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Is Technology an Autonomous Process? Technology, Scientific Experiment, and Human Person

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Is Technology an Autonomous Process? Technology, Scientific Experiment, and Human Person

Abstract. Despite the many turns that philosophy of technology has undergone in recent decades, the question of the nature and limits of technological determinism (TD) has been neglected, because it was considered as solved and overcome, and therefore not worth further discussion. This paper once again raises the problem of TD, by trying to save the opposing, but complementary elements of truth of the two main forms of TD that I shall call "nomological" and "normative": (a) technology is all-pervasive and has an inexorable capacity for extending itself into every field of human life, and (b) we have a capacity to counteract and orient technology, at least in some measure. In order to reconcile these seemingly inconsistent claims, the key move for my argument is a brief analysis of the notion of scientific experiment from the perspective of the distinction between the context of discovery and the context of justification. As a result, two senses of technology are distinguished, which I shall call respectively "reflective" and "methodological." From the point of view of this distinction, the all-pervasiveness and inexorability of technology and the in principle irreducibility of human persons to technology – which nomological and normative TD assert dialectically one against the other – can be reconciled. Among other things, this requires the rejection (in one fundamental sense) of the widely held assumption, made both by nomological and normative TD, that technology is a cultural field whose contents can be neatly separated from the rest of human culture. This thesis should be replaced by the more qualified claim of the reflective unity and the methodological multiplicity of technology.

Key words: technological determinism, technology, ethics, scientific experiment, person, Design Turn

1. Introduction

As a first approximation to a more adequate definition, we may say that the term "technological determinism" (TD) generally designates in today's philosophy of technology any perspective that considers technology as an autonomous and decisive factor in the explanation of

social, political and ethical development (see e.g. Hauer 2017 p. 1, Dafoe 2015, p. 1047). In general, the many turns that philosophy of technology has undergone in recent decades have neglected the question of the nature, value, and limits of TD, because this was considered as already solved, and therefore not worth further discussion. This is true not only of the main exponents of the less recent but always important Social Studies of Science and Technology (see e.g. Hackett et al (eds) 2008, where further references may be found), but also of the more recent Design Turn in technology; since the 1990s both trends have taken an "interactional stance" on technology and human values: on the one hand, technological devices and digital algorithms implicitly or explicitly incorporate (and promote or undermine) values, while, on the other hand, it may be said that "in designing tools we are designing ways of being".[1]

There are some exceptions to the general tendency. A few recent authors have pointed out that the problem of TD is important and cannot be shelved or neglected. As Sally Wyatt wrote about ten years ago in one of the most fortunate essays on the subject, the question of TD, though often regarded as resolved or obsolete, actually persists in several areas, such as in "theoretical and abstract accounts" concerning technology, "in the responses of policy makers and politicians to challenges about the need for or appropriateness of new technologies," and "in the reactions we all experience when confronted with new machines and new ways of doing things" (Wyatt 2008, p. 167). In particular, concerning the theoretical accounts of technology, Natale et al 2019 have stated recently that, though often explicitly rejected, since the beginning of the Web era (in the 1990s), the narratives of both cyber-enthusiasts and critics attentive to the potential threats opened up by new technologies were often surfaced by ideas taken from TD (Natale et al 2019, p. 1. For some examples, see e.g. Toffler 1980, pp. 46-49 and Floridi 2014, p. vi. In general, for the philosophy of digital media technologies, see also Jordan 2008).

For this reason, but also to clarify the interaction between human beings and the products of their thinking and acting, we shall do well, I think, to take up again the problem of TD. This doesn't mean that we cannot take on some important theses of the most recent turns in the philosophy of technology. In particular, as we shall see, the interactional

[1] See Friedman and Hendry (2019), p. 1, where more references on this theme can be found. See also Friedman and Kahn (1992), van den Hoven (2017), and Friedman et al 2017, p. 68. For a very general outline of the development of critical ethical reflection on technology, see Mitcham (2020).

approach generally adopted today - also shared by the most moderate forms of TD - can be accepted, but not without a decisive qualification. And the same is true of other important theses to which we shall come: technology cannot be treated as a monolithic or necessary reality (as the Social Studies of Science and Technology have made clear), and there cannot be value-neutral technology (as the Value-Sensitive Design approach has insisted: cf. e.g. van den Hoven and Manders-Huits 2009, p. 478).

The problem with these conclusions is that they have generally been assumed without adequate justification, leaving some fundamental question unresolved. In general, the strongest form of TD (which, as we shall see, is very rare, but, as has been rightly noted, is very useful as a straw person: see e.g. Peters 2017) has been too hastily rejected, while some central theses of the more moderate forms (much closer to common sense) have been accepted without much reflection. In fact, as I shall try to show, both the more radical and the more moderate versions of TD contain not only tacit assumptions that must be rejected, but also important elements of truth, which are necessary to coherently defend both the contingency and multiplicity of technologies and the link between technological design and values.

In particular, it is important to save the opposing, but complementary elements of truth of two important forms of TD, which, following Bimber 1994, I shall call “nomological” and “normative”. As we shall see, this is tantamount to reconcile two seemingly inconsistent claims about technology which can be found in the representatives of these two opposing versions of TD. The key move for my argument is a brief analysis of the notion of scientific experiment from the perspective of the well-known distinction between the context of discovery and the context of justification. As a result, two senses of technology, which I call “reflective” and “methodological,” are distinguished and at the same time related to each other. This distinction accounts for both the all-pervasiveness and impersonal inexorability of technology and our capacity (however limited) to orient technology. Thus, we shall be in a position to save the elements of truth of nomological and normative TD without accepting the mistaken assumption they share: that technology is a cultural field which can be neatly separated from the rest of human culture. As we shall see, technology, taken in the sense most closely related to its common meaning (as embodied both in devices, machines, equipment, and in special ways of doing things), is an irreducible

multiplicity of methods, not a monolithic reality. And this implies that a more local or piecemeal (though preferably collectively organised) approach to the problem of controlling and/or modifying technologies should be adopted.[2]

The paper is organized as follows. Section 2 distinguishes the previously mentioned versions of TD and outlines some of their key difficulties. Starting from a brief discussion of the distinction between the context of justification and the context of discovery, Section 3 introduces the distinction between two senses of reason (and technology) – "methodological" and "reflective," of which the concept of scientific experiment is an important exemplification. Sections 4 and 5 contain the main results of the paper. Section 4 will show the logical root of the technological way of thinking and the element of truth of nomological TD. The tendency of technology to develop inexorably and independently of human persons is shown to be the magnified expression of one of the most important aspects of scientific experiment, that is, of its exemplifying a 'machine' which exists and develops impersonally and independently of our mental acts, decisions, values and interests. However, as shown in Section 5, this same analysis of scientific experiments brings to light the fundamental limit of nomological TD, namely the irreducibly personal-humanistic side of technology.

2. **Two Main Versions of TD: "Nomological" and "Normative"**

One of the most important results of recent work on this topic is the distinction between different versions of TD. Particularly relevant for our purposes is the distinction traced by Bimber 1994, which may be taken as the starting point of our analysis.

According to Bimber, we may distinguish three interpretations of TD: Normative, Nomological, and Unintended Consequences accounts (Bimber 1994. For a different classification, see above all Wyatt 2008).

[2] In this paper I shall understand "technology" and "technique" as being on a continuum from more general to more specific. If instead we postulated a qualitative distinction between technology as a field of study and techniques as objects of this study, we might be misled: first, because this might be understood as implying that there could be (human) techniques which could be set totally apart from the mediation proper to consciousness and language (for some remarks on this question, see Buzzoni 2008, ch. 1, § 2); second, because the element of truth it contains is better captured using the qualitative distinction on which the present paper wants primarily to call attention – that is, between a reflective and a methodological sense of "technology" and "technique". On the history and meanings of the terms "technology" and "technique," see e.g. Schatzberg 2006, where further references can be found.

The last interpretation, the "Unintended Consequences account", focuses on the unanticipated effects of technological developments. Well-known at least since von Hayek and Karl Popper (see e.g. Popper 1945[1962]), the explanation of collective phenomena by the idea of unintended consequences of rational actions was first applied to technology by Langdon Winner 1977. This kind of TD will not be discussed here because this account, as Bimber rightly noted (1994, p. 89), is neither technological nor deterministic.

On the contrary, the other two versions of TD distinguished by Bimber are fundamental for our purposes. The first is "nomological determinism", which can also be regarded as the "strongest" version of TD (cf. Smith and Marx 1994, p. xii). It is the view according to which technologies "tend" to develop a life of their own and cannot be controlled, guided, or moderated to any significant extent by human efforts or social-political changes (on this see e.g. White 1949, p. 366; Winner 1977, pp. 75-76; Ropohl 1983, p. 86; Staudenmaier 1985; Misa 1988; Bimber 1994, p. 83; Smith and Marx (eds) 1994).

It is difficult to find authors who supported this interpretation of TD in its purest form. Perhaps the best representative is Theodore Kaczynski (2008), who, with the inconsistency typical of the strongest forms of determinism, admits only one possible free act, the revolutionary one, arising from the awareness of complete slavery from technology and consisting in an outright rejection of this latter. There are, indeed, some passages by Thorstein Veblen (1919), William Ogburn (1922), Leslie White (1949), Clarence Ayres (1952), Robert L. Heilbroner (1994a and 1994b) and Jacques Ellul (1954[1964]) which come close to a pure form of nomological TD (see e.g. White 1949, pp. 364-365, and Ellul 1954[1964], Engl. trans., p. 6); but in general all these authors agreed in conceding some influence of society and/or individual persons on technology (see, e.g., Veblen 1919, 339-343 and 349-350; Ogburn 1922, p. 278; Ayres 1952, p. 59).[1] But undoubtedly some elements of nomological determinism are to be found in all these (and, as already mentioned in the introduction, other) authors, today especially in connection with the pervasiveness of modern digital technology.

The second kind of TD to be discussed here – the "normative account" – is, at least in a sense, a fairly direct negation of the first. According to the normative TD, writes Bimber,

"technology can be considered autonomous and deterministic when the norms by which it is advanced are removed from political and ethical discourse and when goals of efficiency or productivity become surrogates for value-based debate over methods, alternatives, means, and ends." (Bimber 1994, p. 82)

Now, these two forms of TD can be easily matched with two seemingly incompatible but common and plausible claims about technology: (a) technology is all-pervasive and has an inexorable capacity for extending itself into every field of human life, and (b) humans have the capacity, at least in particular circumstances and to some extent, to counteract and orient technology. The first claim is an essential ingredient of the nomological, while the second is typical of normative TD. As a consequence, to reconcile these seemingly inconsistent claims about technology will be tantamount to saving the opposing, but complementary elements of truth in "nomological" and "normative" TD.

Both these claims have a long history, starting at least from the first decades of the 20th century to the most recent turns in the philosophy of technology. As far as the first claim is concerned, Max Eyth spoke of the "boundlessness" (*Grenzenlosigkeit*) of technology (Eyth 1924, pp. 1-2), and other, including Ernst Cassirer (1930, pp. 20-21), Ayres 1952 (e.g. p. 53), and Max Bense (1951[1988], p. 436), also stressed this feature of technology at an early stage of the discussion. The latter, in particular, regarded this feature as typical of the contemporary "deep technique" (*Tiefentechnik*), which is characterized by its "penetration into the fine structures of the world" and is able to include everything, blurring the line between the so-called material and non-material fields. Given today's digital form of technology, this ability to insinuate itself in every aspect of our life, even the most private, is so obvious to everyone that any example would be unnecessary or superfluous.[3]

In spite of the fact that the thesis of the inexorable pervasiveness of technology is a very common claim about technology, while we can hardly find authors who support nomological TD in its most extreme form, it is nevertheless easy to understand the essential connection between them: the claim that technology is the true determinant of

[3] See e.g. Zuboff 2018. In a slightly different sense, this same pervasiveness is one of the fundamental assumptions of the Value-Sensitive Design approach, according to which, as already mentioned in the introduction, there cannot be value-neutral technology.

historical-social dynamics would be undermined by the admission of any field that technology could not reach and successfully control.

As for the second claim – that we can and, at least in some measure, do counteract and orient technology – is, at the same time, the most usual objection against nomological TD and the basis of most moderate forms of normative TD. Lewis Mumford (see e.g. 1954, p. 114), Herbert Marcuse (1964), and Jürgen Habermas (1971) may be regarded as classic representatives of philosophers who *de facto* espoused normative TD. But there are other claims that are more loosely related, which are to be found in many authors, and even in well-known philosophers, such as for example Jonas (e.g. 1979, p. 42) and Heidegger (e.g. 1954, p. 41). A more recent example is the "interactional stance" adopted by the Value-Sensitive Design, which patently assumes the possibility that individuals or groups shape the designed technologies in accordance with moral values (see e.g. Friedman et al 2017, p. 68).

If we now compare and examine the two kinds of TD, we see that there is both a sense in which they are adversaries and one in which they are allies. They are adversaries because, as already mentioned, the definition of normative TD implicitly contains the most frequent objection raised against the central claim of nomological TD. Nomological TD rightly insists on the undeniable characteristic (undeniable both to common sense and, to some extent, to empirical studies) of the inexorable pervasiveness of technology. However, nomological TD unduly denies the evidence both that all individuals can control particular items of technology and that some people, who occupy a strategic position, are able to exert even an important influence on technological development (for similar arguments see e.g. Lenk 1994, pp. 10-11, and Rapp 1981, pp. 132-143). To deny these claims would be to deny personal responsibility (and with it human freedom), which is in principle possible, but *de facto* remains here a wholly unproved assumption.

In a more general sense, however, normative and nomological TD are on closer scrutiny allies, since both assume (sometimes implicitly, sometimes explicitly) that the sphere of technology is separate, and may be distinguished and identified independently from other spheres of human culture, such as art, ethics, religion, or pure science. Supporters of nomological TD make this assumption when they argue that technology is the true determinant of any other sphere of culture, while advocates of

normative TD do the same when they believe they can correct the dynamics of technology through forces or values independent from it.

The logical relations between the assumption in question and both forms of TD (with the names of the authors already mentioned in this section) should be more than sufficient to reject any objection that I am here arguing against a straw person. However, I shall quote two exemplary passages, one for each form of TD. In a passage from White 1949, the typical thesis of nomological TD is argumentatively prepared by the possibility of discretely categorizing different spheres of human culture. Although culture is an organized system,

"we may distinguish [...] three sub-systems of culture, namely, technological, sociological, and ideological systems. The technological system is composed of the material, mechanical, physical, and chemical instruments, together with the techniques of their use [...] These three categories [...] are, of course, interrelated; each reacts upon the others and is affected by them in turn. But the influence of this mutual interaction is not equal in all directions. [...] The primary role is played by the technological system. [...] The technological system is [...] both primary and basic in importance; all human life and culture rest and depend upon it." (pp. 364-365)

As an example of this assumption stemming from the normative realm, let us quote the following passage by Mumford:

"Where our ancestors sought power alone, we must seek control; where our predecessors were interested only in causes and means, we must become equally interested in purposes and goals. That is why art and religion and ethics have a significance for the present generation that they did not enjoy even a decade ago" (Mumford 1954, p. 114).

Here Mumford assumes the existence of a purely technological attitude, which is guided by the pursuit of power and which is based on the rationality of the means with respect to the end. He also assumes that this attitude can be countered or at least attenuated by behaviour dictated by different spheres of human culture, such as ethics, religion, politics, etc., which are thought of as forces external to and independent in principle of the technological sphere. In other words, the proposed therapy derives from the fact that, according to Mumford, the first cause

of a technology that is no longer under control is the actual decoupling of technology from other spheres of cultural life, such as ethics, art, religion.

At first glance, this assumption is both very plausible (and it is very common in most quarters of the philosophy of technology). However, it will be one of the main claims of this paper that, when we look more carefully, this assumption must be rejected at least in one important sense. ^Irrespective of the systematic justification that will be developed in section 3, even at first glance some perplexities arise. The first one follows directly from the pervasiveness of technology. The ease with which technology pervades all other cultural spheres would be difficult to explain if technology were seen as a sphere existing independently of other cultural spheres. Second, separate from the other spheres of culture, technology tends to be conceived as a monolithic reality, while today many authors rightly claim the irreducible multiplicity of technology. This claim, initially defended by more or less isolated authors (see e.g. Hans Lenk 1982, p. 22), is today convincingly supported by social-historical evidence, provided by approaches such as: Social Studies of Science; Science, Technology, and Society Studies; the Social Construction of Technology, the Design Turn, etc.

Expressing the results of our comparison and first examination of nomological and normative TD in a more positive and constructive way, we may say that they suggest looking for an account able both to steer a safe course between the Scylla of nomological TD and the Charybdis of normative TD, and to save the elements of truth which they assert dialectically one against the other. However, to reach such a position, which can without contradiction recognise the elements of truth of which both nomological and normative TD are the disguised expression, we need to distinguish two kinds of reason, which we shall call, respectively, reflective and methodological. This distinction will contribute to a clearer insight into the relationship between science, technology, and personal responsibility, an important prerequisite to (re)gain a better control of technology. The next section has the task of introducing this distinction, starting from a brief critical analysis of the well-known distinction between the context of justification and the context of discovery.

3. Two meanings of reason: science, technology, and the main limits of both versions of TD

The distinction between context of discovery and context of justification, under different names, runs through all philosophy of science since its beginnings at the end of the nineteenth century. According to Feigl, the distinction originates in Moritz Schlick's *Allgemeine Erkenntnislehre* (cf. Feigl 1969), but it might also be regarded as a development both of the Kantian one between *quid facti* and *quid juris* and of the Fregean one between "psychology" and "logic" (to be found, respectively, in the second-edition preface to the *Critique of Pure Reason* and in the introduction to *The Foundations of Arithmetic*; for more historical details on this distinction, see Schickore and Steinle (eds) 2009, above all Part I and Part II).

In general, the logical empiricists used the distinction to grant empirical science cognitive autonomy vis-a-vis the wider cultural and historical context. And it was precisely for this reason that the exponents of the relativistic philosophies of science of the 1960s (especially Kuhn and Feyerabend) and the advocates of the sociological turn (notably Bloor and Latour) from the 1980s onwards rejected the distinction in question. According to Kuhn and Feyerabend, for example, merely because they played an historical-causal role in the scientific process, factors such as scientists' prejudices and personal idiosyncrasies, aesthetic preferences, religious beliefs etc., are to be put on a par with more traditional *reasons* for maintaining or rejecting a theory, such as coherence, explanatory scope, unifying power, etc. (cf. Feyerabend 1970, § 14; Kuhn 1962[1970], pp. 151-156; for typical exponents of the sociological turn, see e.g. Bloor 1991, pp. 36–37; Pickering 1991, p. 459; Lynch 1991, p. 476-477; Knorr Cetina 1992, p. 116).

By this, however, the baby had been thrown out with the bath water. It is true that science is always influenced by historical, psychological, social, and, generally, practical elements. Although a countless number of physical, biological, psychological, and sociological factors limit human reason, the irreducibility of reason, at least in one sense, cannot be denied without denying all possibility of meaningful thinking or talking. In fact, there is a minimal sense, which I shall call *reflective*, in which reason is irreducible to empirical, particular causal factors, namely as an expression of its claim to represent, in principle, things as they really are (no matter how far this can succeed). Any claim to reduce reason to causal factors undermines its own argumentative strength, since it presupposes its own truth as something that is irreducible to those causal factors. In other words, the effort to let the object come forward as it is (no matter how far

this can succeed) is essential to reason: it is inescapable and cannot be denied without contradiction, since it is affirmed by the very act of negating it. To assert any empirical fact is to assert, implicitly, the distinction in principle between reason and facts, without which there would be neither one's own asserting nor one's own denying (for a more detailed treatment of the problem, see Buzzoni 2008, ch. 1, §§ 4-7).

So far I have defended the distinction in principle between justification and discovery, understood as an expression of the irreducible autonomy of reason. But now we have to ask a question that, on the contrary, will lead to another sense of reason. On reflection, the claim to represent, in principle, things as they really are, is in itself devoid of any particular content, so that the crucial question becomes: How can this autonomy of reason be concretely realized? It is the answer to this question which drives us to a second sense of human reason, a *methodological* sense, which is the opposite complementary of the reflective one.

In fact, if the general claim of representing things as they are is not to remain devoid of any particular content and cognitive function, it must be realized by means of concrete methodological procedures which make it possible to reconstruct, to re-appropriate and to evaluate in the first person the reasons why a particular truth-claim should be accepted. In other words, the truth-claim of our discourses tends by its very nature to translate (in principle without residue) into particular methods (or techniques).

In science, this is tantamount to the fundamental principle of objectivity: no sentence will be accepted as truly scientific if it is not accompanied by means that allow it, at least in principle, to be tested intersubjectively and established as true or false, reliable or unreliable, consistent or inconsistent, etc. (according to one's preferred epistemological framework). The scientific experiment - a key notion to which I shall return later - is only a special exemplification of the general principle of scientific objectivity, which holds true both for empirical and formal reasoning. If we want to test the truth of an empirical statement or the validity of a theorem, we must adopt a *genetic-reconstructive* attitude and retrace the main methodical steps performed by those who first *discovered* that result.

Re-interpreting and developing freely a well-known Kantian insight from the technological point of view, a scientific experiment may be said to consist in answering a theoretical question by constructing a

mechanism which only obeys laws which exist independently of any particular knower, independently of her/his desires, interests, values. More precisely, in the empirical sciences – which for this reason are sometimes rightly called technoscience – the methodological element mainly consists in building an 'experimental machine', whose functioning technically exemplifies the procedural steps that led to particular experimental results. In other words, scientific experiments are the ways in which technoscience fulfils the requirement, proper to all cognitive discourse, to testify as to how things are in themselves, that is, by means of the technical-operational translation of theoretical concepts into devices, machines or mechanisms (for more details on this point, and for a general theory of the relationship between science and technology, see Buzzoni 2008, chap. 1).

From this point of view, scientific experiments reflect the same duplicity that we have already found in the more general distinction between the reflective and the methodological use of reason. Correspondently, two senses of technology should be distinguished, respectively reflective and methodological, which explain and eliminate the inconsistency between the claims about technology from which we started. Distinction and unity between, on the one hand, the irreducibility of reason to real causal factors in the mentioned (minimal and reflective) sense, and its methodological-operational expression on the other, are again to be found in the notion of technology.

We shall see later on the importance of the reflective aspect of technology and the limits that it implies for nomological TD. Now, from what I have been saying, and in particular from the methodological aspect of technology (the one most closely related to the way common sense understands technology and technique, that is, as devices, machines, equipment, and as special ways of doing things), I intend to derive the most important systematic reason to reject the assumption that normative and nomological TD share: the idea of technology as a unitary and closed cultural sphere. The necessity to resolve any claim of truth or reliability in the construction of methodical paths that can be followed by anyone, brings to the fore one of the most important characteristics of technology. Reformulating in our terms the common sense understanding of technology and technique, we may say that technology is the methodological side of the one reality which is human "culture". From this point of view, we have to speak of technologies in the plural: multiplicity is intrinsically connected with technology, and we ordinarily

(and properly) speak of a moral, artistic, logical, mathematical, etc., techniques. In fact, because of its pure formality, the reflective sense of reason must resolve itself, in all cultural fields, in a multiplicity of special techniques. When we try to convince someone that something is true, good, beautiful, holy etc., we ought to offer ‘reasons’ or ‘methods’ which, in principle, can be reproduced and appropriated in the first person even by those who are not convinced of the intended endpoint of our reasoning.

Now, from what we have been saying directly follows the pervasiveness of technology. In other words, the logical extensions of the words “culture” and “technology” coincide completely in the sense that it is impossible to find a theoretical or practical claim which would only fall under the domain of technology, but not of culture (or vice versa). This conclusion directly undermines the assumption nomological and normative TD share: they emphasize, respectively, the human incapacity or capacity to control something which, strictly speaking, does not exist, that is, technology as a separate field of human culture.

One might reply that this is only because the notions of “technology” and “culture” are so vague as to encompass everything. This is in a certain sense true, but the point is that if you don't grasp the meaning (I could even say the "Sinn", in the way Frege used this term) in which you see that "technology" and "culture" coincide as to their extension, the philosophically fundamental meaning of both culture and technology escapes. It is by virtue of this fundamental meaning, just to give an example, that we can define man as both *homo sapiens*, and, with equal truth, as *homo faber*. And it is still by virtue of this fundamental meaning that it is impossible to identify a particular culture but through techniques of knowledge and of common life. Beliefs, ways of life, arts, and customs shared by people in a particular society (a possible dictionary definition of "culture") cannot be understood as such without understanding the procedural (and in the sense explained above, technological) rules that constitute them intrinsically. And conversely, it is impossible to identify a particular technology, such as metalworking in a prehistoric age, without connecting it to that culture of which it is a methodological moment. Machines, equipment, ways of working metals, etc., must necessarily be placed in relation to the rules of social interaction that define their purposes and only in this way give them a determined and understandable sense.

On the other hand, once we have grasped the philosophically decisive sense in which technology and culture coincide as to their

extension, it is legitimate, and indeed necessary for the needs of interpersonal communications in specific contexts, not only to distinguish culture and technology, but to distinguish different meanings (uses) of both terms (see e.g. Mitcham 1994, pp. 137-160), and indeed it is necessary to remain open to new extensions or restrictions of these meanings (uses), depending on the changing needs of special contexts of life.

But we must now apply the conclusion we have reached in this section to our problem. In fact, this conclusion is a first necessary step towards a position able to overcome the shortcomings of both nomological and normative TD. To develop such a position, on the one hand, we have to account for the tendency of technology to become autonomous (though avoiding any hypostatization of it in a cultural sphere separate from the others), and, on the other hand we have to explain (in spite of the tendency of technology to become autonomous) the dependence of technology (both in principle and, at least in this or that measure, de facto) on our choices, individual or collective. For this purpose, taking up a thread of thought I left pending, we have to expand what we have been saying in this section about scientific experiments.

4. The notion of scientific experiment: the element of truth in nomological TD

As we have seen, scientific experiments reflect the same relationship of unity and distinction we have found in the more general relation between the reflective and the methodological aspect of reason. In the empirical sciences, the translation of the implicit truth-claim of our discourses to represent facts as they are into special methods or techniques mainly consists in the building of ‘experimental machines’, mechanisms which, once started, go of themselves, independently of any particular desire, interest or value of experimenters.

We may start from this aspect of scientific experiments to find an element of truth in nomological TD. To the extent that a scientific experiment is a technical process that takes place independently of us it shows the existence in nature of a connection that, while depending on us for its meaningful expression, does not depend on us for its real contents, to which our judgments, in an important sense, cannot add anything. No consideration on the historical reasons that induced Galileo to study the

trajectory of projectiles can call into question the independence of the relevant experimental results.

In this sense, the central idea of nomological TD is somewhat prefigured in scientific experiments. The tendency of technology to develop independently of human persons is the magnified expression of one of the most important aspects of scientific experiments: the tendency of the 'experimental machine' to develop autonomously and 'impersonally', independently of that which we can say or believe of it. In fact, we should say of the experimental-scientific machine what Ellul said of the generic concept of the machine in support of his thesis of the autonomy of the technological "system": "the ideal for which technique strives is the mechanization of everything it encounters." (Ellul 1954[1964], Engl. trans., p. 12)

But an important qualification may be in order here. The essential idea behind technology is certainly the machine, but the machine in a broader and deeper sense than that intended by Ellul. He is right in emphasizing the need, typical of technological rationality, to increase efficiency by the rationalization of all aspects of human life. But he simply assumes, without discussion, that the machine model can embody rationality. He does not explain why it actually increases practical effectiveness, rather than remaining an abstract kind of rationality, a pure descriptive analytical piece.

To explain this, we have to understand the machine in a much more qualified sense than Ellul does, that is, as an experimental machine. In this way, the same link of conceptual understanding *and* practical efficacy, of theoretical design *and* the operational control of reality, which constitutes the scientific experiment, may be extended to the machine model in general. The practical effectiveness of the machine, from a logical point of view, is in principle the same as that of a scientific experiment. Any machine, as exemplified in law-like scientific experiments, is a closed field of possible interactions between elements that are, at least potentially, already given and organized according to a logical or stereotyped sequence (hence the predictability, perhaps only in a statistical way, of its unfolding).[4] Thus, to the extent that something exhibits general patterns, it will be amenable to scientific experimentation and, therefore, can be transformed into a technological process that develops independently from our expectations, desires, and prejudices.

[4] A slight hint in this sense is to be found in Veblen (1919, pp. 17-18), but its development was hampered by a traditional separation between science and technology.

No limit can be put a priori on this possibility, and for this reason it is not only practically difficult (as Dormehl says: 2014, p. 11), but in principle impossible, to conceive a special field of human action or thought that could not be subject to “algorithmization”. The reproducibility of experimental results will, in fact, vary greatly from case to case, but even the lowest degree of generality we are able to detect in the object of our inquiry allows the use of scientific experiments. In spite of his normative TD, Mumford illustrates this point in an iconic and effective way by his idea of the "Megamachine": the colossal works of engineering in both Egypt and Mesopotamia, which, although composed almost entirely of human parts, are one of the first and most important examples of machines (cf. Mumford 1967, p. 11).

From this point of view, the scientific experiment, interpreted as the technical realization of a theoretical hypothesis, is the key to the comprehension of both the tendency of technology to develop independently of human beings and to its capacity in principle to extend itself into every field of human life (economics, art, moral, leisure, etc.). Moving from here, we can easily understand further aspects of technology. For example, the influence that all technologies (including the internet and other digital technologies) exert on our needs – in a sense already emphasized by Simondon (see e.g. 1958: 24) – and on our ways of thinking and our brains - in the senses explored by cognitive neuroscience and the recent «psychology of technology» (cf. for instance Kool & Agrawal 2016) - can easily be traced back to the most central aspects of scientific experiment. These influences are the result of our effort to adapt ourselves to the conditions imposed by the objective (physical as well logico-procedural) features of the technological devices we use. It is no wonder that, in using a smartphone, I have to become something of a smartphone myself, in the sense that, to use the mobile phone, I have to subordinate myself to the impersonal laws of its technological functioning. However, as we shall see in the following section, also the impersonal laws of technological functioning, unlike the claims of nomological TD, work through the free decisions of human persons.

5. Technology and the human person: the element of truth in normative TD

As we saw in the preceding section, there is a sense in which the central idea of nomological TD is in some sense prefigured in the logico-epistemological structure of scientific experiment. However, there is an equally important sense in which our results do not support nomological, but normative TD. As we shall now see, the analysis of the concept of scientific experiment highlights not only our dependence on technological processes, but also the irreducibly personal-humanistic side of technology.

First, the functioning of the experimental-technical machine is certainly, in a sense, independent of the personal subject. As already said, once it is started, a technical process takes place independently of us. But the reverse side of the picture must also be taken into account: by the construction of the experimental machine the person emerges as an irreducible free entity in the (moral) effort to bear witness to the way that things are and bracket all interferences, prejudices and idiosyncrasies.

To say essentially the same thing in another way: the experimental machine cannot be considered as functioning in accordance with objective and impersonal laws without returning at least implicitly to the personal point of view. Friedrich Georg Jünger (1946 [1949]), although he presented one of the most hopeless picture of technology, indirectly expressed this point through the paradoxical notion of "the perfection of technology" (*die Perfektion der Technik*). For him, the ultimate goal of technology is that “the entire work process, up to the finished product, is performed by automatic machinery and with repetitious mechanical uniformity”. However, this is paradoxical: the complete realization of this goal would be the end of technology itself, which would have reached both its apotheosis and its death (cf. Jünger 1946[1949], p. 189). In fact, a zero of human nature would make the notion of machine unintelligible, since you cannot separate the notion of machine from the human purpose it could serve. Ernst Jünger, brother of Friedrich Georg, made a similar point a few years later: “A clock that creates itself, winds itself, destroys itself: the idol of an automatic world. Even the numbers disappear; it should always say zero.” (Jünger 1963, p. 671)

In other words, the impersonality of technology and its methodological coextensiveness in principle with human culture is just the reverse side of the (reflective) irreducibility of human culture to technology. This human character is everywhere in technology, and we may conceive of technological artefacts in themselves only as a result of a counterfactual abstraction from thinking and acting persons and from

their free projects of intervention in reality. An actual and not only counterfactual abstraction would transform technological artefacts into a multiplicity of indeterminate objects, none of which were uniquely identifiable, for they are for us machines or instruments only insofar as they are implicitly placed in relation to our purposes of (freely) using them.

But there is a second aspect of our analysis of scientific experiment that highlights the irreducibly personal-humanistic side of technology. The two dimensions of our reasoning, methodological and reflective, though in principle distinct, are both present at every moment and at every point of our cultural life. An important consequence of this is the inevitably particular or local character of technologies: precisely because technology is no closed field, it occurs only in local and partial ways, that is, in the multiplicity of its concrete expressions, which are not limited to those connected with Galilean experimental science, but involve every aspect of human thought and agency.

In the light of these conclusions, we may say that, though by a very different path, we have obtained results which, at least in one important sense, are very similar to those of the most recent turns in the contemporary philosophy of technology, from the Social Studies of Science and Technology to the Design Turn, from the Value Sensitive Design to its synergy with Technological Assessment (for a survey of these and many other currents that are common to each other from the point of view indicated here, see e.g. van de Poel 2014). In most of these approaches we find insistence on the fact that technologies are contingent and that values embedded in any given technical implementation are likely to be widespread and pervasive. In fact, from a *methodological* point of view, technology must necessarily be specified from time to time by particular methods of inquiry in correspondence with the particular cognitive problems we are facing. It always has a contingent and historically local character, and there is no fixed set of contents or methods that can be defined once and for all as "technology". Moreover, provided that we accept the necessity of any empirical-scientific claim to translate into concrete actions (thesis here necessarily presupposed for reasons of space), it follows as an important corollary that every methodical application - as rightly stressed by Value Sensitive Design - always takes place in connection with particular values and cannot be separated at any point from our personal responsibility.

The position defended here, however, at the level that we have called *reflective*, is essentially different from the last mentioned approaches. Technology, understood as the capacity of the human mind to understand the world and orient itself within it, is not in itself a particular method. It must resolve itself into particular cognitive and evaluative methods, but, as the condition of possibility of particular methods, is not a particular method in itself.

It follows that the unity and the multiplicity (and locality) of technologies can be coherently articulated and maintained only if no element of this relationship is sacrificed for the other. There are two opposite difficulties, arising from ignoring either the unity or the distinction in the relationship between, on the one hand, the formal truth-claim of our reasoning in general and, on the other hand, the multiplicity of the methods that we have to follow from time to time. In the first case, the concept of technology is reified into a singular essence; in the second, the multiplicity of the various forms of technology collapses into the multiplicity of the social-historical reality that surrounds us. The mentioned recent turns in the philosophy of technology handle the first but not the second difficulty. Taking Value-Sensitive Design as an example - where the meaning of the term “design” ultimately becomes synonymous with the term “technology” -, we should rightly demand technologies that, from an ethical position, we can and want to live with (Friedman 1996, p. 17), but we cannot distinguish once and for all the set of correct and incorrect behaviours (this seems to be the most important point of the objections raised by Umbrello 2020, from within the Value-Sensitive Design itself). Our inability to distinguish between a reflexive and methodological meaning of technology (or design) risks at every moment to lead to a specific set of technical instantiations that are expressions of a particular stage of historical development. The result is that we have positions (and designed technologies) that are unconsciously biased from an ethical, social and political point of view - usually in the Eurocentric sense.

Nevertheless, the insistence on locality, contingency, and value-ladenness of technology is in itself correct and important. And all the more so for Value-Sensitive Design, which has taken moral action beyond the traditionally primary requirements of efficiency, reliability, robustness, etc., insisting on the need to intervene locally, at the level of particular designs, so that technologies can have a positive impact on the quality of human lives. In fact, the distinction that I have drawn in this

paper between two levels of analysis (reflexive and methodological) has the task of clarifying and making consistent some of the most important conditions of the practical possibility of limiting the pervasiveness of technology and of designing technologies "we can and want to live with". Granted this distinction, we may say that, on the one hand technology is coextensive with human culture and can modify our ways of thinking and acting - as many neuroscientific inquiries confirm - at every moment and at every point of the history of human culture. As I have pointed out, this is an element of truth in nomological TD. On the other hand, however, this means that, at every moment and at any point in our culture, we may distance ourselves from our technological contexts and 'locally' change them. And this is an element of truth in normative TD.

Conversely, because opportunity and danger are two sides of the same coin, while no a priori limits can be put to the scope of 'local' interventions aiming at putting some limitations to technology, unfortunately no a priori limits can be put to the pervasiveness of technology either. All particular technologies tend to be interdependent and connected with one another (the car with the highway, and today with the internet – and the other way around) and form an interdependent and interconnected whole. This complex interconnection of different technologies, on the one hand, increases our ability to intervene in the world around us, but on the other hampers interventions aimed at gaining a complete control over it. In different senses, this complex interaction both widens and limits to a considerable extent our freedom of choice, reinforcing and magnifying technology's conditioning power by and over people's actions.

Here we touch on the problem of the relationship between technology and democracy or the political control of technology. But this is another story, which would lead us away from our present problem. In this connection, I confine myself to noting that the control and direction of technology can succeed to a considerable extent only in expanding the individual perspective to the social and political terrain, both because it is especially at this level that particular interest groups try to influence the uses that individuals make of technologies, and also because new technologies can provide important help in overcoming the lack of knowledge and mutual interaction between grassroots movements and elites, which is one of the main weaknesses of current democracies.

Before concluding, I need to answer one last possible objection and, at the same time, prevent a serious misunderstanding. According to an

objection which could come from naturalistic quarters, however plausible the philosophical position I have been developing, it remains that only empirical inquiry can show to what extent, and in what way, individuals (from different backgrounds and in different institutional frames) can control or are controlled by algorithms in their day-to-day practices.

This is certainly true. But far from being an objection to what I have been saying, this remark, when rightly understood, serves as an indirect and additional illustration and corroboration thereof. Our analysis, as philosophical, clarifies only the conditions of possibility of empirical discourses, which are autonomous in their truth-value. Strictly speaking, it not only cannot replace, but requires as a necessary complement empirical (biological, psychological, sociological, etc.) investigations. Our general (or, to use the word used in this paper, *reflective*) claims need *methodological* evidence that can only be supplied by the empirical sciences (for more details on this issue, see Buzzoni 2019). This is indeed only one example of the general thesis of this paper, according to which the methodological sense of reason is a necessary complement to the reflective one, which would remain devoid of any particular content and cognitive function, if it were not realized by means of concrete methodical procedures which make it possible to reconstruct, to re-appropriate and to evaluate in the first person the reasons why a particular truth-claim should be accepted. It is for this reason that, when we have understood the possibilities and limits of our control over technology, we still need to integrate philosophical discourse with empirical investigations concerning the new technologies, including those of the groups engaged in the production, implementation and exploitation of the algorithms capable of influencing both our desires and our innermost thoughts and feelings. This integration is in part still to be written, but this story, as well as giving methodological concreteness to our considerations, is necessary to give to human sciences an ethical and social significance. As a result, what might be designed as the human sciences objection is no objection at all, but an indirect corroboration of one of our main conclusions.

Conclusion

The question of the nature, value, and limits of TD has been generally neglected by the most recent philosophy of technology. However, it should be solved, and not shelved. As we have seen, the tendency of technology to extend itself to every field of human life, on the one hand, and the human capacity, at least in particular circumstances and to some extent, to counteract and orient such a tendency, on the other, roughly characterize the two main versions of TD: "nomological" and "normative". In this paper, by reconciling these seemingly inconsistent claims about technology, I have shown that each version of TD has its own merits and makes a legitimate demand on the other.

In the many turns in the recent philosophy of technology the question of the nature, value, and limits of TD has been set aside in favour of conclusions which are prima facie plausible, but which have been accepted without adequate justification. Our argument has rediscovered some of these conclusions, though by a very different path. In Section 3, I briefly analysed the notion of scientific experiment from the perspective of the distinction between the context of discovery and the context of justification, distinguishing and at the same time putting in connection with one another two aspects of human reason, which I called respectively "methodological" and "reflective".

This analysis brought to light both the tendency of technology to exist and develop objectively and independently of our mental acts and decisions (defended by nomological TD) and the irreducibly humanistic moment of technology (defended by normative TD). However, to reconcile the partial, but complementary, elements of truth contained in each version of TD, it was also necessary to reject the mistaken assumption which they share and which, with very few exceptions, always prevailed in the philosophy of technology: that technology – taken in its reflective sense – can be known independently from the other spheres of culture (and vice versa); that technology – taken in this sense, as a universal pattern of human thought and agency – can be restricted to a particular set of human activities or methods.

From this, three main conclusions followed. First, because technology, in an important sense, does not constitute a sphere separate from other cultural spheres, it is easier to understand why it can pervade all of them. Second, the idea of the (reflective) unity of technology in the (methodological) multiplicity of techniques, far from suggesting any unitary and closed sphere of technology, implies that there is no unitary and closed sphere of technology; on the contrary, technology appears only

in the multiplicity of its particular manifestations: technology is multiple and local, because it is immanent and always exemplified in the most disparate and heterogeneous acts of human persons. Finally and more generally, the all-pervasiveness and impersonality of technology, as well as its co-extensiveness in principle with human culture, are just the reverse (methodological) side of the in principle irreducibility of human culture, freedom and responsibility to technology. It is exactly because technology can pervade all human culture (as rightly, but one-sidedly emphasized by nomological TD) that a critical examination of each mechanization or algorithmization of our lives may happen at any particular place and time – which is a necessary, though only local, condition for controlling and/or modifying them (as rightly, but again one-sidedly emphasized by normative TD). From a reflective point of view, we are certainly condemned to be free, but we are only actually free if and to the extent that we apply the technological means that allow us to realize our values – from that of knowing how things are to moral, social, political, and aesthetic values. From this point of view, one can better understand both that technology tends to be autonomous and independent from our mental acts and decisions (as pointed out by nomological TD) and, at the same time, is always deeply ours and never utterly extraneous to our individual and collective responsibility (as emphasized not only by normative TD, but also by the recent turns in the philosophy of technology.

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[1] I shall leave aside completely the old question of whether or not Marx is a technological determinist. The answer to this question depends entirely on how one interprets the relationship of substructure and superstructure.