



Biobanks as Exteriorized Memories of Life

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Abstract

The aim of this article is to consider biobanks through the conceptual tools of French Thought and twentieth-century French philosophy of technology. Firstly, two pairs of authors and their respective conceptions of the relationship between technics and memory are considered: on the one hand, Jacques Derrida and Bernard Stiegler, who thought of memory and technics on the model of writing; on the other hand, Henri Bergson and André Leroi-Gourhan, who thought of memory as linked to biological life, and of technics as an exteriorization of life. On the basis of this discussion, a philosophical analysis of biobanks is then provided, understanding them as *exteriorized memories of life*, and some conceptual problems raised by biobanks are addressed: the question of exteriorization and its relation with the organic and the inorganic matter; the relation between the living and the environment; the mode of existence of biological data; and the distinction between natural and artificial memory.

Keywords Biobanks · Memory · Exteriorization · Life · Bio-objects · Biological philosophy of technology

1 Introduction

It is undeniable that *the empirical turn* in philosophy of technology (Kroes Meijers, 2000; Achterius, 2001) has contributed to renewing its panorama, bringing to the fore previously neglected objects and approaches, bringing the attention of philosophers of technology back to things, and reminding us that technology is not a unitary and autonomous phenomenon, but a multifaceted set of objects, very different from each other, that populate social reality. However, empirical philosophy

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of technology also encounters some limits, which coincide to some extent with its virtues: by increasingly adhering to objects and incorporating itself into design practices (Kroes & Meijers, 2006), it runs the risk of assuming an ancillary position with respect to other disciplines (in particular engineering), of abdicating its vocation to create concepts (Deleuze and Guattari, 1996), and thus becoming a mere moral advisor of engineers, so losing its critical function (which by definition fits into a broader historical and social perspective than the one opened up by attention to the empirical datum). Rather than opposing the empirical philosophy of technology to more speculative approaches, we should instead be concerned with how to hold together the two demands they convey: can philosophy of technology deal with empirical objects without abandoning the speculative dimension? On the one hand, in fact, ethical questions do not exhaust the spectrum of conceptual issues raised by contemporary technologies, and on the other hand, philosophy has, historically, a vocation for speculation that is nourished by the confrontation with empiric experiences, so that the relationship between praxis and philosophy is not only in terms of the contribution that the latter can give to the former, but also in terms of the capacity of reality to urge on speculation and renew philosophical questions. In this sense, already in 1896, for example, with regard to the question of the relationship between brain and memory, Henri Bergson welcomed the fact that psychology adopted an empirical approach to the problem, so that “a cardinal metaphysical problem is carried into the open field of observation, where it may be solved progressively, instead of forever giving rise to fresh disputes of the schools within the closed lists of pure dialectic” (Bergson, 1990, 16). Against the possible reductionism of the empirical philosophy of technology, *French Thought* has thus long since shown that it can offer, directly or indirectly (Loeve, Guchet & Bensaude-Vincent, 2018), important tools to nurture a virtuous relationship between empirical and speculative approaches.

Precisely on the theme of memory, twentieth-century French philosophy has developed important reflections, also as a result of the numerous technological evolutions that have modified the terms of the problem over time. In one sense, that of memory is a classic theme of philosophy in general, especially French philosophy (Bergson, 1990; Dagognet, 1979; Derrida, 1995, 1998; Ricœur, 2004) and French philosophy of technology (Leroi-Gourhan, 1993; Stiegler, 1994; Stiegler, 2009; Stiegler, 2010). The emergence, in the last century, of digital technologies has revived the question of the relationship between technology and memory, nourished also by the idea of the existence of some operational (or computational) analogies between digital technologies and cognitive processes operated by the brain (Bachimont, 2010). In the wake of Ricœur’s work, a recent and fruitful field of study has also opened up, which can be summarized under the title of *digital hermeneutics* (Romele, 2020), aiming to develop a hermeneutics of digital memories. The theme of memory is therefore recurrent in the *French Thought* and presents itself as a fertile ground for taking up the challenge launched by the empirical philosophy of technology, since on the one hand the question of memory recalls in an almost necessary way other purely speculative themes—in particular that of time and that of life—and on the other, as already seen by Bergson, it offers the opportunity to root reflection in empirical fields of study.

In this article, I will start from the case study of biobanks, a topic still little studied by philosophers of technology, through which it is possible to innovate the way in which philosophy of technology has dealt with the problem of memory. Biobanks are research infrastructures that came into being in the late 1990s and early 2000s, dedicated to the preservation of biological samples (mainly human—but also animal and plant samples), mainly for medical research, but also for the preservation of biodiversity, commercial, and reproductive purposes. They are, quite literally, databases that do not only contain digital data, but also, and above all, biological data. These data are collected from the living bodies of patients or donors, then stored using technologies that control temperatures and keep them cold, in order to preserve certain biological properties over time. They thus carry the biological memory of past organisms, or of earlier stages of still living organisms. Biological samples taken from patients or donors are on the one hand an extremely valuable material for research, a source of disparate information (biological, pathological, molecular, etc.), but at the same time they are a delicate material whose micro-biological characteristics tend to be altered if stored incorrectly. Although some branches of medicine—e.g., virology, immunology, bacteriology—have long practiced the preservation of biological samples, the internationalization of biomedicine in the second half of the last century has led to reflection on the conditions under which they should be handled and stored. It was realized that certain variables, such as the speed at which blood is centrifuged or the temperature at which samples are stored, affect the stability of certain bio-chemical elements on which medical analyses are carried out. This kind of problems has then led to a reflection on the technical conditions for handling and storing biological materials, to the need of technical normalization of samples' conservation, and then to a professionalization of biobanking. Biobanks have thus become important infrastructures in the biomedical system, with their own operating norms and specific professional figures. This process inevitably raises new questions, both conceptual and ethical, relating to the storage of biological samples: a physician storing a little amount of biological samples in his or her refrigerator for a specific research project is not the same thing than an infrastructure storing thousands, or millions, of similar samples, which can be reused for further purposes over the following decades and which thus take on a huge economic value. At the same time, producing vast collections of data on a specific theme (a disease, an organ, a population, etc.) leads to questions about the biological memory of humanity that we are organizing and on the use that we can make of this memory. Moreover, biobank's importance and size have grown enormously in recent years, especially due to the increasing use of big data in biomedicine: to the extent that biobanks store the biological material from which the genetic and genomic data will later be extracted, these are essential infrastructures for contemporary biomedical research.

There are thus several good reasons for treating the theme of memory from a philosophy of technology approach, taking biobanks as a case study and mobilizing the conceptual tools of French philosophy: firstly, there are still few philosophical studies on biobanks, and most of them focus only on ethical and legal aspects, whereas they raise many purely speculative questions concerning the relationship between

technology, time, memory, and life.¹ Secondly, talking about memory in relation to biobanks allows to deal with another theme that is still scarcely present in contemporary studies in philosophy of technology, but which is very important in twentieth-century French philosophy, namely, that of *life*. In fact, although biotechnology, in the widest possible sense (any technology developed or developable by humans in the field of biology), is expanding exponentially, philosophy of technology has not sufficiently addressed this issue, which remains largely relegated to epistemology.

The aim of this article is thus twofold: on the one hand, to obtain a deeper philosophical understanding of biobanks, to understand not only the strategic role of biobanks within contemporary biomedicine, but also how these infrastructures modify our experience of memory and our relationship with notions of living and non-living; on the other hand, to revisit French philosophy of technology in the light of the specific problems raised by biobanks, so that this empirical object may constitute an occasion of renewal for philosophical speculation. In order to do so, the article is divided into two sections: in the first one, I briefly reconstruct the way in which French philosophy of technology has appropriated the theme of memory as technical exteriorization, examining the works of Derrida, Stiegler, Bergson, and Leroi-Gourhan. In the second section, the previous reflections are put at the service of a conceptual analysis of the phenomenon of biobanks.

1.1 Memory, Technics, Writing

Memory has been a philosophical issue of primary importance since Plato, who in the *Phaedrus* traced the coordinates within which the question of memory would move from then on, structuring itself around a series of metaphysical oppositions (interiority vs. exteriority; memory vs. record; natural vs. artificial; authentic vs. artefact; living vs. non-living), in a close confrontation with the problem of the relationship between memory and writing. On the one hand, there is memory in its authentic sense, human memory, which has direct access to the truth, and on the other hand, there is a surrogate of this memory constituted by writing, a technique of exteriorizing memory, which replaces it with a conventional sign, rendering an external image of it that is subject to error and therefore fallible. Writing is, in Plato's tale, the most remarkable invention of the god Theuth, who wishes to make a gift of it to the Egyptian king Thamus, who, however, realizes the dangerousness of this invention for his people due to its ambiguous character, since if writing on the one side helps to remember, on the other side it risks weakening proper memory, which has a more intimate relationship with knowledge and truth:

Trust in writing will make them remember things by relying on marks made by others, from outside themselves, not on their own inner resources, and so

¹ Although the ethical and legal aspects of biobanking are a fundamental issue, the aim of this paper is to focus on the speculative ones. I think moreover that conceptual reflection can open up new paths for ethical reflection, although these cannot be explored within the limits of this paper. Some of these issues are explored in a volume I edited with some colleagues (Clarizio et al. forthcoming).

writing will make the things they have learnt disappear from their minds. Your invention is a potion for jogging the memory, not for remembering. You provide your students with the appearance of intelligence, not real intelligence. Because your students will be widely read, though without any contact with a teacher, they will seem to be men of wide knowledge, when they will usually be ignorant. (Plato, 2002, 275a)

This account has been the model (either claimed or polemically opposed) for most modern theories of memory, which have continued to constantly oppose lived memory to recounted memory, immaterial memory to its material trace, establishing an inevitable, albeit conflicting link, between these two heterogeneous elements: on the one hand, there is no memory without a trace or a scriptural record, and on the other hand, the relationship between writing and memory remains obscure and is the source of countless epistemological and ontological problems. In France, Jacques Derrida too, although he radically deconstructed the Platonic position,² structured his own reflection on memory on the basis of the model of writing, proposing a radical analogy between memory and writing: they are analogous because both are traces (Derrida, 1998), i.e., original forms of inscription. Contrary to what Plato thought, there is no conflict between memory and writing, but a fundamental ontological solidarity, since they possess the same structure, that of the exteriorized trace. Rather, it is the trace itself that contains ambiguity, an ambiguity that is both spatial and temporal: from a spatial point of view, the trace is first and foremost a movement of inscription, i.e., the exteriorization of a process (cognitive or, more radically and generally, ontogenetic). The spatial ambiguity thus lies in the fact that there is no psychic or cognitive interiority that precedes the technical exteriority of the inscription, since individuation itself (or cognition) is inseparable from the process of inscription, and it is not possible to locate a psychic interiority or origin that would be independent of its material and scriptural inscriptions. This process is also described by Derrida in terms of a “movement of temporalization” (Derrida, 1998, 47), since the spatial inscription, thus exteriorized, links the memory of the origin (as retention) to the future (as protention) (Derrida, 1998, 84), in a movement that tends to blur their boundaries. As a trace, memory coincides neither with a transcendental psychic interiority nor with an objectifiable past, but it constantly leans towards the exterior and the future. Memory and writing are therefore essentially technical operations of temporalization and individuation, which always take place by means of an inscription. Writing, therefore, is not to be understood in an alphabetical sense, but in a purely technical sense; it is precisely an inscription, a *grammè* (Derrida, 1998, 9), and constitutes a sort of transcendental condition in Derrida’s philosophy, which metaphorically assimilates it to any other technical or biological process of individuation. The *grammè* is in fact the production of difference, or the original and always singular emergence of meaning and existence. The metaphorical

² As Martino Feyles has noted (Feyles, 2013, 21), Derrida has overturned the view that assimilates memory to interiority, showing how in reality memory has always nurtured a dynamic relationship with the exteriority of matter, which is in turn its support, trace, or document.

notions of trace, *grammè*, or even *arche-writing* (Derrida, 1978) are used to rethink the relationship between the transcendental and the empirical, of which memory is an eminent example, since it is a process of exteriorization of time itself, which does not pre-exist this technical movement of exteriorization, but which through it gives itself a structure, exists.³ The very idea of life, which is also absolutely central to Derrida's thought, is thought of as a particular case of this *arche-writing* of difference, and the history of life is thus thought of as the "history of the *grammè*" (Derrida, 1998, 84), as if life were nothing more than a particular category of the generic transcendental constituted by writing. Writing, and more precisely the non-alphabetic writing that Derrida alternatively calls *grammè*, trace, or *arche-writing*, thus becomes the scheme or metaphor of technics, understood as the inorganic "supplement" of the living, the exteriorization of memory, without which the living would not be such, would not have an existence. This thesis—of a life already always technical—is supported by the theory of exteriorization set out by André Leroi-Gourhan in *Gesture and the Speech* only two years before Derrida published *Of Grammatology*. According to Leroi-Gourhan, exteriorization is a typical evolutionary process through which life in general, and the human being in particular, materializes outside the body certain faculties typical of the living: technicality through tools, reflective thought through handwriting, and finally memory through storage techniques (Leroi-Gourhan, 1993, 258). As we will see later, Leroi-Gourhan also establishes a strong link between technics and memory, which Derrida takes up and reworks in an original synthesis with his personal reading of Husserl.

However, as it is well known, Derrida never systematized or deepened his reflections on technics, allowing others after him to do so. This legacy has been picked up above all by Bernard Stiegler, who can be considered in some respects a follower of Derrida, whose conception of technics he reworked, drawing on his same sources, namely, Husserlian phenomenology on the one hand and Leroi-Gourhan's anthropology of technics on the other. In the first volume of *Technics and Time* (Stiegler, 1998b), Stiegler sets out the thesis of a co-extension between man and technics—technogenesis and anthropogenesis coincide, in his interpretation of Leroi-Gourhan's account of evolution—and at the same time the thesis of a fundamental solidarity between technics and time, which he introduces through the question of anticipation: since the technical object needs, in order to evolve, man's faculty of anticipation, "the heart of the question [of technics] is time," writes Stiegler (Stiegler, 1998b, 82). Technics and time are therefore basically the same issue, and it is an anthropological matter: for Stiegler, if it is true that nature already presents technical tendencies, it is with the human being and his capacity of anticipation that these tendencies are concretized and exteriorized in real technical objects. Through this exteriorization, the temporality of nature and that of technology go out of phase, because technology is configured as a kind of stratification of different temporalities, allowing us both to anticipate the future and to inherit a past and a culture that we have not lived through. In this sense, "technics is above all a memory" (Stiegler, 1998a) for Stiegler, because it incorporates a memory of gestures and operating schemes necessary

³ On this point, see Vitale 2012.

for its functioning. Moreover, the link between technics and memory is twofold, because “if the tool in general is a support for memory without being made specifically to conserve memory, from the Neolithic period onwards, new techniques appear, which have the specific aim of memorizing experience” (Stiegler, 1998a), and this is what he calls *mnemotechnics*. As with Derrida, memory is never substantialized by Stiegler and always retains an operative character; on the other hand, whereas with Derrida the indispensable material counterpart of memory was quite undefined from an ontological point of view (the trace and the *grammè* being largely metaphorical concepts), Stiegler thinks of each type of memory as linked to a specific support: the genetic code for the biological memory of the species, the body itself for the individual somatic memory, and exteriorized techniques for the memory he calls epi-phylogenetic. At the same time, the notion of technics is also specified: technics no longer coincides with a vague and indefinite notion of *grammè* or *différance*, but becomes the inorganic support of epi-phylogenetic memory.

1.2 Memory, Technics, Life

In 1896, Henri Bergson, in his book entitled *Matter and Memory*, had, on the contrary, clearly separated memory and matter, almost opposing them by saying that memory is essentially spiritual; for him, memory is defined precisely by everything that is not matter. If matter is what is tangible, there is no materiality of the past—that would be a contradiction—and memory is therefore essentially immaterial. Memory is rather a function of the movement of consciousness proper to all living beings, it is linked to the duration of consciousness and of the living. Certainly, the activity of memorization is supported by a certain use of the body, and it thus implies a relationship with living matter. Nevertheless, for Bergson, memorization is the result of an activity of the mind, an activity that is, in this case, technical, because it amounts to mobilizing what he calls mechanisms, habits, or automatisms by which the memory of gestures is inscribed in the body. Memory is therefore on the side of the spirit and of life and not on the side of matter, or to put it better, it is on the side of living matter and not of inert matter. This perspective is deepened and specified in *Creative Evolution*, where Bergson rectifies the dualism displayed in *Matter and Memory*, not by abandoning the distinction between these two dimensions, but by making them two kinds of movements of life itself⁴: while life in its essence coincides with duration and spirit (and thus with memory), it also has a tendency, opposite to this tendency towards internalization, which pushes it outwards, through which life thus exteriorizes its activity in manufactured objects and in concepts, i.e., objects that can be manipulated by the body and objects that can be manipulated by the mind. The faculty that presides over exteriorization, fabrication, and action is intelligence, whereas instinct is rather an unconscious faculty of organization, which acts within the organism without ever exteriorizing itself. Memory

⁴ On this subject, see the precise interpretation by F. Worms (Worms, 2004).

is more on the side of instinct and duration⁵ than of intelligence and matter; that is, as in *Matter and Memory*, it remains immaterial, and participates in action without exteriorizing itself in procedures, but tends to coincide with the vital impulse [*élan vital*], which supports action in a completely free and unanalyzable way, without having any immediate relationship to matter. We can argue then that the distinction between instinct and intelligence also overlaps the distinction between pure memory (or image-memory) and habit-memory that Bergson made in his 1896 book: while the former has a direct relationship with the past, from which it emanates and to which it gives immediate access, habit-memory is only a surrogate of genuine memory, since it is a kind of memory materialized and exteriorized through gestures, which helps to reactivate certain behaviors that we have learned through mechanical repetition. Bergson remains in a way Platonic, in that for him true memory cannot really be exteriorized, just as instinct cannot be exteriorized. Exteriorization is not then a movement that starts from a prior interiority, but rather a creative process by which the individual invents technical objects in his living relationship with the environment. What is thus exteriorized is not primarily memory, for memory is not a faculty that can be exteriorized, but it is rather life itself that exteriorizes into inorganic forms. Bergson separates technics and memory and makes them two essential but distinct activities of the living, belonging respectively to instinct and intelligence. However, memory and technics, instinct and intelligence, together constitute the whole of the living being, and cannot be completely separated; rather, they must be thought of as opposing tendencies that pull the living being apart. Thus, intelligence pulls memory outwards and pushes it to solidify into linguistic tools and concepts, just as instinct and memory tend to inscribe technics into organic matter, giving it a flexibility and a plasticity, that inorganic matter does not possess.⁶ It is therefore not quite true that there is no relationship between matter and memory, as Bergson provocatively asserted; rather, it is true that all matter contains a strand of memory, and all memory has traces of materiality. Like memory for Derrida, Bergsonian life never ceases to exteriorize itself and does not exist outside of its exteriorizations, through which it leaves the realm of the virtual to actualize itself in the real.

The deepening of the reflection on the relationship between memory and exteriorization is one of the central themes of Leroi-Gourhan's thought, which moves within the conceptual framework drawn by Bergson.⁷ Leroi-Gourhan fully adopts the idea of technics as an activity of life, through which the living inhabits the environment, and clarifies it through a genetic theory of the tool that relates it to the gesture that constitutes it. On the one hand, the technical characteristics of a tool or utensil arise

⁵ “The evolution of the living being, like that of the embryo, implies a continual recording of duration, a persistence of the past in the present, and so an appearance, at least, of organic memory” (Bergson, 2007, 23).

⁶ This idea could be expressed powerfully in the words of Gilbert Simondon, who remains extremely Bergsonian on the subject of the relationship between matter and memory: “memory is the function by which a posteriori matters become a priori” (Simondon, 2017, 138).

⁷ Leroi-Gourhan's intellectual debt to Bergson has been clarified several times. Cf., for example, Guchet, 2015 and Clarizio, 2021 (especially chapter four).

in the encounter between a gesture and a material: if knife handles are usually made of wood, it is because the wood possesses properties that lend themselves to a certain type of workmanship (e.g., the incision for the insertion of the blade) (Leroi-Gourhan, 1943, 14). On the other hand, “the real significance of tools is in the gesture, which makes them technically effective” (Leroi-Gourhan, 1993, 237), and technics is thus an exteriorized vital activity. However, the technical activity does not end in this manipulative relationship between the living and the environment, but also implies an unavoidable symbolic and immaterial depth, which corresponds to the role played by memory: “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, 114). Technics is thus an operational concatenation of gestures and tools whose relationship is somehow coordinated and organized by memory, which mediates between the brain and the environment, articulating the syntax of experience. Although Derrida and Stiegler relied on the writings of Leroi-Gourhan to demonstrate a solidarity between memory and writing, memory does not in fact take the form of an inscription or a trace, but is a symbolic faculty that allows technical activity to be organized. Its role is active, and not just passive, during technical behavior; memory is not limited to recording the past but, as in Bergson, is action-oriented. With Leroi-Gourhan, we are faced with an operational concept of memory, which should be understood as the faculty of the articulation of life with matter. *Memory is, at the same time, matter for thought and thought for matter*, a sort of medium between man and the world, the brain and the environment, which serves to translate human purpose into technical operations and, reciprocally, to enliven matter by placing it in an operative relationship with bodies, that is, by inserting it into the horizon of meaning of action. By virtue of this median statute, memory is radically non-objectifiable and non-locatable in space and time (since it has to do, at the same time, with the sedimented past, with the present of the action and with the future of its effectiveness). But if memory does not have a direct relationship with matter and if it cannot be located, how is it possible that Leroi-Gourhan speaks of “exteriorization of [...] memory” (Leroi-Gourhan, 1993, 354)?

It seems to me, in fact, that the few times Leroi-Gourhan speaks of memory as something exteriorized, he uses the term only in a metaphorical and improper sense, instead of the more precise one of archive.⁸ On other occasions, instead, Leroi-Gourhan argues that “memory is a product of exteriorization, and it is stored within the ethnic group” (Leroi-Gourhan, 1993, 258), in the sense that technical exteriorization, as an invention, produces a shared experience that has the traits of memory. In this sense, memory is a faculty of life that provides articulation between the brain and the environment, wherever there is an organization of matter. This organization of matter is the primordial vital fact for Bergson and Leroi-Gourhan, and memory is the symbolic faculty that presides over it—be it biological, technical, or social. We can therefore speak of

⁸ On the relationship between memory and archive, see Feyles, 2013.

the exteriorization of memory in a metaphorical sense only, insofar as matter that is organized (biologically, in organisms; technically, in artefacts; socially, in human groups) contains the symbolic rules of its own organization. In this sense, technical invention is a process of socialization of that operative syntax which, by crystallizing in the object, makes itself available to others, whether they be the social group to which they belong or future generations. This is why the history of man and the history of technology are in truth the same history, which is the history of life, i.e., a concatenation of exteriorizations that, “placing outside ourselves what in the rest of the animal world is achieved *inside* by species adaptation” (Leroi-Gourhan, 1993, 235), produces in the same movement the creation of a social world and the evolution of the species. Thus, if initially tool and language gave rise to an exteriorized ethnic memory, distinct from the specific one, later the emergence of graphy and linear writing—techniques for inscribing language and reflective thought in matter—also gave rise to an artificial memory. From this moment on, according to Leroi-Gourhan, it is impossible to separate human evolution from that of the mnestic supports in which collective thought and memory are deposited. It is therefore understandable that he devotes an entire chapter of *Gesture and Speech* to the “history of collective memory,” which is divided into five periods: “that of oral transmission, that of written transmission using tables or an index, that of simple index cards, that of mechanography, and that of electronic serial transmission” (Leroi-Gourhan, 1993, 258). One might think, at this point, that by making human evolution coincide with the evolution of memory recording supports, Leroi-Gourhan establishes an exact parallelism between these phases and the phases of human evolution, but this is not the case. Indeed, with remarkable lucidity, he concludes that “audiovisual techniques really seem to represent a new stage of human development—a stage that has direct bearing on our most distinctive possession, that of reflective thought” (Leroi-Gourhan, 1993, 213). This shift only reinforces the hypothesis that memory should not be thought of as a mere support for thought, but that it actually responds to an operative and interactive conception of human action: what counts, in the end, is not so much the inscription support as such, but rather the relationship that the support has with human faculties and the way in which it enables, or modifies, their performance. Thus, even though electronic technologies constitute the last stage in the *history of memory*, it is in audio-visual technologies that Leroi-Gourhan sees a new stage in *human evolution*, even though the appearance of audio-visual precedes that of electronics by a few years. The relevance of a technology for human evolution is therefore not to be measured by the specificity of its internal functioning, but by the impact it has on the faculties, i.e., by its enabling potential to give man original ways of experiencing the world and interacting with others. This would be incomprehensible if we thought of memory as a mere support; it must be understood as the authentic organ of interaction between the living being and the environment, the instance that shapes man’s relationship with the world. Leroi-Gourhan’s reflection on memory therefore remains open-ended and needs to be updated on the basis of recent technological developments.

2 Biobanks: Memory as the Exteriorization of Life

The topics raised so far—of exteriorizations, memory, technology, time, and life—are clearly central to a philosophical reflection on biobanks. The fact that the biological samples stored in biobanks are exteriorizations of living organisms, whose memory they preserve in some way, thanks to specialized technological infrastructures, is something immediately visible. But beyond this immediate evidence, is it possible to gain a deeper philosophical understanding of the phenomenon of biobanks through the philosophies of technology referred to here? Conversely, can biobanks, as an empirical object for philosophy, clarify anything about our conception of memory, technology, and life? As a matter of fact, the question of exteriorization is at the heart of the reflections on technics and memory of all the authors discussed above, who deal with it in different ways: for Derrida, exteriorization is a process that generates memory at the same time as it generates the trace of memory; Stiegler also points out that exteriorization is a process of technical invention, and both Derrida and Stiegler stress that the exteriorization is always an operation of temporalization. Bergson, on the other hand, inextricably links exteriorization to the movement of life: every exteriorization is an exteriorization of life; finally, Leroi-Gourhan highlights the dynamic character between the technical and material supports of memory and memory as the faculty of reactivating a knowledge sedimented in technical objects. What is interesting at first glance is that biobanks bring together all these criteria: they are at once, literally, exteriorizations of life, insofar as they relocate biological material outside of living organisms, and, in this way, they are a collection of traces in the Derridean sense: the exteriorization of organic life in inorganic structures objectifies at the same time the interiority of the body. It is in fact only after this exteriorization that the interiority of the body can be investigated through certain medical analysis. As the exteriorization of a biological memory, biobanks also constitute a process of temporalization, since they extend the temporality and survival of certain elements of the body beyond the temporal limits imposed by the natural life cycle of an organism. Finally, exteriorization provided by biobanks creates new kinds of supports for memory, that demand to be activated a whole series of technical operations and infrastructures, thus constituting a new stage of the “history of collective memory” evoked by Leroi-Gourhan.

The concept of exteriorization seems therefore particularly relevant for understanding biobanks, although the existing literature has so far preferred to focus on other properties of biological samples (delocalization, commodification, exchangeability, mobilization, objectification).⁹ It seems to me, however, that the concept of exteriorization of memory allows to consider biobanks not only at the level of isolated biological samples, but also as collective entities in which humanity decides to preserve a part of its biological memory.

⁹ See, for instance, Lafontaine, 2021, and Vermeulen et al., 2017.

2.1 Exteriorization: Between Organic and Inorganic

If, on the one hand, the understanding of biobanks benefits from a comparison with the aforementioned philosophies of technology and exteriorization, on the other hand, biobanks also allow to rethink the concept of exteriorization itself. With biobanks, exteriorization is in fact no longer a movement from the organic to the inorganic, no longer, in short, an additive process through which inorganic matter extends organic matter, thus spreading its dominion over the environment. Exteriorization is no longer a simple “substitution of the organic by the inorganic” (Feyles, 2013, 51), as it is rather the organic matter itself that is exteriorized. In some ways, however, technique is nevertheless implicated in this exteriorization: although what is being exteriorized is biological matter and not a technically produced object, exteriorization takes the form of a substitution of the environment associated with the biological matter in question, which moves from a biological environment (the organism) to a technical one (the biobank freezer and, more generally, the entire biobank infrastructure). Exteriorization is a kind of relocation of organic material from an organic environment to an inorganic environment, more precisely a technical environment in which temperature conditions are controlled to halt or slow down as much as possible its metabolism. In some ways, this is a plastic example of the main performance of any biotechnology, which, beyond its specificity, first and foremost constitutes an objectification of life. These objectual life-forms are now the raw material of biomedical research and bio-capitalist economy (Rajan, 2006), to the extent that some authors have now begun to speak of bio-objectification processes (Vermeulen Tamminen Webster, 2017). The first capital consequence of such a bio-objectification is that the opposition between the organic and the inorganic is no longer entirely relevant to define the mode of existence of living form. From a conceptual point of view, this consideration opens up the vertiginous possibility of thinking of a life at least partially freed from the specific mode of existence and temporality of organic matter. If until recently this possibility was merely a literary fantasy, long since dreamt up in science fiction literature, it is now a real working hypothesis for some scientists who, mastering the techniques of cryogenics, are working on the hypothesis of being able to slow down the metabolism of certain mammals in order to possibly prolong their lives (Asfar et al., 2014), or to make their lives intermittent at will.

2.2 Technology, the Living and the Environment: Mediation, Hybridization, Artificialization

Secondly, if exteriorization no longer presents itself as a substitution of the organic by the inorganic, this also means that it does not have the features of a technical invention. Indeed, Bergson, Leroi-Gourhan, and Stiegler all conceived of the exteriorization as an inventive process, through which life (for Bergson and Leroi-Gourhan) or human beings (for Stiegler) create technical objects that modify in some way the relationship between the individual and the environment. This pattern,

however, does not seem to work with biobanks, where exteriorization looks more like the extraction of biological data (the collection) and its subsequent storage in artificial repositories (the storage). Technics constitutes here a new form of interaction between the living being and the environment as compared to the classic biological philosophy of technology. For Bergson as well as for Leroi-Gourhan, for example, technics is an exteriorization of the living being through which it manipulates matter to modify the environment for different purposes. Technics thus plays a mediating role between the living and the environment. This view was overturned at the beginning of the 1960s by the emergence of the concept of the Cyborg, a term (contraction of the expression cybernetic organism) coined precisely to imagine the possibility of forms of life freed from the needs imposed by the environment. The Cyborg, unlike other living beings, does not technically modify the environment to make it habitable, but technically modifies itself in order to be adaptable to different environments. This concept was born precisely to imagine the possibility of leading an extraterrestrial life: “Altering man’s bodily functions to meet the requirements of extraterrestrial environments would be more logical than providing an earthly environment for him in space ... Artifact-organism systems which would extend man’s unconscious, self-regulatory controls are one possibility” (Clynes & Kline, 1960). In this case, technics does not act as a mediator between the living being and the environment; rather, the environment is excluded from the relationship, which becomes a binary relationship of hybridization between organism and technology, thanks to which the organism can adapt to any type of environment, or rather can free itself from the need to adapt to the environment.¹⁰

With biobanks, we are faced with yet another change in the way of conceiving the triangle between the living being, technology, and the environment. Rather than mediation or hybridization, technology has a function of artificialization for the living, insofar as its preservation in a state of latent life depends on the technical conditions of the environment in which it is immersed. In fact, it is a function already widely clarified by Gilbert Simondon who, also moving in the framework of a biological philosophy of technology, has investigated all the conceptual latitudes of the relationship between the individual (technical or living) and the environment. For Simondon, in fact, artificiality is not synonymous with technique (“the technical object mustn’t be seen as an artificial being” (Simondon, 2017, XV)), but is rather a function of the relationship that the individual has with its environment, thus determining its mode of existence:

the essential artificiality of an object resides in the fact that man must intervene to maintain the existence of this object by protecting it against the natural world, giving it a status of existence that stands apart. Artificiality is not a characteristic denoting the fabricated origin of the object in opposition to spontaneous production in nature: artificiality is that which is internal to man’s artificializing action, whether this action intervenes on a natural object or on an entirely fabricated one. (Simondon, 2017, 49)

¹⁰ On this subject, see Hoquet, 2018.

An artificial being is therefore an object, whether technical or biological, whose metabolism is not autonomous, but is regulated by an external human operator. More precisely, in the case of biological samples stored in biobanks, it is a question of stopping the metabolism so that biological characteristics, which can be reactivated at the appropriate time (in the case, e.g., of biobanks for reproductive purposes) or analyzed using appropriate techniques, are preserved. The Cyborg and a biological specimen or any other bio-object thus represent, in a sense, two opposite extremes with respect to a living organism: if the Cyborg moves away from the living insofar as it frees itself from the dynamic relationship with the environment that characterizes the living, the bio-object moves away from the living because its relationship with the environment is, on the contrary, too close, too determined, and lacking in plasticity, so that its mode of existence comes close to that of an artificial object. Whereas Simondon defined the technical object as an individual whose mode of existence tends to be as concrete as that of a natural being, without ever becoming completely concrete, one could on the contrary define a bio-object as an individual whose mode of existence tends to be as artificial as that of a technical object, without ever being completely artificial. Although biobanks therefore call into question the organic/inorganic pair of concepts for defining the living, they show us, quite negatively, that a living being is characterized most of all by a dynamic relationship with the environment (and indeed the Cyborg is so autonomous from the environment that it is a pure utopia). In this sense, it could be said that, from a Simondonian perspective, the concept of “artificial life” is a boundary concept, since after all there can be no completely artificial life,¹¹ just as there can be no completely concrete (or natural) technical object.

2.3 Technics and Exteriorized Memory

In fact, Simondon’s notion of artificiality can also be mobilized in order to understand retrospectively the functioning of memory as outlined by Leroi-Gourhan, as well as the distinction that the latter establishes between human and artificial memory. If one assumes Simondon’s definition of artificiality, as what distinguishes a being whose functioning is not spontaneous, but must be assisted and regulated by the human, artificial memory should be understood as a memory that, being external to the body, functions neither autonomously nor automatically, but is activated through the interaction with the human operator. Although Simondon, in *The Mode of Existence of Technical Objects*, also distinguishes human memory from machine memory, the latter remains understood as a mere form of recording that, like Leroi-Gourhan, he names “memory” in a metaphorical sense only. Not surprisingly, he refers to it as a “non-living memory” (Simondon, 2017, 138), suggesting that true memory is only the memory of the living, in line with the Bergsonian conception.

¹¹ On the contrary, the notion of “technical life” has a specific, albeit purely analogical meaning for Simondon (in the sense that it indicates one of the modes of human life and not the mode of existence of technical objects. On the notion of technical life in Simondon, cf. Clarizio, 2021, especially the last chapter).

Even in Simondon, therefore, technics cannot be conceived simply as the support of memory, firstly because memory cannot be located in matter, and secondly because, if it cannot be located, it means that memory has a purely virtual and evenemential character, existing only in the active interaction between man and machine. Rather, technics constitutes the set of infrastructures and operations through which memory is reactivated each time in this interaction between the human operator and the machine. From the point of view of a philosophy of memory, then, technics is not an activity of inscription of a memory in a matter, but it is the set of procedures and infrastructures that allow the dialogue between human memory and the artificial memory of the machine. In this sense, technics could be defined as an activity of actualization of memory, which would otherwise remain in an always latent and virtual state.

This is precisely what happens in biobanks, where life, reduced to a state of latency, requires the interaction between a series of techniques on the one hand (techniques for conditioning biological materials, techniques for controlling and monitoring temperatures, techniques for analyzing biological data, techniques for translating biological data into computer data, etc.) and the human technical operator on the other, so that its memory can be reactivated. In this way, a blood sample stored for decades in a freezer can be extracted, thawed in a controlled manner, and subjected to analyses through which the biological memory of the body to which it belonged can be reactivated for specific purposes. Although most of the techniques used in biomedicine are computer techniques, this does not mean that living beings also possess a scriptural structure, as was also argued by Stiegler when he interprets DNA as a form of program. It simply means that technology, in its operative character, enables a dialogue between heterogeneous realities, in this case the living and the digital. But there is nothing necessary about this dialogue, whose historical configuration is not only contingent, but also debatable and open to criticism (Stevens, 2013).¹² There is therefore no need to postulate any ontological continuity between the living and the technical (in the form of writing) in order to think of communication between biological memory and artificial memory, since the technique serves precisely to establish operational analogies between the two memories. It should also be noted that the biological memory in some way contained in biological samples is not reified in them, since it also depends largely on the technologies available and the technologies used: preserving a biological sample at $-20\text{ }^{\circ}\text{C}$ is not the same thing as preserving it at $-80\text{ }^{\circ}\text{C}$ or $-196\text{ }^{\circ}\text{C}$, because each type of freezing aims to preserve some data and not others. Once again, therefore, rather than as a thing, memory should be thought of as the actualization of a virtual that is always contingent, and which depends on the specific interaction between the living being and technology.

¹² In a nutshell: contemporary biomedicine focuses on the study of genomic and genetic data because these are the techniques it has developed to study the living, but it is not necessarily the case that the living is first and foremost reducible to its genetic and genomic aspects. Indeed, there are good reasons to doubt this.

2.4 Trace and Anticipation

If we wanted to enucleate some of the conclusions reached so far, we could say that memory is more a biological than an anthropological fact; technology is not a support for memory, but an activity of actualization of memory; memory is not a writing, but a virtuality of life, which is activated in the interaction between the living and the material. But before I conclude, there are still at least two concepts developed by Derrida and Stiegler, respectively, which can be related to two aspects of biobanks that have not yet been investigated. These are the concepts of trace and anticipation, which can shed light on the mode of existence of biological data and the role of biobankers, respectively.

From a Derridean perspective, as we have seen, the trace is not a simple unambiguous inscription, and although it has a certain materiality, or perhaps precisely because it has a certain materiality, the trace does not have an unambiguous meaning, but refers more vaguely to a memory that needs to be reactivated. On the basis of Derrida's conception of the trace, Hans-Jörg Rheinberger has developed an epistemology of biological data that takes account of their non-uniqueness and radically singular character. In particular, he distinguishes the biological data, as trace, from the computer data that is extrapolated and analyzed from this trace, to be then read or visualized: "the trace is thus supposed to be anterior to both writing and image" (Rheinberger, 2011, 338). Conceiving of biological data as traces¹³ has several epistemological advantages: firstly, it avoids postulating a strict analogy between biological data and writing, which would present a risk of reductionism; secondly, it maintains the singular link existing between a biological data enclosed in a sample tube and the particular biological and existential trajectory of the person from whom that sample comes; lastly, it keeps open the possibility of imagining new interactions between biological memory and artificial memory, which may arise (if the biological datum is not unique, but its interpretation depends on available technologies at a certain time, the possibility remains open that technological innovation may in the future reveal new knowledge based on the same datum).

The latter question also opens up the issue of anticipation, which Stiegler saw as an essential theme in the relationship between human and technology: in order to evolve, technical objects need the human capacity to anticipate, which is not, however, an intellectual capacity for Stiegler, but rather an embodied one, since the technical gesture that is exteriorized in the tool is already in some way a movement of anticipation. Even in biobanks, the biobankers, who are the human operators in charge of regulating the entire technical infrastructure, need a certain capacity of anticipation. However, the way in which the biobanker relates to technology is not that of a carrier and producer of tools; in line with the anthropology developed rather by Simondon in *The Mode of Existence of Technical Objects*, he is rather a regulator of machines and not a technical individual himself. Anticipation should therefore be seen here, as Simondon puts it, in terms of an imaginative function. Indeed, the biological samples stored in biobanks are not simply samples of raw

¹³ Similarly, Xavier Guchet gave an interpretation of biomarkers as traces (Guchet, 2016).

biological material, but bio-objects which, before being stored, undergo a series of treatments that make them suitable for specific functions, or specific types of analysis. The biobanker therefore needs to know in advance what the future use of a biological sample will be (will it be used for a study on the prevalence of lung cancer in a given geographical area, or for a study on the impact of lifestyles on a disease? Is it possible to treat it in such a way that it is useful for both purposes?) and use this special capacity of anticipation to decide how to process it. In a certain sense, therefore, the biobanker as a technical operator must possess a certain capacity of anticipation, which is not, however, defined in a direct operative relationship with the material, but which is based on what Simondon called a true “technical culture”.

3 Conclusion

The phenomenon of biobanks has proven to be extremely interesting in rethinking the question of the relationship between memory and technology. In particular, it obliges us, first of all, to seriously reconsider the theme of life and all its declinations in philosophy of technology (the relationship between the organic and the inorganic, between the living and the environment, etc.). Secondly, it allows to explore the meaning and sense of exteriorization, a theme that is central to all the authors discussed and which undoubtedly deserves more attention; thirdly, it allows to think concretely about the role of humans in complex technical systems such as biomedicine and demonstrates the importance of developing a philosophy of technical infrastructures. Last but not least, it has demonstrated the fruitfulness of French twentieth-century thought on technology, as well as the possibility of making it dialogue in a profitable way with the expectations of an empirical philosophy, and the possibility of establishing a dialogue between authors who at first sight may appear distant, starting from concrete objects on which each can shed a ray of light. These goals are certainly only partially achieved within the limits of this article, but are likely to be taken up in the future.

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