. The resulting broad and synthesised views can provide philosophy of technology with a bird's eye perspective of the issues, and provide new vocabularies to discuss them. In this way, philosophy of technology can help to determine how technology relates to society, and how the engineering sciences relate to the social sciences, and how their relation can be improved.

The second philosophical method is *analysis*. Philosophical analysis is aimed at gaining a better understanding of the issues by subjecting our notions to a critical analysis and, where possible, improving them. The point of departure of philosophical analysis is that the ideas, notions and means of argumentation with which we think we know reality are frequently unsound. Philosophical analysis is aimed at tracing the shortcomings in them and improving them. Analysis can help clarify the meaning of concepts like that of "artefact," "sustainable development" and "privacy", it can help us understand and evaluate debates in science, engineering and politics, and it can help us understand the workings of engineering and of technology in society.

Thirdly, philosophy has a number of *normative research* methods, which constitute a means of looking at how the world *should* be and how people *should* conduct themselves. Normative research does not *describe* reality, but *prescribes* how it should be. This is done on the basis of *values and norms* that prescribe what is good and why we should strive for it. In contrast to this, most scientific fields are *descriptive*: they describe or declare reality as it is.

Normative research does not only take place in ethics, which investigates how we should conduct ourselves and what are the conditions of a good life, it also takes place in epistemology, which seeks to identify epistemic norms for knowledge, in aesthetics, which investigates conditions for beauty and art, in political philosophy, which investigates how states and societies should be organized and how they should act, and axiology, which investigates which values are most important to us. A normative approach can be very useful in solving social problems that involve technology. For such problems, philosophy can investigate which value issues apply and which are threatened, and assess solutions on their expected consequences for the realisation of desired values. It can do so while evaluating the role of technology and making normative recommendations for its development and use.

Using methods of synthesis, analysis and normative research, philosophy of technology is capable of studying the cohesion between technology and society, clarifying and critically analysing social and technological problems, and normatively evaluating technological developments, and in so doing enabling a more effective development and application of technology. But for it to play this constructive role in society, how may it be developed? This is the topic to which I will now turn.

The Prospects for a Constructive Philosophy of Technology

For philosophy of technology to have a real influence on the development of technology and its impact on society, it has to get out of its academic niche and become a real societal actor. Philosophers of technology will have to do more than publish in academic journals and speak at academic conferences in our field. They have to start doing work that is *engineering-relevant* and *policy-relevant*, and start making a major *contribution to public discussions*. This requires philosophers of technology to do much of their work in close association with engineers and policy makers, and to engage in debates with the general public.

To be relevant to engineering, philosophers of technology must to develop an orientation towards, interest in, and knowledge of engineering science, engineering design and technology development. They should be developing philosophical approaches not just geared towards understanding and evaluating engineering activities, but also towards improving them, and do so in a way that is actually useful for engineers. They should also be forging collaborations with engineers, so that at least some engineering work is performed in collaboration with philosophers of technology. Philosophers can help engineers and technology developers gain a better understanding of the relation between technology and society, can clarify the role of values and ethics in technology and design, and use their philosophical abilities to question and examine central assumptions and clarify central ideas in engineering. They should strive to have a role early in the process of research and development, so that they can contribute to better technology by helping to guide these processes rather than evaluating their outcomes after new technologies have already been produced and are used in society.

One promising approach for engineering is the approach of value-sensitive design (VSD) (Friedeman, Kahn and Borning, 2006; Manders-Huits and Van den Hoven, 2009; Brey, 2010b), which is the design of technological products and systems in such a way that they conform to a desired set of (moral) values. Elaborate VSD methodologies have been developed to integrate considerations of value into the design process through the identification of relevant values, translating them into design requirements and design features, and doing so in a way that is sensitive to contexts of use and that makes appropriate trade-offs between values. A second approach is that of ethical parallel research (Van der Burg and Swierstra, 2013), an approach in which research in ethics of technology is undertaken parallel to technological research projects that are studied for ethical issues in the

parallel ethical project. Ethicists interact with the engineers to learn from their research and to help them identify and deal with ethical issues in their research.

To be relevant to policy, philosophers of technology should do policy-relevant work, become policy-savvy and and dare to make policy recommendations. They should moreover invest in collaborations with policy makers and in doing work for governmental organizations. One way in which they can do so is in developing *ethical assessments of new and emerging technologies* (Brey, 2012). Such assessments identify potential ethical issues with new technologies and optionally suggest ways of mitigating or avoiding such issues. Such assessments can also be useful for engineers and technology developers, but they are more often commissioned by policy makers. Another way in which philosophers can become more policy-relevant is through collaborations with scholars working in the area of *technology governance* (Edler, Kuhlmann & Behrens, 2003). Technology governance concerns the ways in which the development and implementation of technology can be steered between different sectors of society: state actors, industry, civil society and NGO actors, and others. Collaborations with technology governance scholars will allow philosophers of technology to more effectively develop their ideas about technology and society in a way that can play a role in actual technology governance processes.

Regarding engagement with the public, philosophers of technology should dare to be opinion leaders regarding new technologies and the role of technology in the great social issues of our time. Public lectures, op-ed pieces, interviews, and the organization and moderation of public debates are therefore activities that a constructive philosopher of technology engages in. Finally, to enable a constructive approach, it is important that philosophers technology collaborate more in general with other fields (not just engineering, but also social and behavioral sciences, technology assessment, science and technology studies, ergonomics, etc.) as well as with nonacademic actors (from policy, industry, NGOs, etc.).

In Europe, the prospects for a constructive philosophy of technology are particularly good. This is because both at the European (EU) level and at the national level in many European countries, governments and research funding agencies are interested in supporting research and innovation that is more responsive to societal and ethical concerns, and that involves collaboration between academic and nonacademic actors. At the EU level, funding programs have increasingly been paying attention to issues at the interaction of science and society, and in recent years a new approach has emerged that has become an important part of the European research agenda: *Responsible Research and Innovation* (RRI) (Sutcliffe, 2011).

RRI has become a major goal for research and innovation policy at the EU level. The goal of RRI is to make research and innovation processes and products in Europe more responsible in the following senses: ethical acceptability, societal desirability (they should contribute to the common good) and environmental sustainability (Von Schomberg, 2012) RRI is a governance-oriented approach that is seen as requiring the involvement of more stakeholders in research and innovation processes, and as requiring more collaboration between universities, governments, industry, civil society / NGOs, and greater involvement of the general public. As should now become obvious, RRI is an approach that can involve philosophers of technology (especially ethicists, but also others), and that is engineering-relevant, policy-relevant, and contributing to public discussions, just as I have argued a constructive philosophy of technology should be.

In the period 2014-2024, the new EU framework program for research and innovation, Horizon 2020, will take its course, is a funding program with a budget of tens of billions of euros.[2] In the program, 900 million euro has been allocated towards RRI projects. Most such projects will involve the multidisciplinary and multi-actor collaborations described above, and

[2] http://ec.europa.eu/research/horizon2020

philosophers of technology are positioned well to be included in them. In addition, Horizon 2020 makes available 27 billion euro for research on so-called *Grand Challenges*: major societal challenges that it wants to help solve through multidisciplinary projects in research and innovation. The Grand Challenges include major challenges in the areas of health, food, energy, transport, climate and resources, inclusive societies, and secure societies. This is another area in which philosophers of technology could play an important role in multidisciplinary, problem-solving oriented, research.

Conclusion

I have made the case for a constructive philosophy of technology that actively seeks to change the practices and products of technology and its implications for society, and that is developed and applied in interaction with other disciplines and non-academic actors. I have argued that at least in Europe, the prospects for such a philosophy of technology are good, and I have indicated some approaches in it that have been developed in recent years. In spite of its applied nature and interdisciplinary orientation, a constructive philosophy of technology still makes use of methods of philosophy, like synthesis, analysis and normative research, and it should in principle be able to retain the critical edge that philosophy of technology has traditionally had. It should be added that retention of this critical edge is not automatically a given, since the approach may require collaboration with parties that one is critical of and becoming dependent on funding from those one is critical of. This is sometimes the price of becoming a social actor rather than a bystander, and philosophers will just have to see that they choose working arrangements in which their independence and integrity is sufficiently guaranteed.

In making the case for a constructive philosophy of technology, I am not making the case that reflective philosophy of technology should be replaced by it. The reflective approach has its value, as a general way of studying technology and its relation to society, and provides theories and analyses that can be used in constructive approaches. It is in the continued development and combination of constructive and reflective approaches that the philosophy of technology can make progress, and if it chooses this path, it will have a bright future ahead of it.[3]

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[3] This essay is loosely based on a presentation in a panel on "Paths of the Philosophy of Technology in the 21st Century" at the 2013 conference of the Society for Philosophy and Technology in Lisbon, Portugal, July 3-6.

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