WHAT IS THAT THING CALLED PHILOSOPHY OF TECHNOLOGY?

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Summary

A philosophy of technology is mainly a critical reflection on technology from the point of view of the main chapters of philosophy, e.g., metaphysics, epistemology and ethics. Technology has had a fast development since the middle of the 20th century , especially

after the end of World War II. The most important philosophies about that development will be summarized by concentrating on the views of the most relevant representatives of each of them, both for the early philosophies of technology (from Aristotle to Ellul) and for the most recent contributions (like those by Winner Feenberg, and ecosophy). After a critical systematization of those views, the accent will be put on the pressing ethical issues raised by contemporary technology. Among them, it will be discussed, on the one hand, the ethical dimension of technological assessment denouncing the fallacies committed by those who deny the presence of that ethical dimension. On the other hand, it will be argued in favor of the need for new ethical categories and principles for addressing the ethical problems related to the planetary scale of technological application and its consequences. A corollary of such discussion will be a call for a new politics moving beyond the concerns for what happens here and now and for a new ethical and political responsibility. The ethical and political problems related today to technology are not mere technical ones to be handled by particular experts, but are about issues requiring the evaluation of value-judgments and value-systems for a future human society capable of living in solidarity. The final outcome will be the proposal of the main notes for a new and defendable philosophy of technology inviting to overcome instrumental rationality and to welcome a new ethics, politics and a radically different sense of responsibility.

1. Introduction

The answer to the title question has been repeatedly provided mainly by different philosophers concerned with the variety of issues and problems generated by technology.

The main purpose of this chapter is to provide an updated brief survey of those problems and replies advanced by those philosophers from different philosophical perspectives on technology.

Among the most quoted definitions of technology we will mention the following: Mesthene (*Technological Change,* New York: Mentor, 1988, p. 25) has stated that technological knowledge is "knowledge for the sake of practical purposes. Technology is using tools for specific goals". J.Pitt (*Thinking About Technology*, New York-London: Seven Bridges Press, 2000, p.11)) says that technology is "humanity at work…it is the activity of humans and their deliberate use of tools…". Finally, C.E. Rogers (quoted by Vincenti, B. (*What Engineers Know and How They Know It: Analytical Studies from Aeronautical History,* Baltimore: John Hopkins University Press, 1966, p.6) affirms that "(Technology) refers to the practice of organizing the design and construction (it would be sensible to add 'operation') of any artifice which transforms the physical (again, we should add 'social') world around us to meet some recognized need".

Of course, no matter how acceptable those definitions might be, and independently from the fact that they correctly stress that technology is a means for achieving human practical ends, i.e., that technology is initially a human instrument for achieving certain goals, each definition can only be considered as a mere initial attempt to characterize technology and requires to be expanded by further discussion as it will become clear below.

However, those definitions also make clear that there are crucial differences between pure science, applied science and technology. Thus, J. Feibleman (*Technology and Culture,* II, 4 (1961)) understands by pure science a method of investigating nature in an attempt to satisfy the need to know. Its fundamental goal is explanation. By applied science he means the use of pure science for some practical human purpose. Its main aim is to do, and mainly control something in nature. Finally, technology might be conceived as a further step in applied science by means of the improvement of instruments.

Accordingly, there could be technology without pure science; in fact that has happened for millennia, although it is no longer the usual case today. Nevertheless, there could not be applied science without pure science; for example, there could not be an application of the theory of groups in crystallography without a previous theoretical research ending in the theory of groups. There is no doubt that technology has been and is even more today one fundamental impetus to science (for example, the steam engine has been the main impetus to the development of thermodynamics).

2. Locating Technology with respect to Science

We are going to make a systematic comparison between science and technology in terms of the following main categories: (1) Structure and content, (2) method, (3) goals, and (4) ways of progress (if any).

2.1. Structure and Content

The main components or elements of technology or, more precisely, of any situation centrally involving the use of technology are: a goal or purpose, mainly human or more specifically, social, boundaries mainly constituted by the laws of science, the availabilities at hand, i.e., what is available, the action for the achievement of the goal, and the instrument(s) being used. The final by product of the interplay among the former elements is the technological artifact.

For many scholars there is also an important difference in terms of their referent. Bunge (*Scientific Research II: The Search for Truth,,* Berlin, Heidelberg, New York: Springer Verlag, 1967, chapter 11) claims that science deals with the real, natural and social world, whereas technology handles the artificial; its main task is to interfere with the world.

Consistently, there is a noticeable difference in scope. Scientific laws are general claims allegedly valid for the whole world. Technology works within what those laws allow (with what is possible on narrow localities).

And science and technology might be distinguished because of their richness and depth. From a practical angle, technological knowledge is richer than the scientific one, but the former is less deep than the latter insofar as its goal is basically instrumental and not basically explanatory in character. Just as pure science focuses on objective patterns of laws, technology as an action-oriented research, aims at establishing rules, i.e. stable norms of successful human behavior.

Rules indicate how one should proceed to achieve certain predetermined goals. They are sets of instructions to perform finite numbers of acts in a determinate order and for the sake of establishing a certain end. The technological rules are one among several types of rules (of conduct, social, moral, legal, rules of thumb, mainly in the arts and production, and rules of sign).

Although the technological rules are different form the others and, mainly, from scientific laws, there is a fundamental non-logical relation between scientific laws and technological rules. Bunge (*op. cit.)* claims that the relationship between laws and rules is not a logical but a pragmatic one. More precisely, laws do not objectively imply rules, but invite us to advance and apply a rule. Thus, if "If A then B" is a law-like statement, it invites us to attempt to apply the corresponding rule. For example, if the law statement is "Magnetism disappears above the Curie temperature", then we are led to advance the following nomo-pragmatic statement, "If a magnetized body is heated above its Curie-temperature, it becomes de-magnetized". And the latter, in turn, invites us to propose the following rule: "For demagnetizing a body, heat it above its Curie-temperature". On the one hand, given a scientific law we have no warrant that the corresponding rule will be successful, because the law is about an ideal model of reality, so that the rule when applied to reality itself might fail. On the other hand, the success of a technological rule is no warrant for the truth or dependability of a law

2.2. Method

There is a widespread agreement about the non-existence of a strict and proper method of technology. Technological knowledge is the outcome of the application of scientific methods to practical problems, i.e. for achieving certain practical goals.

According to Bunge (*op. cit.)*, there are two types of technological theories: substantive, about the objects of action, like in the theory of flight, or operative, concerned with action itself (for example, regarding the optimal distribution of aircraft over a territory). Substantive theories are always preceded by scientific ones. The former take advantage of the results of the latter and apply them. However, they don't make necessarily use of its methods. Thus, the theory of flight is an application of fluid dynamics. Operative theories, in turn, employ the methods of science. They use theory concepts like probability and are empirically testable.

2.3. Aim

It is usually claimed that the main goal of technology is efficiency rather than truth, i.e., fitness of purpose and economy. Technology is fundamentally an instrument for achieving human practical goals, whereas science is conceived by the majority of scientists as not only an instrument. Moreover, whereas science is basically explanatory, that is not the case for technology which is knowing how rather than knowing why.

Some scientists and several philosophers of science subscribe to the view that science is merely an instrument of prediction. But even if that were so there are also important differences between scientific prediction and technological forecast. In scientific prediction we witness a conditional correlation between events, the former being referred by the so called initial conditions and the latter being the one being predicted. A technological forecast establishes a relation between means and ends.

A scientific prediction informs us that under certain circumstances, something will (not) happen. A technological forecast tells us how to intervene on the circumstances at hand, so that certain events may be brought about or prevented.

2.4. Pattern of Change

One of the most obvious contemporary myths is that both science and technology not only are progressive, but mainly that both constitute the two most progressive of human activities.

However, and without taking any stance about the literal acceptability of that myth, there is common agreement that both, science and technology have very different patterns of change. We cannot be surprised by the fact that science and technology differ in the ways in which they change. It is plainly obvious, for example, that there have been important technological changes without being preceded by relevant scientific discoveries (e.g. the steam machine was built before having a satisfactory scientific explanation for it), and vice-versa. Consequently, the main plausible features of scientific progress cannot be extended to technological advance without a previous and thorough critical discussion.

Perhaps, nobody like Kuhn (*The Essential Tension*, Chicago: University of Chicago Press, 1977) has been more straightforward in stressing the distinctions between the ways in which science and technology change. Those differences between both patterns of development are nothing else but consequences of several previous differences. Among them, Kuhn overemphasizes the following: both, science and technology face different sorts of problems. Whereas scientific problems are defined by a certain dominant paradigm (i.e., are internal to that paradigm that guarantees their solution), technological problems are determined by economic, political, social and military factors external to the sciences themselves and, correspondingly to any scientific paradigm.

Moreover, the scientist and the technologist are subjected to different sorts of education. The former is heavily trained within a unique paradigmatic framework for successfully operating within that paradigm. The latter requires of a much more ample education not being tied to any specific paradigm. As a consequence, both do not have to have the same virtues for being successful in their respective activities. Then, it is very rare that the same person be highly successful in both types of activity.

As a corollary, Kuhn concludes that there are crucial differences between scientific and technological progress. In scientific progress, the scientist usually proceeds closely linked to a given paradigm. That progress consists in the scientist’s increase of capacity for solving the puzzles defined by each paradigm. In technological advance, the technologist operates taking what it is useful for him under the circumstances at hand, no matter where it comes from. This is consistent with the type of instrumental rationality operating in technological advance, according to which it is rational to adopt that instrument or carry on that innovation that would maximize the efficiency for achieving the desired goal.

3. Locating Philosophy of Technology

There is plenty of room for a philosophy of technology. The contemporary situation all over the world, especially in the capitalist superpowers, stresses the enormous influence of technology in everyday life as well as in the survival and development of the current standards of living. We do not need to mention the ecological disasters provoked by an erroneous and uncontrolled employment of technology in order to show the relevance of philosophical criticism, but it is enough with facing the subtleties and multidimensionality of the problems related to the design, production and use of technological devices (e.g. in areas like, for example, medicine, pacific use of nuclear energy, military weaponry, communication and information).

Those problems invite to a philosophical reflection and criticism from the perspective of the main areas of philosophy, like epistemology, metaphysics, axiology, and ethics. Accordingly, Bunge ("The Five Buds of Techno-philosophy", *Technology in Society* 1, 1 (1979), pp. 67-74) speaks of five chapters of techno-philosophy: techno-epistemology, techno-metaphysics, techno-axiology, techno-ethics, and techno-praxiology.

Techno-epistemology is about the main features of technological knowledge. Thus, our previous discussion about the distinctive characteristics of science and technology would be part of techno-epistemology.

Techno-metaphysics is mainly concerned with the critical discussion of the artifacts, and their fundamental differences with natural objects. Some thinkers, like Heidegger, prefer to speak of the ontology of technology instead of techno-metaphysics due to his particularly negative view of metaphysics.

Techno-axiology deals with the crucial issue of the nature of those values involved mainly in technological assessment. The discussion about the presence of not only internal but also external values in that evaluation is one of the central topics.

Techno-ethics studies the presence of ethical values in the different stages of technological production and assessment. The decision for deciding whether an artifact is good or bad, a decision about it being right or wrong, for example, about technological transfer is at the central core of this area of philosophical research about technology.

Techno-praxiology is about technological rationality, i.e., about the standards for establishing the rationality of decisions about any stage or aspect of technology; for example, whether it would be rational to continue building nuclear power plants in the USA for the production of cheaper electricity.

Of course, the answers to any question in those areas depend upon the philosophical perspective from which those questions are faced. Accordingly, we need to discuss the most important philosophies of technology that have dealt with the main problems belonging to the five main areas of techno-philosophy.

4. Early Philosophies of Technology

To proceed systematically, it is recommendable to distinguish between early and recent philosophies of technology.

The early views to be discussed are: Aristotelianism, Technological pessimism, Technological optimism, Existentialism, and Neomarxism. Among the recent views, there will be selected for being briefly studied those of L. Winner, A. Feenberg and the ecosophers.

4.1. Aristotelianism

Techno-epistemology: According to Aristotle, technology is an arrangement of technics to make possible and serve the attainment of human ends. Techne as productive cognition is the capacity to make involving reasoning. Then, technological knowledge is different from both, everyday and scientific knowledge. It is productive knowledge, the outcome of a capacity of doing according to reason.

Techno-metaphysics: Artifacts are the objects produced through the use of technics that human action. There are two kinds of instruments: of production (e.g. a hammer), and of action (e.g. a chair) allowing the actualization of functions.

Techno-axiology: Instruments and artifacts derive their meaning and value from their use (medicine is valuable because of its function to cure diseases and improve human health). The basic value is human life itself. Accordingly, technology is not the “end, but certain activities, politics and philosophy pursued for their own. They determine the limits of technology. More precisely, technological knowledge and artifacts are in themselves value-neutral; they are not end in themselves. And the ends come from outside technology. Those ends are fixed (unchangeable) and determined by the stable structure of the society, reflecting the stable structure of the universe:

Techno-ethics: Technological knowledge and artifacts are good or bad according to their use for attaining certain ends that, as we have mentioned before, are ultimately stable. Technological transfer could be good according to the way in which it is carried out and fundamentally depending upon the ends being pursued.

Techno-praxiology: The rational way of realizing technological assessment is by establishing the adequacy of the technological means with respect to the ends to be attained. One witnesses again the presence of technological rationality, but taking into account the rationality of the ends themselves, i.e., their consistency with the ultimate ends of humanity and society.

This Aristotelian view is too simple for today’s society, which is basically a non-stable one. Accordingly, it is not right to speak today of fixed and stable ends. Moreover, nowadays, civilization is rather of means than ends, and even one in which usually certain means become new ends. Finally, it is dangerous and truly inconvenient to claim that technology and its artifacts are not good-bad in themselves, but become so according to the ways in which they are used. For example, a pile of nuclear bombs is in itself dangerous. This is closely related to the crucial issue of establishing responsibilities among scientists and technologists participating in programs for producing nuclear weapons: are they not responsible for the outcomes? Only politicians who order certain uses for those weapons should be blamed for the disastrous outcomes?

4.2. Technological Pessimism

Jacques Ellul (*The Technological Society*. New York: Vintage Books, 1964) is the most extreme representative of this view. In fact, there are different ways of being pessimist about the current state of technology and its consequences without endorsing, like Ellul does, a sort of technological determinism bordering on fatalism. For the sake of clarity, one has to go through the different chapters of Ellul's conception of technology.

Techno-metaphysics: Technique has become the "milieu"(omni-comprehensive frame) in which humans live without any possibility of escape. Such "milieu" is artificial, autonomous, self-determining and independent of any possible human intervention. The word 'Technique' refers not only to machinery but also to methods of organization, management practices, and a mechanicist way of thinking. Technique introduces order, clarification and rationalization. It is fundamentally efficient and imposes efficiency to everything. Our civilization is first and mainly a civilization of means. But technology is not simply a medium; on the contrary, it has become our life-framework and a way of life: this is its most substantive impact.

Techno-epistemology: Although technological knowledge is obviously progressive, it is unavoidably ambivalent, because, (a) any progress has a price, i.e. gains are always accompanied by losses (for example, the new technologies allowing people to have new ways of enjoying their free time generate more superficiality), (b) technological progress creates more problems than the ones it solves, e.g. the decrease in the mortality rate gives rise to overpopulation; as a consequence, vast majorities of people survive with a minimum and insufficient consumption of food, (c) the damaging effects are inseparable from the positive ones, for example, the unemployed produced by the increase in automation, and (d) technological progress is accompanied by unpredictable effects, like the devastating effects produced by the use of DDT in Mexican agriculture and in Borneo.

Techno-axiology-ethics: As a consequence of the omni-comprehensive and monopolistic domination of Technique, the human mind is totally ruled by technical values. Humans are not free of making free choices outside Technique. As a result, a new technical morality has come to replace any other morality. According to Ellul, the fundamental problem can be put into a nutshell in the following questions: (i) Are human beings capable of remaining free in a world of means? Ellul's reply is strictly negative. (ii) Who could and ought rule the future of the technical society? No one seems to be capable of having the slightest chance of success. (iii) Could it come into existence a new and real civilization including Technique? It is very difficult to believe in such a possibility. Ellul thinks that Technique can never engender authentic freedom because authentic spontaneity can never take place in that world of Technique insofar as any spontaneity would introduce disorder in it, contrary to the regimented order that Technique defines and requires for its efficient continuity.

Technopraxiology: Technique generates a rationality of its own, i.e. a thorough and encompassing instrumental rationality to which any human rational decision should accord with. Even the ends to be pursued are defined by that rationality, mainly because the means themselves gradually become the main goals to be achieved. And that rationality has become autonomous, making the development of Technique to look as having its own causality.

It is obvious that Ellul defends an extreme technological pessimism that should be appreciated for its straightforwardness, clarity and systematic nature. However, there are problems with the main arguments advanced in the defense of his main claims. No matter how strong his shocking theses about progress are, they are argumentatively weak. For example, it is widely known that the solution of any problem generates new problems, as it is usually shown in scientific research. But that it is not sufficient for negatively criticizing the problem-solving activity. Moreover, scientific progress also has gains and losses, but this does not make that progress ambivalent. What must be done is to evaluate the relative weight of gains and losses, and/or to determine if any gain is accompanied by a corresponding loss; and, if the answer is positive, then it must be discussed if that loss is of equal relevance with respect to the corresponding gain. Furthermore, it is historically false that progress always generates more and worse problems than the ones it solves. Leo Marx claimed that to affirm that to every technological advance corresponds negative and insuperable negative effect is clumsy and a-historical. Because at a certain moment and under certain circumstances it might be the case that a given solution might be accompanied by negative and insuperable effects, that should not be extrapolated for all circumstances in all contexts. To do that would be to commit the fallacy of extrapolating the present to all times and places.

It might be true that there is no way out from Technique itself. But that is not the whole truth. There could be a way out from the alleged bad effects of Technique if one alters the context favoring those effects. And those contextual changes could be structural and political ones. But that is precisely what Ellul stubbornly rejects. According to him, the real solution should consist in a radical revolution in the human spirit. He thinks that what should be done is (a) to make humans aware of their slavery to Technique, (b) to destroy the Myth of Technique, (c) to teach humans how to become independent of the process, (d) to emphasize the necessity of philosophical reflection, and (e) to dialogue with technicians.

But these are not serious solutions. They look like aspirins for curing cancer, in other words like merely paradigmatic cases of Utopianism. For example, it is impossible to dialogue with technicians for destroying the myth of Technique, or to convince them that what they do is to make humans being slaved by the byproducts of the activities of those same technicians.

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Biographical Sketch

Ricardo J. Gómez was born in Buenos Aires, Argentina where he earned his degree in Mathematics and Physics in 1959 and his degree of Professor of Philosophy at the University of Buenos Aires, Argentina in 1966. In 1978, he earned his Master of Arts degree at the Department of History and Philosophy of Science (Indiana University at Bloomington, USA) where he also earned his Ph.D. degree in Philosophy at the Department of Philosophy (1982).

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