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RESEARCH ARTICLE

Two Problems of the Biological Philosophy of Technology

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Abstract

The aim of this article is to highlight and discuss two problems of the biological philosophy of technology. In particular, I will analyse the work of André Leroi-Gourhan and Gilbert Simondon, and I will show that (a) the meaning of the analogy between technical and natural objects that underlies the approach of the biological philosophy of technology remains problematic and (b) the biological approach to technology is very effective for analysing tools and machines, but is not sufficient to describe the so-called information technologies. In the last part of the article, I will argue that, in order to understand information technologies, it is necessary to integrate the biological approach to technology with a grammatological approach. I will try to show that, next to the tool and the machine, there is a third category of technical objects that can be better described using the notion of "writing" proposed by one of the masters of the so-called French Thought, Jacques Derrida.

Keywords Simondon · Leroi-Gourhan · Stiegler · Derrida · Philosophy of technology

The aim of this article is not to be polemical. Discussing the problems of the biological philosophy of technology [BPT] does not mean to devalue a theoretical approach that has proved to be scientifically fruitful. On the contrary, this article starts from the assumption that the major positive contribution of the French philosophy of technology is the elaboration of a biological theory of technology. This theory has the advantage of having a strong systematic coherence and a solid philosophical foundation, but above all, it is strongly rooted in documented empirical facts. However, I would like to focus not on the merits of this theory, but on its limits. In particular, I will try to show that (a) the meaning of the analogy between technical and natural objects which underlies the approach of the BPT remains problematic and (b) the biological approach to technology is not sufficient to describe the so-called information and communication technologies [ICTs].

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In the first part of the article, which is devoted to thesis (a), I will proceed as follows: (1) I will analyse how Leroi-Gourhan conceives the analogy between biology and technology, showing that he is aware that this analogy has limitations; (2) I will analyse the main arguments which Simondon proposes to argue that technical objects have a mode of existence analogous to the mode of existence of living organisms; (3) I will focus on the interpretation of Simondon's theory offered by Stiegler. This interpretation brings out the fundamental problem of the intentionality of machines. I will try to show, in disagreement with Stiegler, that the issue remains very problematic in Simondon.

In the second part of the article, I will analyse the second thesis (b) proceeding as follows: (4) I will try to show that the ICTs cannot be described by exclusively starting from the approach of a BPT. In this regard, Leroi-Gourhan's theory of technique remains too closely linked to the gesture-tool paradigm, and Simondon's description of the mode of existence of technical objects appears to be relevant only to machines; (5) I will argue that it is necessary to integrate the biological approach to technology with a grammatological approach in order to understand ICTs. I will try to show that, next to the tool and the machine, there is a third category of technical objects that can be better described using the notion of "writing" proposed by one of the masters of the so-called French Thought, J. Derrida.

1 The "Kinship" Between Biology and Technology

It is not an exaggeration to say that the most general hypothesis that Leroi-Gourhan tests in *Évolution et techniques* [ET] is that there is an essential "kinship" between technology and biology. This hypothesis is presented several times in the two volumes of ET, and it is definitively confirmed in the last paragraph of *Milieu et techniques*:

> If we are looking for the real kinship of Technology, it is towards Paleontology, towards Biology, in the broadest sense, that we must turn. At any moment, it is clear that technical elements follow one another and that they are organised in the same way as living organisms (Leroi-Gourhan, 1973, 439, author's transl.).

Leroi-Gourhan is well aware that the parallelism between biology and technology has limits. Firstly, it is because the production of a technical object is always the result of an intention. On the contrary, it is clear that one must be very cautious in "attributing determined purposes to life". Otherwise, there is a risk of falling back into the ancient cosmic-metaphysical conceptions that are typical of Greek and mediaeval philosophy. Properly speaking, as Kant had already shown, purposes can only be attributed to nature by analogy (Kant [1970] 2000; 1965). Secondly, Leroi-Gourhan notes that technological evolution proceeds in a quasi-Lamarckian way: individual experience produces innovations, and functional innovations are passed on to posterity. On the contrary, biological evolution occurs randomly as a result of merely statistical processes, in accordance with the well-known Darwinian model. In this sense, technological evolution is in some ways more "rational" than biological evolution: indeed, "in technology, the hereditary transmission of acquired characters is normal" (Leroi-Gourhan, 1973, 437).

These important differences lead Leroi-Gourhan to be cautious: there is a similarity between technology and biology, but "similarity does not mean identity" (Leroi-Gourhan, 1973, 439). Nevertheless, the link between the two disciplines is strong, and "it is to be expected that in the future the proximity of the two disciplines will become increasingly clear" (Leroi-Gourhan, 1973, 440). It is the generalisation of the notion of "evolution" that grounds and legitimises this link. Darwin showed that the history of life must be articulated in evolutionary terms; Leroi-Gourhan shows that the history of technology also develops according to the same fundamental principle: "technical evolution, in its highest forms, does not deviate from evolution as biology has been able to outline it" (Leroi-Gourhan, 1973, 340).

This fundamental thesis is argued first and foremost from an empirical point of view. The historical classification of the different varieties of technical objects carried out by Leroi-Gourhan has a very strong theoretical cogency because the empirical cases illustrate the general theoretical hypothesis with extraordinary evidence. Leroi-Gourhan demonstrates case by case, by analysing the palaeontological and archaeological finds, that "each form of utensil, period after period, presents itself as if it had for its ascendant the form that preceded it". But alongside the empirical evidence, arguments of a purely theoretical nature are also developed. In this respect, Leroi-Gourhan reworks Bergson's concept of tendency (Bergson, 2007 [1907]) in the framework of a theory in which the different technical objects, just like the different living beings, are the result of the interaction between a vital impulse and the resistance posed by the inertia of matter. Thus the "technical tendency" finds its place alongside the vital tendency. But since the laws of matter are the same for life and technology, it is natural to think that the resistance of matter to the vital tendency through its inertia is analogous to its resistance to the technical tendency:

> by dragging a plastic mass through water, it is demonstrated that any solid moving through a liquid element necessarily takes on a particular spindle-shaped form and that it is impossible for the tuna, the ichthyosaurus, the whale and the boat to adopt any other general shape than the one imposed by physics (Leroi-Gourhan, 1973, 337, author's trans.).

The fish cannot but have a "tapered" shape because its environment, water, conditions it in an essential way. The resistance of the water to the original impulse of life makes the shape of aquatic beings converge towards the most "rational" solution from a physical and mechanical point of view. But the same physical and mechanical laws also determine the historical development of the technical object "boat". Historically, the shape of the boat has been mostly the same in all civilisations — with the exception of local variations due to particular uses or a specific symbolic or cultural purpose — because the technical tendency interacts with the resistance of matter. This resistance and this interaction are the same in the case of the vital tendency and of the technical tendency, because the laws of physics and chemistry do not change. In this sense, we can speak of a technical determinism that is analogous to the determinism of matter (Leroi-Gourhan, 1943, 14).

The determinism of the laws of matter is not sufficient to account for the differences that remain between technical objects of the same type. The design of a technical object and even its evolution over time also depends on social and aesthetic factors.

Leroi-Gourhan recognises the importance of these factors in part three of the second volume of *Gesture and speech* [GS]. Indeed, the typical forms of technical objects are not completely universal, because "the particularizing function of aesthetics" intervenes (Leroi-Gourhan, A. 1993 [1964], p. 271). This aesthetic function explains "the distinctions between ethnic groups" in the way technical objects are made.

However, even if, compared to ET, in GS the recognition of the importance of social, symbolic, and aesthetic factors is much clearer, Leroi-Gourhan's position remains oscillating. Aesthetic behaviour makes it possible to distinguish different ethnic groups within the same biological human species. The diversity of ethnic groups explains the difference between technical objects of the same type (Leroi-Gourhan has in mind above all particular objects such as houses or clothes). Nevertheless, since "the fact remains that thought is reflected in organized matter" (Leroi-Gourhan, A. 1993 [1964], p. 147), "technoeconomic determinism is a reality whose effect upon the life of societies is deep enough to bring into existence structural laws" (Leroi-Gourhan, A. 1993 [1964], p. 147). Even the aesthetic difference between technical objects is, after all, relative, because "the principles of functional aesthetics are derived from the laws governing matter" (Leroi-Gourhan, A. 1993 [1964], p. 304).

2 Technical Objects also Exist

A few years after the publication of ET, Canguilhem, in a fundamental essay entitled "Machine and Organism", baptized the new direction of theoretical reflection on technology inaugurated by Leroi-Gourhan with the expression "biological philosophy of technique" (Canguilhem[, 1965] 2008, 94). Leroi-Gourhan in Canguilhem's opinion represents "the most striking example of a systematic and duly detailed attempt to bring biology and technology together" (Canguilhem[, 1965] 2008, 94).

About 10 years later, Simondon published *Du mode d'existence des objets techniques* [MEOT], thanking "Professor Canguilhem" in the preface and pursuing the project of a BPT started by Leroi-Gourhan. In Simondon, the analogy between the living being and the technical object is further developed and, in a sense, radicalised. The fact that the title refers to the mode of "existence" of technical objects is significant. In those years, the debate around the notion of existence was very heated. Sartre gave his famous lecture *Existentialism is a Humanism* just 13 years before the publication of MEOT. Reading that text, one understands that Simondon's choice to use the term "existence" in reference to technical objects definitely goes against the trend of that time. In a crucial passage of Sartre's lecture, the uniqueness of man was illustrated precisely by contrasting the mode of being of a technical object — a paper knife — and the mode of being of a human being. The paper knife, like every technical object, is the realisation of a given essence. "The essence of the paper knife […] precedes its existence" (Sartre, 2007 [1947], 21). Man, on the contrary, "is a being whose existence comes before its essence" (Sartre, 2007 [1947], 22). In this sense, from Sartre's point of view, the technical object, properly speaking, does not "exist". The technical object is certainly real, but only man exists (Heidegger, 1996 [1927], 39 and ff.).

Simondon challenges this way of thinking. At the basis of this conceptual shift lies the fundamental distinction between abstract technical object and concrete technical object. From Simondon's point of view, the paper knife is a technical object to which the category of existence cannot be applied because it is an abstract technical object. But not all technical objects are so abstract; a locomotive, for example, is much more concrete, and for this reason, its mode of existence is more similar to that of living beings (Simondon, 2017 [1958], 49).

Concretization makes the evolved technical object similar to the living being in several ways.

a) Firstly, the concrete technical object is characterised by a high degree of integration of the components of which it is made up. Whereas an abstract technical object is made up of parts that retain their meaning even outside of the totality of which they are a part; on the contrary, the parts of a concrete technical object are so well adapted to each other that they would lose their meaning outside of the totality. Thus, for example, a part of an evolved engine only makes sense in relation to *that* particular engine and could not function in any other engine, whereas the handle of a hammer, which is a more abstract technical object, can be separated and still retain its autonomy: it can be used as the handle of an axe. This mutual causality of the parts is one of the characteristics that distinguishes the living being from the inanimate entity: the tooth of a lion only makes sense in relation to *that* particular predator; we could not imagine transplanting the tooth of a lion into the mouth of a zebra. The most important difference between an organism and an inanimate being is this mutual causality of the parts: an organ has a causal dependence on the organism, which a simple part of an abstract object does not have. But for Simondon, the link between the technical elements and the technical individual is a quasi-organic link: the elements are quasi-organs.

b) Secondly, Simondon shows that advanced technical objects present a "convergence of functions into a structural unit" (Simondon, 2017 [1958], 28). In this sense, the "cooling fins" of an advanced engine are both cooling instruments and structural elements that prevent deformation of the cylinder head. Therefore, they have a dual function: they ensure the engine's mechanical strength and guarantee adequate heat exchange with the outside world. Biology never ceases to show us examples of this functional convergence in living beings, but if we wanted to make a similar comparison to Simondon's example, we could think of the polyvalence of skin in mammals. The skin serves covers organs and tissue and serves also as a perceptive instrument, as a thermal regulation system, etc.

c) Thirdly, the evolved technical object presents a high degree of interconnection with its environment. We could say that, by becoming concrete, a technical object not only acquires greater internal coherence, but also greater coherence with the outside world. In this sense, for Simondon, a complex machine that can only function inside a factory is more abstract than a machine that can function in a natural environment or even in different natural environments (Simondon, 2017 [1958], 50).

To indicate this integration between the evolved technical object and the natural environment, Simondon coined the expression "associated milieu". The associated milieu is a mixed environment that is both artificial and natural: a railway, for example, which is the associated milieu in which the locomotive moves, is made up of the superimposition of a technological structure (the rails, etc.) on a natural structure (the landscape). This

interconnection between the technical individual and the associated milieu acquires its full meaning if we bear in mind that contemporary biology has gradually discovered the vital link that unites the living being to its environment (Canguilhem, 2008 [1965], 111). The living being is not only bound to its natural environment (the lion has adapted to the savannah, not to the mountains); more radically, the living being is an active part of its environment (Uexküll, 2010 [1934]; Odling-Smee, F., Laland, K., & Feldman, M. 2003). The existence of the living being is therefore only possible as a being in a given environment. So it is clear that the fact that an evolved technical objects present a high degree of interconnection with its associated environment presents a strong argument in favour of the analogy between the technological and the biological point of view. In a certain sense, one could say that there is a rule of proportionality: the relation between the living being and its environment is equal to the relation between the technical individual and its associated milieu.

3 Intentionality of Machines?

Stiegler made a decisive contribution to the rediscovery of Simondon that has started in the 1990s (Stiegler, 1998, 2002, 2009, 2010, 2016). His interpretation of MEOT proposed in the first volume of *Technique and Time* [TT] is also significant because it gives us a glimpse of a decisive question, which remains problematic. Stiegler sees Simondon's work as a step forward from the thought of Leroi-Gourhan. In ET the origin of the evolutionary process is still considered to be a human tendency, and the development of technique depends not only on the material conditions imposed by the external environment, but also on the cultural, psychological, and symbolic conditions (what Leroi-Gourhan calls the "inner environment"). In this sense, it can be said that in Leroi-Gourhan technical evolution, despite repeated claims of technical determinism, remains an anthropologically determined phenomenon. Simondon's perspective is very different, according to Stiegler:

> The tendency no longer has an anthropological source. Technical evolution stems completely from its own technical object. The human is no longer the intentional actor in this dynamic. It is its operator (Stiegler, 1998, 66).

According to Stiegler, Simondon's contribution to the BPT is linked to "the renunciation of the anthropological hypothesis". The essential problem that appears in these pages is that of the intentionality of the technical evolutionary process. In Stiegler's interpretation of Simondon, this intentionality is to be attributed to the machine rather than to man:

> In the industrial age, the human is not the intentional origin of separate technical individuals qua machines. It rather executes a quasi-intentionality of which the technical object is itself the carrier (Stiegler, 1998, 67).

But can a machine be considered an intentional being? One must note Stiegler's caution in the passage I have just quoted. The technical object is not endowed with a "real" intentionality, but with a "quasi-intentionality", which man is supposed to execute. The same prudence

inspires an important subsequent passage in which the question is formulated in even more radical terms:

> There is a historicity to the technical object that makes its descriptions as a mere hump of inert matter impossible. This inorganic matter organizes itself. In organizing itself, it becomes indivisible and conquers a quasi-ipseity from which its dynamic proceeds absolutely: the history of this becoming-organic is not that of the humans who "made" the object. (Stiegler, 1998, 85)

If the technical object exists — as Simondon shows — it means that it has its own "historicity". Inert matter does not really have a history, because it has no existence. Matter is only a present-at-hand reality — to put it in Heideggerian language — but historicity defines the mode of being of an ipseity, that is, of an individual conceived as a self. Should we think that technical individuals have their own ipseity? In this respect, there is a conceptual difficulty in Stiegler's reading of Simondon. On the one hand, in TT we read a radical formulation ("inorganic matter organizes itself") in which matter seems to become an agent subject; on the other hand, it should be noted that a few lines later Stiegler speaks of a "quasi-ipseity", which is evidently distinguished from the true ipseity, and which corresponds to the quasi-intentionality of which he spoke earlier.

This question is important because it concerns the theoretical foundations of the BPT. This approach draws its strength from the recognition of the undeniable analogies that exist between the organisation of the living beings and machines and from the undeniable analogies that exist between the history of technology and the evolution of life. The fundamental problem that arises is the following: how are these analogies to be interpreted? The living being is certainly an active subject, an individual with its own intentionality. Should we claim that the technical individual also has its own ipseity and intentionality?

Looking closer at MEOT, one can see that the question of the mode of existence of technical objects remains unresolved or at least open. The reading that Stiegler proposes in TT seems to be too one-sided in this respect. It is true that MEOT very explicitly criticises the reduction of technical objects to an anthropic point of view[1]; it is also true that the technical individual is presented in several passages as an entity that must be treated with the respect that is due to the otherness of another self. But at the same time, Simondon continually repeats that the technical object remains substantially different from the natural object. Summarising the arguments in support of this thesis, we need to point out that:

a) Technical objects *tend* towards concretization, but they are never fully concrete, while natural entities are concrete from the beginning[2] (Simondon, 2017 [1958], 51).

b) The ensemble of open machines, which are the most evolved machines, "presuppose man as their permanent organizer" (Simondon, 2017 [1958], 17).

[1] Guchet (2010) highlights this critique of the reduction of the technical object to the anthropic point of view very clearly. At the same time, he shows that for Simondon, it is not simply a question of destroying all humanism, but rather of elaborating another humanism in which there is an essential space for technology.

[2] "Simondon is careful not to take this point too far. He never asserts that the mode of existence of technologies is entirely commensurate with that of living things" (Chabot 2003).

c) Living beings have a reproductive capacity; "a technical being, on the contrary, does not have this capacity" (Simondon, 2017 [1958], 71).

d) There is a substantial difference between the memory of machines and the memory of living beings (Simondon, 2017 [1958], 137).

e) A machine is capable of recording, but not of perceiving information and meaning (Simondon, 2017 [1958], 150).

f) The idea of the robot, i.e. the machine with its own intentionality, is a myth created by the fear produced by a lack of genuine technological understanding (Simondon, 2017 [1958], 16).

All these arguments — which I can only present here in a quick summary — lead to the exclusion of the idea of an intentionality of machines. But if it is true that the living being is defined by having a tendency — in different degrees, from the most basic tendency of a primitive living being to the complex intentionality that defines man — what about the analogy between the technical object and the natural object? What is the point of comparing the technical object with the living organism if the first property that seems to characterise the living being from an ontological point of view, namely tendency/intentionality, cannot be attributed to the technical object?

Here, we come across the first difficulty that is not entirely resolved in the thought of Leroi-Gourhan, Simondon, and Stiegler. Two observations can be proposed regarding this problematic point:

1) In Simondon's perspective, it is not so much a question of claiming that the technical object has an autonomous life, but rather of demonstrating that human life is essentially a technical life. The distance between these two theses is subtle, but fundamental. Man is structurally associated with the technical object, and the technical object is structurally associated with man. To recognise that this relationship is constitutive means to sweep away the "facile humanism" that despises or disregards the technical object, which is Simondon's constant polemical target. However, there is an aspect of this relation that the expression "technical life" risks to conceal and that is not really clarified in MEOT: the fact that the relation is asymmetrical. Man is not structurally bound to any particular technology or to any historically or geographically determined "technical ensemble". Man is not bound to his technical environment, just as he is not bound to his biological environment.[3] On the contrary, the machine, which is constitutively associated with man, cannot be associated with any other type of living organism. All the evolved and concrete technical individuals that we know are *human* objects, and they would make no sense in relation any other living form. An element of asymmetry therefore resides in the inseparable human-technical relationship.

2) It is essential to understand whether the analogy between technical and natural objects is to be interpreted in an ontological or epistemological sense. Some of the formulations of Leroi-Gourhan, Simondon, and Stiegler seem to suggest an ontological perspective.[4] The conceptual difficulties that I have highlighted depend on the

[3] Here, I am reformulating a classic argument of phenomenological anthropology (see Heidegger 1995; Scheler 2009 [1928]).

[4] It seems to me that Guchet also recognises some ambiguity in some of Simondon's expressions: "Il est vrai que certaines analyses peuvent prêter à confusion et indiquer une forme d'anthropomorphisme de la technique chez Simondon" (Guchet 2008, 143).

assumption of this ontological perspective; they all lead back to the in some ways disarming observation that there are undeniable similarities between a living organism and machines, but that there are also, equally undeniable, differences. A purely epistemological approach seems to be the only way able to avoid this aporia.[5] But it must be understood that by effectively, ontologically, attributing life to a technical object, we unduly transform a regulative principle into a metaphysical principle.

4 The ICT Problem

The second problem depends on the change in the historical and technological context. The current technology is very different from the one that Leroi-Gourhan or Simondon described. The digital revolution represents a change in the history of technology comparable to the transition from craft to industrial technology. Leroi-Gourhan and Simondon observed with curiosity the first steps of information technology, but they could not observe the radical novelty of the digital world. When Simondon and Leroi-Gourhan passed away, in 1986 and 1989, the Web did not exist yet. Thus, the question that needs to be asked is: is the biological approach to technology able to describe ICT?

To answer this question by referring to Leroi-Gourhan, we first need to make a distinction between the two positions presented in ET and GS. In the classification of techniques proposed in ET, there seems to be no place for technologies dedicated to the transmission, processing, and recording of information. The introduction of the book clearly explains the "logical" criterion that regulates the breakdown of human activity into different sectors: the subdivision is built "posant en principe que c'est la matière qui conditionne toute technique" (Leroi-Gourhan, 1943, 18). This leads to the distinction between the means of action on matter, the means of transport, the techniques of manufacture, the techniques of acquisition, and the techniques of consumption. Within this theoretical framework, since the interaction between body and matter is central, there seems to be no place for the technologies of writing, calculation, memory, and communication. We must not forget that the parallelism between technical and biological evolution was first of all justified by Leroi-Gourhan on the basis of the determinism of matter. But the question that arises in the age of digital technologies is the following: can the development of ICTs be explained in terms of physical and chemical determinism, as we do for the development of material technical objects?

Compared to ET, things change considerably in GS. Here, the questions of language and memory become central. One of the many merits of GS is to have recognised and argued the close link between technique and language. Leroi-Gourhan repeats several times that these two phenomena are the "expression of the same intrinsically human property" (Leroi-Gourhan, 1993 [1964], 113). This link is reinforced by the fact that "tool and language are neurologically linked" (Leroi-Gourhan, 1993 [1964], 114) and by the observation of "the close synchronism between the evolution of techniques and that of language". These observations offer a theoretical

[5] It seems to me that Guchet (2008) goes in this direction by insisting on the epistemological value of the analogy between organism and technical object, stressing several times that this analogy does not lead to a "naturalisation des techniques".

basis for the grammatological conception of technique that I will discuss in a moment. At the same time, the notion of "program", which Leroi-Gourhan uses systematically in GS, undoubtedly represents the point of contact between the BPT and the Derridean notion of writing. However, Leroi-Gourhan's perspective remains partially limited because he considers language and memory in their essence, as instruments to be used for recording an operating sequence[6]:

> Techniques involve both gestures and tools, sequentially organized by means of a "syntax" that imparts both fixity and flexibility to the series of operations involved. This operating syntax is suggested by the memory and comes into being as a product of the brain and the physical environment. (Leroi-Gourhan, 1993 [1964], 114)

In this perspective, a certain category of technical objects, the category of tools, seems to remain central. Language and memory are thought as conditions for the possibility of using the tool: in other words, "language intervenes as the medium for the actions to be performed" (Leroi-Gourhan, 1993 [1964], 234). It is clear, however, that this close link with the bodily gesture and the tool no longer has any explanatory capacity when we consider the most significant technological innovations of our time. To put it somewhat bluntly, Google has no essential link with a bodily gesture or the use of a tool.

The problem also arises if we analyse Simondon's thoughts. Surprisingly, in MEOT, we do not find a taxonomy that explicitly distinguishes the basic categories of technical objects. In one important passage, Simondon makes a distinction between tool, i.e. "the technical object enabling one to prolong and arm the body in order to accomplish a gesture" (Simondon, 2017 [1958], 130), and instrument, i.e. "the technical object that enables one to prolong and adapt the body in order to achieve better perception" (Simondon, 2017 [1958], 130); but this distinction is not fully developed.[7] On the contrary, the important distinction between "element", "individual", and "ensemble" is developed in a more systematic way, but this distinction does not imply the identification of different categories of technical objects.

This lack of a taxonomy distinguishing the general types of technical objects is significant because it seems to conceal a fundamental limitation of the theory proposed in MEOT: the essential law describing the evolution of the technical individual, the law of concretization, can only be applied in relation to one class of technical objects, the class of machines. In the case of tools — which remain "abstract" — the law of concretization applies only in a relative way. But what about ICT? Do the technologies of writing, representation, and calculation have an analogous

[6] The importance of the notion of the operational chain in the theoretical framework of *GS* is underlined by Audouze (2002, 286).

[7] The distinction between tool and instrument is developed by Simondon later, in a 1968 course entitled *L'invention et le développent des techniques* (Simondon 2005, 88). Compared to MEOT, this course more explicitly elaborates a taxonomy that implies a clear distinction between tool and machine. Simondon explains that it is necessary to distinguish a "troisième type de dispositif qui n'est ni utile ni instrument, mais ustensile ou appareil" (Simondon 2005, 94). The characteristic of these technical objects is their autonomy with respect to the energy provided by the human body: these objects "sont alimentés en énergie indépendante de celle que peut fournir le corps humaine" (Simondon 2005, 94). The ideal machine results from the integration of the tool, the instrument, and the apparatus (appareil). It seems clear, reading that course, that the machine is the technical object that can properly be considered as an organism ("comme un organisme") (Simondon 2005, 95).

structure to that of living beings? Isn't there a third species of technical "objects" that cannot be understood according to the dynamics of evolution and concretization described earlier?

In Simondon's thought, we can certainly find some categories that remain fundamental even in the age of digital technologies.[8] In particular, the notion of "associated milieu" is a powerful theoretical tool that can be used to describe the internet.[9] What is the Internet if not the most extensive associated milieu that humanity has ever produced? We can think of devices connected to the Internet (smartphones, PCs, etc.) as technical "individuals", using this term in the way Simondon has interpreted it. Indeed, these technical objects, insofar as they are machines, possess the fundamental characteristics of concrete technical objects: (a) they are made up of parts that have a quasi-organic degree of mutual causality; (b) they present more and more phenomena of structural convergence; (c) they are integrated into an associated milieu in which they gradually acquire greater and greater autonomy. This description, however, only captures one side of the reality of ICTs. I would like to say that with the theoretical tools of the biology of technology one can describe the hardware, but not the software of current ICTs. However, nowadays technological evolution is as much a software problem as it is a hardware problem. What does Microsoft produce? What kind of tool is a search engine like Google? What kind of invention are social networks? These questions identify a structural limitation of the BPT: since this approach is based on the analogy between the living organism and the technical object, it is closely linked to the similarity between body and machine.[10] However, a computer program is not simply a machine-body, even though it needs a machine-body to function. Therefore, the evolution of ICT is not reducible to the principles of biological evolutionism and does not obey to the laws of concretization that define the existence of machines.

[8] De Angelis and Romele (2015) show how Simondon's categories can be used to think about phenomena such as online social networks: it seems significant to me, however, that the theoretical reference here is not the theory of concretisation proposed in MEOT, but rather the theory of the transindividual and that the analogy is no longer between the body and the machine but that between the social network and the linguistic network.

[9] To think of the Internet from Simondon's perspective, one would probably have to put together the considerations on the associated milieu developed in MEOT and the considerations on technical networks developed in the course *L'invention et le développent des techniques* (Simondon 2005, 99) and in the texts collected in *Sur la technique* (Simondon 2014, 84 and ff.; 307 and ff.; 417 and ff.; 437 and ff.).

[10] The texts collected in *Communication et information* [CI] (Simondon 2010) certainly represent a broadening of the theoretical perspective with respect to MEOT. However, the critique that I propose in this essay can also be applied to CI. Simondon displays, as usual, an extraordinary encyclopaedic spirit, using findings from ethology and biology. This approach allows him to compare the visual and sound signals produced by animals (e.g. the sounds produced by bees, or dolphins, or birds) to the signals produced by communication tools (e.g. the telegraph, radio, or television). But, even in this case, it is worth noting that the analogy, while meaningful and useful, is only partially valid. The comparison with the animal world is useful as long as it is a question of understanding the tools whose function is to enhance perception, but it is no longer adequate when it comes to understanding information technologies. These technologies are forms of writing and not simply prostheses of our perceptual systems, precisely because they involve complex processes of coding, elaborating, and storing data. In order to understand these processes of writing, the comparison with the animal and plant world is not very helpful.

5 What Is a Program?

If it is not a machine and not a tool, then what is a program? This is where Derrida's thought can be useful: a program is essentially a form of writing.

The first paragraph of the first chapter of *Of Grammatology* [OG] is entitled, not by chance: "The Program". The grammatology that Derrida imagines is a new science of writing, even if both the word "science" and the word "writing" acquire a new meaning in his perspective. Writing is no longer conceived as an instrument for transcribing language. Derrida distinguishes the common or "vulgar" concept of writing from what he calls "arche-writing" (Derrida, 1997 [1967], 56). While the common concept of writing is based on the privilege of linearity and voice, the arche-writing goes beyond these categories. In the common conception, writing is conceived as a tool whose purpose is to translate a system of meanings that is essentially verbal into a perceptible form. For Derrida, on the contrary, verbal language is only one of the historical modes of arche-writing: "oral language already belongs to this writing" (Derrida, 1997 [1967], 55). Cinema, painting, and sculpture, but even dance and gesture, are also presented in OG as forms of writing (Derrida, 1997 [1967], 9). Furthermore, a software, which can only be "executed" by a machine and not by a human, is also writing: "And, finally, whether it has essential limits or not, the entire field covered by the cybernetic program will be the field of writing (Derrida, 1997 [1967], 9)".

It is easy to see that in this broad sense, the notion of arche-writing goes beyond the boundaries of the traditional concept of language, conceived as something man can understand. But it also goes beyond the boundaries of the traditional notion of technique, understood as the ability to produce artificial objects. However, the link between the notion of technique and that of writing remains essential. Arche-writing can be called by many names, always necessarily metaphorical: signifier, trace, supplement, etc. Among the many names, the name "technique" is for Derrida one of the least inadequate, even if in OG he stated that it is necessary to avoid a reductive interpretation of the idea of writing as technique:

> Technics in the service of language: I am not invoking a general essence of technics which would be already familiar to us and would help us in understanding the narrow and historically determined concept of writing as an example. I believe on the contrary that a certain sort of question about the meaning and origin of writing precedes, or at least merges with, a certain type of question about the meaning and origin of technics. That is why the notion of technique can never simply clarify the notion of writing. (Derrida, 1997 [1967], 8)

Arche-writing is not simply a technique at the service of language because (a) the common notion of technique is based on an idea of instrument that Derrida does not accept; (b) the idea of a technique "in the service of language" presupposes a hierarchy in which verbal language has primacy; (c) the ordinary notion of technique implies a separation between inside and outside that grammatology deconstructs. However, these reservations do not prevent Derrida from noting the original

kinship between the fundamental problem of grammatology, namely the problem of arche-writing, and the problem of technique. In *Memories for Paul de Man*, Derrida expresses this connection in the most general way: "deconstruction is inseparable from a general questioning of *tekhné* […] deconstruction is nothing without this interrogation" (Derrida, 1989, 16).

What are the advantages, from a theoretical point of view, of taking a grammatological perspective on technique?[11]

a) First of all, the notion of writing technology identifies a category that has great historical depth and that is able to unify very heterogeneous forms of technical objects. A papyrus, a mosaic, a book, a website, and a computer program — just to give some examples — are not reducible to the dynamics described by the biology of technology, but they are products of a writing technology. All forms of writing and inscription are technical objects like tools and machines. It should also be noted that the notion of writing technology is more general and more precise than the notion — which I myself used earlier for convenience — of ICT. The term "information technology" usually refers only to computer-based technologies: in this way, one loses the historical link between digital writing and older writing technologies such as printing or oral language. Furthermore, the notion of writing technologies includes non-verbal inscriptions — such as cinema or photography — which would be difficult to classify as information technologies. But besides being more general, the notion of writing technologies is more precise than the notion of ICT. The notion of writing preserves a necessary reference to materiality, whereas the notion of information runs the risk of being more idealistic. Writing is not simply the organisation of matter but retains a necessary link with the material spatiality that is necessary for there to be inscription.

This clarification is important. Derrida in OG reads the history of Western metaphysics as an attempt to remove writing. The removal of writing is achieved first and foremost by denying any constitutive value to the materiality of the signifier. In this sense, the digital revolution can be interpreted as the fulfilment of the dream of Western metaphysics, that is, as the affirmation on a planetary scale of an absolutely universal and ideal language. In reality, the digital world retains an essential link with materiality for at least two reasons: firstly, because the digital archives where information is stored continue to be physical places; secondly, because, alongside the spatial materiality of the signifier, there is a non-material "materiality" of the signified. This materiality of the signified is that resistance to idealisation which emerges, for example, when we are confronted with an untranslatable expression. This is why Derrida describes digital technologies as writings characterised by "a

[11] Among the authors who have recently attempted to think about digital technologies and the Internet from a grammatological perspective, we should mention at least Ferraris (2018; 2021) and Stiegler (2013). In § 3 of the article, I criticise Stiegler, but certainly there is a continuity between Derrida's reflection on writing and Stiegler's reflection on technique. In my opinion, Stiegler has the merit of having developed some aspects of Derridian thought by giving it a more systematic and accessible form. In particular, it seems to me that the notion of tertiary retention (Stiegler, B. 1998, 2002, 2009) is in many ways a reformulation of the Derridean problem of writing.

quasi-immateriality" (Derrida, 2001b, 16), which is different from the complete dematerialisation of the signifier.[12]

b) A second advantage is the possibility to account for the complexity of technical digital objects. Many of the most significant technical changes of nowadays take place at a level that is often considered immaterial (as shown by the increasingly common expression "dematerialization"). Economists consider software as "intangible assets". What does the term "intangible" mean? Can an intangible object be compared to a living body? Of course, this does not mean that software does not need hardware, that the web does not need material infrastructures, or that the computational speed of microprocessors does not depend on a material structure. It does mean, however, that in the digital age, there are technological changes, which occur, not in the electronic machine, but in new ways of writing in and through the machine. This is not a question of returning to an idealistic conception[13]: it is a question of recognising a difference. A smartphone is certainly an electronic machine that evolves according to rules similar to those of the corporeal machine, but it is not only that. It is also the support of an increasingly complex system of writings: for instance, it is the support of an Android operating system, which can interact with Google's search engine or with the Facebook platform. But Android, Google, and Facebook are not technical individuals in Simondon's sense; they are texts in Derrida's sense.

c) Thirdly, the advantage of a grammatological perspective is in deepening of the analogy that underlies the BPT. I speak of "deepening" because there is no incompatibility between the two approaches that I am describing. On the contrary, they are two complementary, albeit distinct, approaches. If in Leroi-Gourhan and Simondon the technical object is thought of on the basis of the analogy with the living organism, in Derrida it is the "psychic" that is considered as an arche-technique more original than any technique of material production. This is clear in *Freud and the scene of Writing*, where Derrida analyses the different images that Freud uses to describe the psyche. These are always metaphors in which the psychic is compared

[12] On the complex relationship between technique and materiality in Derrida, see Lindberg (2016, 383 and ff.) and Derrida (2001b, 114 and 137).

[13] Floridi's position, which outlines the progressive absorption of reality into the "infosphere", seems to me to risk falling into this idealism of information: which, on the other hand, Derrida's notion of writing manages to avoid. From a grammatological point of view, one can never claim that "objects and processes are dephysicalized, in the sense that they tend to be seen as support-independent" (Floridi 2014, 50). For Derrida, it would not be correct to say that since "information can so easily be decoupled from its support" then "the actual format, medium, and language in which data, and hence information, are encoded is often irrelevant and disregardable" (Floridi, 2010, 25). On the contrary, Derrida would probably say that the support is always relevant, because it is an unavoidable condition for all communication and also because it produces effects of meaning (and thus modifies the information). Also the "informational metaphysics" that is proposed in some passages (Floridi, 2010, 70) of *Information. A very short introduction* seems to me to risk being idealistic. In some ways, Floridi's position seems the inverted image of the biology of technique. The BPT persuasively explains the analogy between body and machine, but it is weak when it comes to explaining information technologies; on the contrary, Floridi's philosophy of information convincingly explains information technologies, but it risks being one-sided in affirming the priority of information over the physical medium that carries it.

to a writing technology: hieroglyphic writing, the telescope, and the mystic writing pad. These comparisons are by no means accidental for Derrida:

> We shall let our reading be guided by this metaphoric investment. It will eventually invade the entirety of the psyche. Psychical content will be represented by a text whose essence is irreducibly graphic. The structure of the psychical apparatus will be represented by a writing machine. What questions will these representations impose upon us? […] Finally, what must be the relationship between psyche, writing, and spacing for such a metaphoric transition to be possible, not only, nor primarily, within theoretical discourse, but within the history of psyche, text, and technology? (Derrida, 2001 [1967], 250)

For Derrida, the comparison between the psychic and the writing machine is necessary because there is a structural analogy between the two. This means that technique, before being a way to producing objects, is the way we think. This is why in *Memories for Paul de Man*, Derrida explicitly distances himself from the Heideggerian opposition between technique and thought: "the essence of technology and the thinking of this essence retain something technological" (Derrida, 1989, 139). Thought always retain something technological, because the "psychic" has a textual structure.

Already in his essay *The Pit and the Pyramid*, Derrida raises the question of the similarity between the human psychic apparatus and the computer. The theme is taken up many years later in *Papier Machine* and in *Archive Fever*. Reading these three texts together, one can conclude that the human mind has a technical dimension at least from three points of view: firstly, because it has a capacity to calculate and calculation is the opposite of meaning (Derrida, 1982 [1968]); secondly, because it is an internal archive that keeps a trace of events (Derrida, 1996 [1995]); and thirdly, because thought is always textual and textual production is regulated by a code and a grammar (Derrida, 2001b). These three dimensions of the human mind — computation, memory, code, and grammar — share a characteristic trait: they are linked to repetition. For Derrida, a machine is essentially this: a system that predetermines repetition. A machine can certainly be similar to a living body, and in this case, it will be a device that predetermines the repetition of a gesture or a physical operation. But a machine can also be "immaterial" and "psychic": in this case, it will be a system that predetermines a "mental" operation. In other words, it will be a textual machine or a program that predetermines an operation of writing.

A text, if it is truly a text, is never simply reducible to the technical principle of the machine. Insofar as it has meaning, a text is always also an event. But there is no meaning without an archive, without a grammar, and without a code. There is no event without a system of possible repetitions. "In the future (but there will only be a future on this condition), it would be necessary to consider the event and the machine as two compatible, even indissociable concepts" (Derrida, 2001b, 34, author's trans.). This indissoluble link between repetition and event legitimises the analogy between the mind and the textual machine. In fact, taking up a passage in which De Man compares the machine and the text, Derrida points out:

> It is not said that the machine is a grammar of the text. Nor that the grammar of the text is a machine. The one is like the other, as soon as grammar is

> isolated from rhetoric (performative rhetoric or cognitive rhetoric, rhetoric of tropes), according to another distinction. The machine is determined from the grammar and vice versa. (Derrida, 2001, 136, author's trans.)

Metaphorical analogy undeniably has a foundation, but it is not an ontological identity.

In this way, the analogy underlying the BPT, while remaining problematic, is completed: Leroi-Gourhan showed that the organ resembles the tool; Simondon showed that the machine resembles the living body; Derrida showed that the psyche resembles a writing program.

6 Concluding Remarks

The link between biology and technology is justified in Leroi-Gourhan because the deterministic laws of matter govern both technical and biological evolution. Therefore, this link must be less relevant in all those areas (information, meaning, culture) where the determinism of physical and chemical laws is less important.

In Simondon, the analogy between the technical object and the biological individual is based on the recognition of three fundamental characteristics: organicity, functional convergence, and interconnection with the environment. Nevertheless, in MEOT, it is clear that living organisms have an intentionality of their own, whereas technical objects do not. This difference is important because some readings (e.g. Stiegler's) tend to oversimplify the difference that remains between biology and technology. At the same time, the question of the intentionality of technical objects brings out a first limitation of the BPT: if the living being is defined first and foremost as an organism that has a tendency or an intention, the comparison between technical object and organism lacks the fundamental element, the element that ontologically defines the living being as such, namely intentionality.

The second limitation is linked to the lack, in Leroi-Gourhan and Simondon, of a clear distinction between three different types of technical objects: tools, machines, and writings. The tool is linked to the bodily gesture. The machine is a quasi-organism that resembles the organic body insofar as it is capable of repeating an operation. In contrast, writing techniques — which include ICTs[14] — cannot be thought

[14] Although Derrida does not feature much in the essays included in Romele and Terrone (2018), the idea that digital media are first and foremost "Recording Devices" is close to the idea of writing technology that I use in this article. In particular, it seems to me that the contribution of Bachimont outlines a theoretical perspective that has many points of contact with the Derridean one. Bachimont rightly points out that the planetary diffusion of the Internet implies a change in the relationship between recording and communication: "whereas, until then, we used to communicate without recording, and the issue of recording was eventually raised after the communication, the IP imposed recording in the form of packets first, in order to communicate these same packets in a second stage" (Bachimont 2018, 19). In Derridean terms, one could say that this change in the relationship between recording and communication is a change in writing. But the change in the forms of writing also implies a change in the content of meaning that the writing has to convey: "If we now register to communicate, this implies that communication is conditioned by the technical choices of the recording" (Bachimont 2018, 20). Bachimont's position seems to me particularly interesting because it explains the non-neutrality of the medium.

of in analogy with bodily operations but in analogy with mental operations. The Derridean notion of writing implies a radicalisation of this analogy. In a grammatological philosophy of technique, the human mind appears as a writing machine that is able to perform some essentially technical operations such as calculating, storing information, encoding, or decoding data, executing a programme.

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Declarations

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