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INTRODUCTORY REMARKS ON AXIOLOGY OF TECHNOLOGY

Barbara PRZYBYLSKA-CZAJKOWSKA

Silesian University of Technology; bprzybylska@polsl.pl, ORCID: 0000-0001-8028-1188

Purpose: The main goal of the paper is to present an initial version of possibly comprehensive and detailed axiological fundamentals for the Technology Assessment.
Design/methodology/approach: The paper can be placed in the tradition of the analytic philosophy – historically (in the sense of history of technology) informed.
Findings: A classification of values relevant for technology-assessment has been constructed. A certain number of instances have been given for each values-group.
Research limitations/implications: The analysis carried out in this text presents the results of the first stage of the technological-axiological studies. They should be widened (many relevant values have not been even mentioned) and analytically developed (more precise descriptions should be given).
Practical implications: The axiology-of-technology investigations, even in its present form, can be useful for all institutions and organizations active in the domain of technology assessment and in related fields (in particular: technology policy and management).
Social implications: The analyses presented in this text could make the public debates on technology more nuanced and less ideological. They should help overcoming the schematic opposition of techno-optimism and techno-pessimism.
Originality/value: The paper seems to start from where many other works end: The general thesis about "saturation" technology with values has been soundly substantiated and can be regarded as well-founded. It is time to make further steps – toward systematic and detailed axiology of technology. This text seems to be one of the first steps in this direction.

Keywords: value, sustainability, responsibility, ontology of technology.

Category of the paper: viewpoint, general review.

1. Introduction

Two complementary theses about the development of technology can be formulated: Firstly, a thesis stressing the continuity of this process since the beginning of the history of the *Homo sapiens* species (since the Paleolithe). Secondly, a thesis emphasizing the historical importance of the passing from agrarian to industrial civilization (societies); in other words – emphasizing

the historical significance of the (first) industrial revolution that started in the second half of the 18th century.

The complementarity of these two theses would deserve a separate discussion. At this place, I would like to make but two brief comments on this issue. First: The development of technology can be regarded as – "roughly taking" (leaving aside many otherwise important mathematical "details") – an exponential process (Similarities with other global processes – demographic, ecological, etc. should be noted). And second remark (of epistemological, psychological and sociological character): very slow processes are weakly (individually and socially) "perceivable". Only when a threshold has been exceeded the given processes starts to be widely perceived (Vallor, 2022).

So, it is not a coincidence that the development/progress of technology began to be a subject of analyses and many controversies in the 18th century (Franssen, 2009; Lizut, 2014). Symbolically, though not only, the publication of the Jean-Jacques Rousseau's "Discourse on the Sciences and Arts" can be regarded as the starting point of these debates. This work was published in 1750: one year before the publication of the first volume of the "Encyclopedia" of Jean de Alembert and Denis Diderot – the great work of the Enlightenment, a work that played significant part in the popularization of the idea of progress, also – of technological progress.

The history of these debates would deserve a rather large book (Mitcham, Briggle, 2009). To my knowledge, no such book has so far been written. For this reason, as only interpretative hypotheses I will formulate a few comments on this history. It appears that for the whole 19th century dominated criticism of technology expressed by philosophers, poets, artists…shortly put – by so called "humanists" of various sorts. In the 20th century the situation began to change. There is little doubt that the two world wars and the role technology played in them both (in particular: Hiroshima and Nagasaki) contributed to gradual change of the situation. The cultural shift in the 1960s (most vividly manifested in 1968 – "Paris May" and the like events), and – even more importantly – the development of ecological consciousness, environmental movements etc. – they have also played a significant role in this process. Without going into its details but trying to mention some concrete events, I want to say a few words about the first – published in 1972 (also the year of the UN Stockholm conference) – report to the Club of Rome (established in 1968) "Limits to Growth". It was and remains a very controversial document. Nevertheless, whatever your opinions about this text might be, two points are significant and deserve attention: First, the Club of Rome members were engineers, economists, businessmen, etc. – and not "humanists". Second, modern scientific methods and technologies (computer modelling) were applied to produce this report. – To summarize these reflections: In recent decades the "external" criticism of technology has been supplemented by the "internal". In my opinion, this change should not be underestimated. Due to this change criticism of technology has become more concrete, more specific, much less utopian. Somewhat paradoxically: more practically critical, less – rhetorically (so to speak: less radical in words, more radical in deeds).

Ending these introductory remarks, I would like to locate the criticism of technology in a broader context. First: Philosophers have criticized not only technology but also – philosophy. And even some mathematicians have criticized mathematics. Second: these phenomena can be regarded as instances of this trait of modern culture that some sociologists (e.g. Anthony Giddens, Alan Touraine) call – self-reflexivity.

It is rather obvious that each criticism (of a person, of a theory, of a social order… – of whatever) presupposes some criteria of evaluation. And it also should be (but actually is?) obvious that any criticism (so, in particular, of technology) can also be an object of criticism. I think that criticism that is based on clearly (precisely, systematically…) explicated evaluative criteria is – all other factors equal – better than one based upon "tacit" evaluative intuitions. In short, axiology of technology is a precondition of the "good quality" of the criticism of technology.

In the next chapter I will present an overview of the general axiological *problematique*, and in the subsequent – an overview of the axiology of technology (Vermaas, 2022).

2. Axiology – an overview of the problematique

Though the term "axiology of technology" has recently been quite often used, the term "ethics of technology" seems to be still more widespread. Even for this reason only, it might be useful to say a few words on the relations between axiology and ethics. These remarks will be not only of conceptual character. I am going to present the substantive reasons why I prefer the concept of axiology to the concept of ethics.

The concept of ethics goes back to Aristotle; incidentally – like that of logic. The idea of good (goddess) is central for ethics, while that of truth – for logic. These two (good, truth) – together with beauty (aesthetics, the discipline for which this concept is central, was constituted – as autonomous branch – only in the 18th century) – co-create a system often called "Plato's triad". Let us underline right away that the word "triad" is to indicate the fundamental character of these ideas (or – values, as we would say today) and their strong interconnectedness.

The concept of axiology is much "younger": it was introduced at the beginning of the 20th century (1902) by a French philosopher Paul Lapie (except for this terminological invention almost completely forgotten) and used some years later (1908) by a noted German thinker Eduard von Hartmann. The term "axiology" is coined on the basis of the Greek word *aksia*, translated into English as "value" or "worth". The second word deserves some attention due to its familiarity with the German "*Wert*". – The last word was in the second half of the 19th century adapted by German philosophers (Herman Lotze and others) from the British economy in which theory of value played an important part (Adam Smith, David Ricardo). A significant role in popularization of this notion played the Friedrich Nietzsche's philosophy, and in

particular his book "*Jenseits von Gut und Boese*" (Beyond Good and Evil, 1886) in which he proclaimed the "revaluation of all values". – There is no doubt that the very notion of "value" and the Nietzschean ideological program exerted significant influence on the cultural transformations in the 20th century. But other phenomena should also be taken into account. Their systematic overview is not possible here. Nevertheless, I would like to invoke at least one phenomenon: so-called "cultural relativism" – an important current in 20th-century social sciences – initiated (1887) by an American anthropologist Franz Boas. This phenomenon has been a of great many debates and controversies… In whatever way we would like to summarize them, one point seems to be obvious: the differentiation of axiological systems (systems of values) – in time, and geographical and social space –is great.

It appears that these cultural-anthropological or historical studies have had more far reaching consequences for theory of values: It is difficult or perhaps even impossible to compare various axiological systems using but three values (or types of values) such as goodness, truth, and beauty. Interestingly, some philosophical investigations lead in a similar direction: Max Scheler, one of the important ethical thinkers of the 20th century, distinguishes religiously-relevant values, spiritual values (interestingly, this group comprises both the intellectual and moral values), vital (or hedonistic) values and sensible (or utilitarian) values.

I would like to end this chapter with a remark on philosophy of values – on their metaphysics (and epistemology). An analogy with mathematics should be useful: the majority (if not all) of mathematical problems can be solved without resolving disputes over the nature (the mode of existence…) of mathematical objects. By the way of analogy: we can debate on the relations between justice and mercy, between freedom and solidarity – without deciding how these (and all other) values exist.

I would even say that it would be immoral to wait for resolving fundamental metaphysical issues (in particular – these belonging to the metaphysics of values) – however interesting this question might be for some of us: In practical life it is much more important to achieve axiological agreement (consent to some values), even partial, than – the metaphysical understanding (consens).

3. Axiology of technology - an overview

I am profoundly convinced that the "value-ladenness of technology" (Lizut, 2014) should be today regarded as well-established fact (Rapp, 1981; Poel, 2009; Radder, 2009). But what kind of values are at stake here? – To answer just this question is, in my opinion, the main task of axiology of technology.

I believe that any "regional" axiology (e.g. axiology of sciences or of a particular discipline – mathematics or psychology…, of art or of education…; the concept of "regional" ontology/axiology is drawn from Husserl's phenomenology) should be based on the ontology of the given "region" (Brey, 2022). In accordance with this conviction, my overview of axiology of technology will be based on its ontology. I will avail of the version of the ontology of technology presented in the paper of W. Czajkowski (2022).

Therefore, this chapter will be divided into two parts. In the first one, the axiology of technology viewed 'structurally' ('statically') will be outlined. In the second – the axiology of technology development (of technology viewed 'dynamically') will be discussed.

So, let us pass to the first part of this chapter. It should be convenient to subdivide it further – in accordance to accepted here ontological assumptions – into two sections. In the first section the 'internal' values (Alexander, 2009) of technical objects will be discussed, and in the second section – 'external'. (It must be emphasized here that it is not my intention to contend that one can draw a sharp division line between these two groups of values. Nevertheless, this division seems to be useful.) The simplest characteristic of this division might be given by formulating supposition that the 'internal' values are discussed mainly by engineers, and the 'external' ones – by social scientists and philosophers (A similarity between 'internalist' and 'externalist' approaches in the epistemology and philosophy of science may be noted).

Let us start from a value that can be called "simplicity" (Interestingly, it is a value appreciated both by methodology of science and art criticism; likewise – by the legal theory). It should be stressed that neither general version of this concept nor its special version (applied directly to artifacts) is itself very simple: Its systematic analysis would demand application of some mathematics; it is not possible here. I have to limit myself to making three remarks. First – on the relative character of this value: Paraphrasing Albert Einstein, one could say: artifact should be as simple as possible, but – no more (Compare 'simple bicycle' with 'simple jet' – nothing more is to be added here). Second – on various 'dimensions' of simplicity: for instance, it is by no means obvious that there always is a simple (linear) correlation between simplicity of construction of an object (of its structure) and that of technology of its production. And third – on the relations between simplicity and other 'internal' values.

With simplicity is closely connected a value that can be named 'transparenc' (I have chosen this word on purpose – to suggest some connections with issues being in focus of, say, the well-known organization – Transparency International). This value seems to be particularly important in the case of great technical systems such as energetic system or Internet.

Transparency is one of a whole group of ('internal') values that could be defined as, say, 'epistemic'. Predictability is other value belonging to this group. Its characterization I will commence from a general note on the importance of knowledge (of various kinds): For various reasons (grouped around/connected with the value of safety – one of the most important in our life), we want to possess knowledge about some elements of the future: about the weather in our city, about the situation on the stock exchange, about emotions of some persons important

for us… Adding new items to the world we live in, we would not like to raise the level (sufficiently high…) of unpredictability of 'our' world.

With the value of predictability are connected still three other values. One of them I will call 'controllability'. It is doubtful if you can formulate a definition of this term both precise and valid for all technical objects; I am going to describe here only some intuitions labelled with this term. We can control (some) simple technical objects (tools): we can stop at any moment hammering a nail (though we are not able to stop the arrow we have just fired). But it is much more difficult to stop functioning many complex systems. But, regarding all other parameters as fixed, we prefer those artifacts that can be stopped and restarted as soon as possible and at possibly little costs.

The second value connected with predictability is one well-known under the commonly accepted name of 'reliability': In short, the probability that the technical object will function without failures for a certain (fixed) period of time.

Closely related to predictability is also a value that can be called 'diagnosability' (let us note that simplicity of an object seems to be a precondition of its diagnosability). With this word you can characterize the level of ease (or difficulty) of checking whether the structure and functioning of this object remains regular.

And the last but not the least: despite the process of miniaturization, some (technological) artifacts are sufficiently large to be visually perceivable. Therefore, among values that characterize these objects we should distinguish a set of esthetic values. On the one hand - intrinsic values (values analogous to those which characterize a painting or a sculpture), on the other – elements of a landscape (either natural – e.g. cable transport in mountains, or – of a city e.g. Street lights). Let me say here a few words about the building of the Centre Pompidou in Paris: Technical solutions and artistic ideas (and respective values) are there closely interconnected.

At this point, I have approached the border area between 'internal' and 'external' values. Thus, let us look at this second group. Roughly speaking, it contains values characterizing relations between technology, and social and natural world.

Let us start from the well-known: 'sustainability' and – hereof: sustainable technology) (Kuzior, Kiepas, Leks-Bujak, 2012). It is interesting and significant due to two facts. First, it is an important element of the language of the current (scientific, political, ideological…) debates on globalization (Ciążela, 2006) and related issues. Second: it designates a value that may be regarded as/called meta-value (second-order value…). This value characterizes a relation between a certain number of (first-order) values. In the case of mathematically measurable values a precise, formal characteristic (definition) might be introduced here. But many (if not the larger part of) values are not measurable thus only an intuitive characteristic can be given: For instance, if all parameters characterizing an object (a situation etc.) assume positive values then the object is more "sustainable" than if some parameters would assume better values but at least one – negative. – Though I must confine

myself to this short and sketchy comment on this problem, I would like at least to stress its great importance for the axiology of technology.

And now, let us look at the values grouped under the label ‘sustainability’. According to the standard view, three types of values constitute denotation of this term (Kuzior, 2014). The first group contains ‘environmental values’, the second – ‘social’ ones, and the third – ‘economic’.

I would like to stress that in all the three cases the word “value” is used in the plural form. For sure, I will not be able to list all the values that should be included into one of these three groups. – Much extensive text would be necessary. Thus, let us discuss briefly some instances only.

Let us start from ‘environmental values’. First: those characterizing the level of the exploitation of natural resources (coal, oil, copper, etc., etc.). Second – the (unintentional) ‘production’ of by-products (carbon dioxide, methane etc.) It should be stressed that from the perspective of the axiology of technology, neither the global exploitation of resources nor the global ‘production’ of by-products are particularly important. These global parameters depend only partly (even: to a limited degree) on technology. Much more important is global demand for various products that in turn depends on the number of people and on many social/economic factors. For the evaluation of technology much most significant are relative parameters: the use of resources (similarly: the emission of by-products) per unit of product (one car, one TV-set etc.) per the unite of a product (one car, one computer, one dress etc.).

Let us move on to the “social values”. There is no doubt that the development of technology has had great influence on many (if not all) characteristics of social world. Let us take into consideration but two phenomena (processes). First: industrial revolution. And second: the development of Internet (Kiepas, 2017). The choice of these processes is not incidental. Both processes have many consequences that can be evaluated in various ways. For this reason, the next limitations will be necessary.

In the case of the (first) industrial revolution I want to focus our attention on only one (though very important) of its consequence: urbanization. But, at this (very complex, multifaceted) process I would like to look from a special perspective: Urbanization has been a very profound change of the social space (this term is to denote, roughly speaking, materially transformed by humans and culturally experienced geographical space of our planet) – one of the most fundamental elements of the social world/social reality. Various characteristics of social space have a significant influence on the character of interpersonal relations (e.g. their /in/stability) and on the quality of human life (from physical parameters such us the level of noise to aesthetic and cultural values).

Communication (its structure, various characteristics etc.) between people is also one of the most fundamental elements of the social reality. It is obvious that many of its essential characteristics have been determined by technology (invention of writing, invention of print etc.) The rise and development of the Internet has transformed very profoundly various aspects (economic, political, psychological, cultural…) of communication. – It is the most doubtful as

to whether it is possible to formulate a single (be it positive or negative) evaluation of these transformations, thus – of the Internet. If you cannot formulate an unequivocal evaluation of one (even very great and important) technological innovation, how should formulate a simple and unequivocal evaluation of the whole technology? (Incidentally, a similar remark could be formulated in relation to science or religion, to politics or business…).

A few words at least should be said about technology and violence (in its various forms: from violence used in interpersonal, even familial, relations to world wars). – This is a huge subject (comprising the problem of self-defense, the concept of just war and great many others). Mentioning this issue, I would like to formulate two remarks. First: no systematic and comprehensive (thus much more extensive than the present text) presentation of the axiology of technology cannot neglect this issue. Second: any discussion of this issue should take into account the fundamental difference between such devices as knifes or baseball bats (that happen to be instruments of violence only occasionally) on one side, and machine guns or atom bombs (designed as possibly effective instruments of mass killing) on the other.

And now, a few words on "economic values". Let us leave aside the general problem how to distinguish "social values" and the "economic values" (and the question whether such a distinction is useful or even meaningful). I will tentatively assume that this distinction can be connected with the important idea of theoretical economy that distinguishes real economy and nominal (financial) economy. Many economists hold that currently (for the last three decades or so) financial economy has dominated real economy, and that this domination has had some negative social, political and economic consequences. Even if you are not prone to accept fully this opinion, the quick development of financial economy can hardly be doubted. And it is rather evident that this process has been possible due to development of the Internet. – So much about axiology of 'statically' (or 'structurally') viewed technology. Let us pass now to the axiological problems of the technological development (Rapp, 1981).

Discussing these problems, I am going to take into account not only actually existing (either in the past or currently) mechanisms of technology development but also those that coming into existence (or even just possible).

I will begin from the concept of democratic decisions concerning technological development. In the contemporary world it is a product of collective work of great many people using expensive instruments – it must be financed. In many countries – from public (state) sources. Thus, in democratic societies citizens should have voice also in the issues of technology policy. This is perhaps the simplest and most convincing argument. But other arguments also, perhaps more controversial, could be formulated. For instance, some decisions concerning the development of Artificial Intelligence can have some fare reaching consequences affecting the nature of man and society. It can be held that such decisions should not be undertaken by elites (of whatever sort: be scientific, or business, or political, or any combination of them) but by the global society.

On the other hand, one can be skeptical as to making democratic decisions concerning technology development, if democracy should be understood here in the simplest way – in which just voting plays the central role. The problems of technology development demand rather deliberative democracy – democracy in which unrestrained debate plays the key part. This thesis leads toward a more general formulation: Due to the variety of consequences of the technology development, this development should be accompanied by critical (the words 'critical', 'criticism' or 'critique' should not be understood here in the ordinary language sense, but rather in the spirit of the Kantian tradition).

Among issues concerning the development of technology, one issue seems to be closely connected with the idea of responsibility for the future generations (Ciążela, 2006). Assuming that the possibility of making decisions about preferred way of life can be regarded as an important value if related also to societies and not only to individuals, we can claim that technological solutions that leave open alternative options of future technological development are better than those that determine strictly the future development.

With the previous two values still one value seems to be closely connected. It can be defined as "optimal pace" of technological development: neither "zero growth" of technological innovations (to be more precise: I mean here "real life" innovations and not those existing in an "ideal" form) or faster and faster tempo of innovations. The word "optimal" can be understood here in a few ways. For instance: in more objective sense: as denoting such pace that leaves time for analyzing various consequences of technological innovations. Or. in a more subjective one: as characterizing "psychological tolerance" for changes.

4. Final remarks

We – all the people – are responsible for our common future (Ciążela, 2006; Kuzior, 2014). – I accept this opinion if to regard it as the initial most general assumption that requires concretizations, reservations, etc. I would commence from emphasizing that the burden of responsibility is not – and neither could or should be – evenly distributed: it rests on some of us more than on others. It depends on the (material and other) conditions of our life, on our education and place in the social division of labor…And our responsibility differs not only in degree but also in type.

If you accept the conviction that technology influences the current and future state (Abney, 2022) of our world and that its development should be controlled (Grunwald, 2009; Johnson, 2022) then you should also accept that the development of the control of the technology development is a task for which some of us are responsible in a particular way (Ess, 2022).

First: philosophers (in cooperation with sociologists, historians etc.) Controlling the development of technology is a very difficult and subtle task: too much control may be more dangerous than too little. Good control of technology development demands good theoretical foundations – to be delivered by philosophers. And not only by the philosophers of technology. Good philosophy of technology needs support from ontologists, social philosophers, ethicists and philosophers of history…It could be said that one of (let us stress the last two words) the tests of significance of a special issue (studied in this or that branch of philosophy) for the philosophy of technology (Mitcham. 1994).

Second: engineers, and especially – the academic teachers of engineering sciences. I see two specific tasks for them (Dietrych, 1985; Kroes, 2009). *Primo*: (much more active) participation in the development of the philosophy of technology. Neither ontology nor axiology of technology will achieve such level of precision, concreteness etc. as it would be demandable if philosophy of technology is not only to comment but also effectively participate in the development of technology. *Secundo*: they should regard philosophy of technology as a part of fundamental engineer education – on a par with mathematics or physics.

Third: politicians (Briggle, 2022). They should be aware of two their responsibilities. Firstly: for supporting institutions delivering opinions about technology development. And secondly: for studying and using theses opinions (Hitachi, 2020; Kuenkel, 2019).

Let me end this text with these words: the future is open and we can participate in its formation.

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