Belinda Barnet, "Do Technical Artefacts Evolve?" *Technicity*, edited by Arthur Bradley & Louis Armand (Prague: Litteraria Pragensia, 2006) 167-199. ISBN 80-7308-125-3

Belinda Barnet

Do Technical Artefacts Evolve?

> The reproducibility of the technical machine differs from that of living beings, in that it is not based on sequential codes perfectly circumscribed in a territorialised genome.[1]

How does one tell the story of a machine? Can we say that technical machines have their own genealogies, their own evolutionary dynamic? The technical artefact constitutes a series of objects, a lineage or a line. At a cursory level, we can see this in the fact that technical machines come in generations; they adapt and adopt characteristics over time, one "suppressing the other as it becomes obsolete."[2] Since the early days of Darwinism, analogies have been drawn between biological evolution and the evolution of cultural artefacts. It is obvious that technical artefacts in particular change over time; we can see these changes happening around us, and they appear to be accelerating. So are we to understand this dynamic from a biological, an anthropological or a sociological perspective?

* Parts of chapter 6 were originally published as an article in *Ctheory* as "Technical Machines and Evolution" (Article 319, 2004). The author would like to thank Niles Eldredge for his feedback and comments on this manuscript.

1 Félix Guattari, *Chaosmosis: An Ethico-Aesthetic Paradigm*, trans. P. Bains and J. Pefanis (Sydney: Power Publications, 1995) 42.

2 Guattari, *Chaosmosis*, 40.

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I want to locate a dynamic in technics that stems neither from biology nor from human societies, which grants the technical object its own materiality, its own limits and resistances, which allows us to think technical objects in their historical differentiations. This calls for a new consideration of technicity, and a new consideration of the human being in relation to technics. The task will be difficult—"at its very origin and up until now, philosophy has repressed technics as an object of thought. Technics is the unthought."[3]

This essay will be a collection of notes towards such a perspective; it will be a prolegomena to the history of a technical machine, a history which is not included here and which has yet to be written. I will be exploring the work of Bernard Stiegler in relation to technicity and to human thought, but my task will not be to invert the history of philosophy itself, to imagine the human as what is invented by technics. I do not wish to put forward a theory of human evolution. Similarly, there has been a long and bloody Hundred Years War among cultural anthropologists over whether human culture can be said to evolve,[4] a war that predates Darwin and continues to the present day. I will not be contributing to this debate, although I will be visiting some of its key arguments. My intention is much narrower, or perhaps more jaded; I am interested in the *technical artefacts* that accumulate around human culture, and how they change over time. I want to clear a space in which a technical object might evolve, and in which I might trace such an evolution.

3 Bernard Stiegler, *Technics and Time. Volume I: The Fault of Epimetheus*, trans. Richard Beardsworth and George Collins (Stanford: Stanford University Press, 1998) ix.

4 Stiegler, *Technics and Time*, 134. See J. Fracchia and R.C Lewontin, "Does Culture Evolve?" *History and Theory* 38 (December 1999): 52-78.

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Introduction

Niles Eldredge collects things for a living, and there are two great collections in his life. The public one is on display at New York's Museum of Natural History; its 1000 individual specimens stretch floor to ceiling for 30 metres across the Hall of Biodiversity.[5] There are beetles, molluscs, rotifers and fungi, spiders, fish and birds, all arranged into genealogical groups. The other collection is private; it spans an entire wall in his home in rural New Jersey. This collection contains over 500 specimens, but of the "musical rather than the biological variety."[6] He collects cornets, a type of musical instrument. There are silver and gold ones, polished and matte, large and small, modern and primitive. Ever the biologist, Eldredge has them arranged in taxonomic relationships of shape, style and date of manufacture. Much of the variety in cornet design is based on the way the pipe is wound.

Late in 2002, Eldredge's curiosity got the better of him. He decided to feed these specimens through the phylogenetic computer program he uses for his trilobites, to apply the "scientific method" to technical evolution for the first time. As usual, he asked the computer to come up with all the possible evolutionary trees and then make a "best guess" based on the existing specimens.[7] The results were astounding. Compared to the phylogenetic diagram for trilobites, the diagram for a technical machine seemed much more "retroactive." Eldredge's musical instruments could defy the laws of evolution.

In the world of living things, there are basically only two ways creatures can obtain a characteristic: by inheriting it from a previous generation, or by evolving it in the present one. This last form of evolution is itself the subject of debate; an organism can't change its DNA in one lifetime (with the exception of certain bacteria). Biological organisms evolve gradually over hundreds of generations, subject to natural selection. They are

[5] Gabrielle Walker, "The Collector," *New Scientist* (26 July 2003): 38.

[6] Walker, "The Collector," 38.

[7] Walker, "The Collector," 38.

dependent on the previous generation to acquire their characteristics (this is called "vertical transmission" or parents to offspring). If a species dies out—biological "decimation"—its accumulated characteristics die with it. But technical machines are different.

> With cultural evolution comes the capacity to co-opt innovations at a whim. Time after time, when the cornets on one part of the tree acquired a useful innovation, designers from other branches simply copied the idea.[8]

In technical evolution, machines are not entirely dependent on the previous generation. They can borrow innovations from generations in the past (retroactivation) or they can borrow from entirely different branches of the evolutionary tree (horizontal transmission). As Eldredge put it in an interview with the author in 2004:

> The key difference is that biological systems predominantly have "vertical" transmission of genetically-ensconced information … the neatness of evolutionary trees in general in biological systems stems from the compartmentalisation of information within historical lineages.

In Eldredge's diagrams, cornets that were relatively primitive seemed to co-opt innovations from different branches at a whim. If there was a particularly good innovation, then a "burst" of rapid evolutionary activity would appear. The lines in the cornet evolutionary tree were thoroughly confused. Instead of a neat set of diagonal V-shaped branches, a "cone of increasing diversity," you would see flat lines from which multiple machines appeared.[9] When this happens in biology, it implies explosive radiation—the appearance of multiple new species in a geologically short period. In the biological world it

8 Walker, "The Collector," 40.
9 Walker, "The Collector," 41.

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is extremely rare, yet it appears to characterise Eldredge's cornets. In the cornet diagram, the gradual passage of time and generations does not precede the development of a particular characteristic. Innovations appear spontaneously, often with no physical precursor. This means that the cornet's relationship to time and inheritance is different from that of biological organisms.

Another striking feature of Eldredge's diagrams was that outdated or superseded machines could re-appear with new designs, as if they were held in memory and only needed a certain innovation to burst into activity again. This is what we mean by "retroactivity." Technical machines can reappear, borrow from each other across branches and then rapidly evolve in a single generation. In biological evolution, when branches diverge, they diverge irrevocably; similarly, when branches die out, they cannot reappear. Technical machines are different. There is no extinction; nothing is irrevocable. Technical machines can operate on the past.

> Technical structures, ensembles and channels are static combinations in which phenomena of retroactivity appear: by using the steam engine, the steel industry produces better steel, allowing in turn for the production of more efficient machines.[10]

This raises the question of technical "memory," a topic we will explore in the next section. Why can technical machines retroactivate? What is the relationship of human thought to this? Is it humans that "remember" previous generations of technical machines and transfer their characteristics between branches? If so, how and where do they remember them? Memory, and in particular technical memory, bridges "not just past and present, but outside and inside, machine and

10 Stiegler, *Technics and Time*, 31.

organism"[11] Over 100 hundred years ago, a contemporary of Charles Darwin was also obsessed with "the substantial identity between heredity and memory." In his book *Life and Habit*,[12] Samuel Butler argued that biological heredity was but one mode of memory, and that "all hereditary traits, whether of mind or body, are inherited in virtue of, and as a manifestation of, the same power whereby we are able to remember intelligently what we did half an hour, yesterday, or a twelvemonth since."[13] The question of memory and inheritance will be the leitmotif of this essay. It will be the question we pose to history. It will be the question that marks this theory of technical evolution.

Eldredge is also interested in memory and in technical evolution, but at this stage, he wants to warn against the indiscriminate use of biological metaphors.[14] If innovations are taken from the past and spontaneously appear in another branch in which they have no physical precursor, this constitutes a break from genetic evolution. There is an evolutionary dynamic going on, but its rules of inheritance are not based on Mendelian genetics. Similarly, the kind of selection that operates on horizontally-transmitted characteristics is not Darwinian natural selection.[15] We need another explanation for retroactivity and for horizontal transmission where there is no physical precursor. So I will be thinking the evolution of technical objects in terms of lineages and diagrams; but I will also be interested in precisely where this is different from biological evolution, where it exceeds the

11 John Sutton, *Philosophy and Memory Traces* (Cambridge: Cambridge University Press, 1998) 4.

12 Samuel Butler, *Life and Habit* (1878): http://www.gutenberg.org/dirs/etext04/lfhb10h.htm

13 Samuel Butler, *Luck and Cunning* (1878): http://www.gutenberg.org/dirs/etext04/lckc10h.htm

14 Eldredge, cited in Walker, "The Collector," 41

15 M. Matteo, "Nongenetic Selection and Nongenetic Inheritance," *British Journal for the Philosophy of Science* 55.1 (March 2004): 43.

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biological.[16] Technical machines are ensembles in which phenomena of retroactivity appear, where there is a different relationship to time and inheritance, where there are different material limits and contingencies.

So we need to recognise a limit to genealogical metaphors. But the question remains: what is the relationship between human thought and technics? If there is technical "remembering," then there must also be a mode of transfer and storage, and a place where this occurs.

> There is no archive without consignation in an external place which assures the possibility of memorisation, of repetition, of reproduction, of reimpression.[17]

Is this place inside or outside? If it is inside human memory, then how does it exceed our biological death as human beings? If it is outside, then where is it located precisely? The relationship between human memory and technics constitutes a tension, a tension that marks the break from genetic evolution. To explicate this tension, I will need to articulate a mode of passage, a logic. Eldredge does not provide one; as a scientist, he has simply pointed out that a dynamic exists, and that this dynamic is different to biological evolution. To articulate this logic, I will be using the innovative thinking of Jacques Derrida and Bernard Stiegler.

Derrida thinks the relation between humans and technics in terms of an "originary supplementarity": human memory is a prosthesis of the inside. It is neither inside nor outside, but constitutes a "relative interiority." Stiegler's thinking may be seen as a radicalisation of this concept. Whereas Derrida is concerned to articulate the tension in terms of a "logic," the logic of difference, Stiegler is concerned to articulate this logic

16 In this article I will be using the term evolution to mean the "fate of heritable information in an economic context," Niles Eldredge's personal definition.

17 Jacques Derrida, *Archive Fever: A Freudian Impression*, trans. E. Prenowitz (Chicago: The University of Chicago Press, 1996) 11.

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in terms of its historical differentiations in different technical systems. The logic will only appear in its differentiation; the "interiority is nothing outside of its exteriorisation."[18] This is why Stiegler will be useful to any material genealogy of a technical machine. He will give us descriptive purchase on this logic as it is articulated in technical objects. We will unpack this concept in more detail presently.

For the moment, let us return to the problem raised by Eldredge; technical machines break the laws of genetics. From his perspective, this is because they are subject to intelligent design. Part of the reason Eldredge created these diagrams in the first place was to prove to the Creationists that intelligent design has its own dynamic, and this dynamic is radically different to what we find in nature. Technical machines are invented; this is what distinguishes them from biological organisms. As Aristotle puts it: "not one product of art has the source of its own production within itself."[19] Or rather, technics do not have the capacity for self-production. Silicon does not automatically rise up into a computer. As an object, it must first be thought in the mind of a human, and then created.

Created objects and artefacts are what most readily come to mind when the word "technology" is mentioned.[20] The domain of "technics" is even more restricted; in general, it designates "the restricted and specified domain of tools, of instruments."[21] These objects are not a fact, but the result of human thought. In this sense, technical objects might be taken as by definition human fabrications. Humans create technics; technics do not pre-exist or constitute the human.

This understanding dominates the contemporary thinking of technics, and consequently extant histories of technical

[18] Stiegler, *Technics and Time*, 152.

[19] Cited in Stiegler, *Technics and Time*, 1. Cf. Aristotle, *Physics*, II.1.25—30.

[20] Carl Mitcham, *Thinking Through Technology: The Path Between Engineering and Philosophy* (Chicago: University of Chicago Press, 1994) 161.

[21] Stiegler, *Technics and Time*, 93.

machines.[22] It is based on an opposition, an opposition as old as metaphysics. We must address this before any new theory of technical evolution can be discussed.

The Aporia of Origin: Thought and Technics

"At the beginning of history," asserts Bernard Stiegler, "philosophy separates technē from episteme," and to these two regions of beings two dynamics are assigned: mechanics and biology.[23] It is in the inheritance of this conflict that technical knowledge is devalued as mere supplement, and the human affirmed against the process of technicisation. Human thought (the philosophical episteme) is pitched against the sophistic technē (art or craft). At the time, these sophistic "arts" were primarily mnemotechnics and writing—techniques of memory. To the ancients, they were a form of bastardised anamnēsis, a mechanical incursion on thought. Human memory was "the noblest region of … personality,"[24] an originary knowledge for which technē served as mere extension. Platonic philosophy was constituted on this opposition between human knowledge, which is transcendental, and technics, which lacks self-production. The reason it is separated is to account for the possibility of access to knowledge, or more precisely, an originary and purely human knowledge. It is the answer to an ancient aporia.

Aporia comes from the Greek, "meaning, 'without issue,' or 'without way' … that which thought cannot resolve or untie without forgetting the undecidability which structures the aporia."[25] It is a limit question, a question which is irreducible, and which will consequently reappear in every attempt at an

22 Stiegler, *Technics and Time*, 14.

23 Stiegler, *Technics and Time*, 2.

24 Cited in Darren Tofts, *Memory Trade: A Prehistory of Cyberculture* (Singapore: Stamford Press, 1998) 58.

25 Richard Beardsworth, "Towards a Critical Culture of the Image—J. Derrida and B. Stiegler, *Echographies de la télévision*," *Tekhnema 4* (1988).

answer. This particular aporia—Plato's *Meno* and the aporia of memory—is crucial to the history of philosophy[26] and also crucial to the history of technics.

What is human knowledge? Or more precisely, what is purely creative human knowledge? This would be the knowledge that humans draw upon to create technologies; it would not be inherent to the created object or artefact. So in a sense, it could not be acquired by experience, as this would accord the object itself knowledge, if not agency. It would need to be uncontaminated by technics at the beginning. But this presents a problem—a problem encapsulated in an address by Meno to Socrates in his discourse on the essence. The problem is that such knowledge is impossible. The question is actually formulated in response to Socrates's attempt at founding a human value (Virtue) in the human, as opposed to something acquired in the outside world of objects and experience:

> How will you look for something when you don't know in the least what it is? How on earth are you going to set up something you don't [already] know as the object of your search?[27]

Socrates, in response, rephrases the aporia to highlight the problem:

> a man cannot try to discover either what he knows or what he does not know. He would not seek what he knows, for since he knows it there is no need of the inquiry, nor what he does not know, for in that case he does not even know what he is to look for.[28]

This aporia is taken up and resolved by Socrates through the myth of reminiscence.[29] Man has access to an originary

[26] Stiegler, *Technics and Time*, 98.

[27] Cited in Stiegler, *Technics and Time*, 97.

[28] Cited in Stiegler, *Technics and Time*, 98.

[29] See Beardsworth, "Towards a Critical Culture of the Image."

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knowledge, to an originary memory acquired before the fall. Man already knows what he does not know—it's just that he has forgotten it. Knowledge is an unveiling, a remembering. Human memory is transcendent.

> Thus the soul, since it is immortal and has been born many times, and has seen all things both here and in the other world, has learned everything that is.[30]

Consequently, argues Stiegler, the aporia is settled in terms of an opposition. Thought has the principle of its creation, of its movement, within itself, and this transcends the world of objects. The human being does not receive its knowledge from the outside world, from the finite world of objects, but finds it again and again within himself. The myth of reminiscence thus institutes metaphysical oppositions between soul and body, thought and technics, infinite and finite. For our argument concerning technical objects, this myth places the act of creation squarely on the shoulders of human beings who have access to an originary knowledge, uncontaminated by technics, and consequently by finitude, in the beginning. The history of a technical machine would thus be the history of pure invention, of human beings who have access to a transcendent memory.

This is precisely the divide that Stiegler, and also Derrida, problematise. Derrida argues that memory is always already contaminated by technics. The prosthetic already-there: this is what the myth of reminiscence "forgets." Stiegler argues that the prosthetic already-there constitutes a break with genetic evolution; and not only this, it is a break which constitutes the human. Both philosophers put the idea of pure human memory into crisis, and consequently the idea of any access to a realm of thought uncontaminated by technics.

To return to our original question: how does one write the genealogy of a machine, and where would human beings figure in this diagram? It is impossible to deny the role of human

30 Socrates, cited in Stiegler, *Technics and Time*, 99.

thought in the creation of technical artefacts. But where does the knowledge required to create these artefacts come from? Plato maintained that creative knowledge is transcendent, that it is uncontaminated by the world of experience (and by extension, the technical object itself). Creative knowledge doesn't come from the world of objects. To deny a transcendent human memory is to reinstate the ancient aporia: purely human knowledge becomes impossible.

So for now, we should rephrase our question.

> It is impossible to deny the participation of human thought in the essence of *machinism*. But up to what point can this thought still be described as human?[31]

This, then, will be the subject of the next section. But we will approach it from a different angle, in order to question the relation of memory to technics, and also to question where these memories come from. Is it humans that remember previous generations of machines, and where are these memories stored? We will approach it from the perspective of evolution.

Epiphylogenesis and the Aporia of Memory

> Humans die, but their histories remain. This is what distinguishes them from animals.[32]

Death is the radical effacement of memory. It is the erasure of our personal experience, our personal histories—and it is an inevitability that we are aware of. We cannot take death away from each other, any more than we can take upon ourselves someone else's death. Death cannot be transferred, nor can we

31 Guattari, *Chaosmosis*, 36.

32 Bernard Stiegler, "Our Ailing Educational Institutions," *Culture Machine* 5 (2000): http://culturemachine.tees.ac.uk.

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deliver ourselves from it. It is our "first and last responsibility,"[33], and it is this question and this awareness which mark us as human. We are finite beings.

Our awareness of death is what drives us to create archives, technologies of retention and storage. We leave traces of ourselves and our experience in other people's memories, in the memories of our children; but also in the nonliving—in writing, in objects and artefacts, on cave walls, in woven rugs and on computer screens, in language and culture. We leave traces of our experience outside ourselves as individuals, traces that will not be lost when we die, but will remain.

> Among these traces most have in fact not been produced with a view to transmitting memories: a piece of pottery or a tool were not made to transmit memories, but they do so nevertheless, spontaneously. Which is why archaeologists are looking for them. Other traces are specifically devoted to the transmission of memory: for example, writing [and] photography.[34]

Bernard Stiegler argues that these inscriptions comprise a structure of inheritance and transmission, a structure that accumulates with each successive generation. It is a structure which exists outside our own genetic limitations, outside the finite lifetime of the individual, but which nonetheless carries in it our collective wisdom: the ideas and experiences that we have had, the techniques that we have learned, the tools and artefacts that we have created. For Eldredge, this is what we mean by the word "culture." Culture is but a series of memorials. In fact, it is a gift to others—the gift of death.

Importantly, this structure of inheritance and transmission, the material it contains, is not inherent to us. We are not born with it; it is not a genetic memory. It is inscribed and transmitted outside our genetic programs. In other words, we

33 Jacques Derrida, *The Gift of Death*, trans. David Willis (Chicago: University of Chicago Press, 1995) 44.

34 Stiegler, "Our Ailing Educational Institutions."

are born into it, we acquire it through experience. In is in this sense that Stiegler calls the structure epigenetic—it exists outside and in addition to the genetic, like a surrounding layer. This is a word in use by the scientific community as well, to designate "those characteristics inherited outside of genetic encoding and transmission."[35] We will be using it in the same sense, to designate that which is not coded for in our genes, but which we acquire.

To acquire something outside our genetic programming, then, this thing must exceed the biological. The epigenetic structure must pre-exist us; it must exist beyond our short lives to be subject to inheritance and transmission. We are born into it; it was here before us and it will continue after us. This is what Heidegger calls the already there, this "past that I never lived but that is nevertheless my past, without which I would never have had a past of my own."[36] Language is a perfect example. It is not genetic; it is acquired, and yet it has its own history, its own genealogy, its own memory that exceeds the individual. In entering into language, it creates a past for us, and we acquire this past, which we continue as our own. We might call this acquisition an "event." It becomes the interface through which we enter into relation with the world. So when we are born, we acquire something that we have not individually created but which, nevertheless, shapes our experience of the world. And unlike the plant and animal kingdom, this acquisition, this epigenetic event, is not lost when we die. In the case at hand, observes Stiegler, life conserves and accumulates these events.[37] There is history, there is culture, and there are the artefacts which carry them beyond our death—technics.

Consequently, Stiegler demarcates a third structure, the structure which stores and accumulates our individual

[35] Philip Cohen, "You Are What Your Mother Ate," *New Scientist* 4 (August 2003): 14.

[36] Stiegler, *Technics and Time*, 140.

[37] Stiegler, *Technics and Time*, 177.

epigeneses, which exists beyond our own central nervous systems, beyond our individual genetic and epigenetic memories. This contains what we are for the moment calling culture (past epigenetic events, lessons of experience), but also what we are calling technical artefacts. The structure is at once our own and also transcendental: it is larger than ourselves. It is a store, an accumulation, a sedimentation of successive epigeneses, a thing which evolves, which has its own historicity and dynamic.[38] Far from being lost when the individual human dies, it conserves and sediments itself. Stiegler calls this the epi-phylo-genetic structure, implying by that terminology a material genealogy proper to it.

So he distinguishes here between three types of memories out of which the human develops:

> Genetic memory; memory of the central nervous system (epigenetic memory); and techno-logical memory [epi-phylogenetic memory].[39]

Stiegler locates or amalgamates "language," "technics," "technique" and "technology" within this third type of memory, epiphylogenesis. Not because they are of an essence, but because they are all forms of memory support; they are forms of inscription, transmission and ultimately, transcendence. They are larger than ourselves; they exceed our death as human beings. Technics, however is afforded a special place here; although in common parlance it designates tools and instruments, Stiegler also uses the term in the Greek sense (technē). In other words, it designates skill, art and craft. Technical objects are the result of the transmission of these operational chains, which are transformed in time as artefacts. Language itself is also a technique, a skill, a mode of transmission—and thus it is a form of technics.[40] Technics, for

[38] Stiegler, *Technics and Time*, 140.
[39] Stiegler, *Technics and Time*, 177.
[40] Stiegler, *Technics and Time*, 94.

Stiegler, are always memory aids—whether they have been created explicitly so (for example, language or photography, which are mnemotechnics) or not (pottery and rugs). This is what he means by epiphylogenesis.

Epiphylogenesis, then, designates a new relation between the human organism and its environment. It is technics, as the support of the inscription of memory, which is constitutive of transcendence. The biological human, with its genetic and epigenetic memory, dies. This is the paradox of Man: "a living being characterised in its forms of life by the nonliving,"[41] by its relation to death. In other words, epiphylogenesis gives human beings access to transcendence, and thus to time. It is finitude, our constitutive finitude as biological humans (which the myth of reminiscence "forgets") that propels man to invent himself within this structure. But at the same time, this structure transforms the human as much as it is transformed by it. In Stiegler's terms, the "what" (technics) invents the "who" (humans) at the same time that it is invented. Neither term holds the "secret" of the other—neither term is originary. In this way, Stiegler develops Meno's aporia into an inextricable relation; it is our inscriptions in the nonliving, in what is dead (technics) which constitutes transcendence.

I will retain several of these concepts in my nascent theory of technical evolution. Firstly, the concept that technics is a memory aid—and that, unlike pottery or woven rugs, there are certain forms of information storage, communication and display that are also mnemotechnical systems: like the internet, or writing. That this memory aid is in itself nonliving, that it exceeds the biological, will also mean that its description must be of a different order to the biological. There will be a limit to Darwinian metaphors, as Eldredge put it. Technics constitutes its own domain, it has its own relationship to time and inheritance, its own dynamic radically different to what we find in nature.

41 Stiegler, *Technics and Time*, 50.

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Consequently, any genealogy of a technical machine will need to recognise that the "intellectual capital" of the societies in which particular technologies evolve belongs properly to this dynamic. The discourses surrounding the evolution of specialised techniques and procedures (for example, computer engineering), form a part of this system; they are not "purely" human, as they exceed the biological. They are systems which humans enter into and take on as their own, which are transformed in time as technical artefacts. Together, technics, technique and language constitute a third layer. This is what Stiegler means by epiphylogenesis.

Next, we need to ask how the passage to this "third layer" is effected. What is the process of "liberation" that memory pursues? And in an even more practical sense, how do particular elements of a technical system retroactivate or transfer themselves to other systems within this structure?

This emphasis on transfer and retroactivity will distinguish my theory of technical evolution from Stiegler's; Stiegler recognises these two phenomena, but subsumes them back into the logic of epiphylogenesis, the preservation in technical objects of epigenetic experience. I wish to draw them out as the dynamic which distinguishes technical phylogenesis. According to Eldredge's diagrams, the phenomena of horizontal transfer and retroactivity must be the basis of any theory of technical evolution, if we wish to capture the difference between technics and biology. In the following section I will look at how French anthropologist Leroi-Gourhan and Stiegler approach this dynamic. I will also look at a theory that has become quite popular in the last ten years, a theory which claims to account for the transmission of information by non-genetic means: memetics.

The Dynamics of Technical Evolution: Transmission and Innovation

To account for the passage from the genetic to the non-genetic, Stiegler draws on the work of Leroi-Gourhan. In his book

Gesture & Speech, Leroi-Gourhan proposes that the evolution of man is characterised by a "freeing of memory"—the exteriorisation of human capacities and genetic traits (what he calls "organs") into technics. For Leroi-Gourhan, this process silently propels our evolution as a species.

> The whole of our evolution has been oriented toward placing outside ourselves what in the rest of the animal world is achieved inside by species adaptation. The most striking material fact is certainly the "freeing" of tools, but the fundamental fact is really the freeing of the word and our unique ability to transfer our memory to a social organism outside ourselves.[42]

From the appearance of Homo Sapiens, the constitution of this external social memory dominates all problems of human evolution.[43] Technology has, in this sense, created the human as a species; humanity is nothing but a process of "exteriorisation," a process in which our access to time and culture is accomplished through external supports which transfer our memories. Tools are "exuded" by humans in the course of their evolution; they spring, literally, from the nails and teeth of primates, and in turn give us an non-genetic advantage over other species, who are condemned to hunt without weapons, to feel the cold against their skin without clothes. As a species, we are characterised by our physical and mental non-adaptation. Our memory is transferred to books, our "strength multiplied in the ox, our fist improved in the hammer."[44] For Leroi-Gourhan, we can trace all contemporary technologies back to this process of exteriorisation. Tool and gesture are now embodied in the machine; operational memory

42 André Leroi-Gourhan, *Gesture and Speech*, trans. A. Bostock Berger (Cambridge: MIT Press, 1993) 236.

43 Leroi-Gourhan, *Gesture and Speech*, 229.

44 Leroi-Gourhan, *Gesture and Speech*, 246.

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(technique) now embodied in automatic devices; the capacity to correlate recollections in the punched-card index.[45]

Consequently, Leroi-Gourhan understands technological evolution as a relation of the human to matter, where the human exteriorises technical forms. Further to this, he contends that technics is itself in perpetual transformation; it evolves in its organisation. It is at once its own milieu, separate from that of the human animal. This evolution is parallel to the evolution of the human, but it also organises itself. We can see here the inspiration behind Stiegler's concept of epiphylogenesis; there is a systematicity to the evolution of technics, a kind of techno-logic which is not entirely human. For Leroi-Gourhan, there is an inherent dynamism to technics, itself productive of new lineages and machines. When we look at particular machines in retrospect, it would appear that they were inevitable in some sense; as if they were guided by "archetypes":

> Everything seems to happen as if an ideal prototype of fish or of knapped flint developed along preconceivable lines … from the fish to the amphibian, to the mammal, or to the bird, from form-undifferentiated flint to the knapped tool, to the brass knife, to the steel sword.[46]

Everything seems to point to a universal technical "tendency." This tendency is the essence of technics; there is a necessity proper to it as a milieu. Consequently, the evolution of technics will have its own phylogenetic limits; as in the evolution of biological animals, there are only a given number of possibilities. Differentiation, the creation and development of new machines, artefacts and tools, is silently propelled by technical tendencies down certain lines. For Leroi-Gourhan, the human inventor is always guided by archetypes. He is but a combinatory genius,[47] selecting from and giving culturally

[45] Leroi-Gourhan, *Gesture and Speech*, 264.
[46] Leroi-Gourhan, cited in Stiegler, *Technics and Time*, 45.
[47] Stiegler, *Technics and Time*, 36.

specific embodiment to these archetypes. Technical continuity, its evolution as a milieu, is transcendent. This continuity, and its presence as archetypes, excludes "pure invention, ex nihilo."[48] So the human has a particular relationship to technics—that of exteriorisation—but at the same time, the technical milieu has its own dynamic which guides the process of invention itself, which exists beyond and before the inventor. The inventor is moved by technical tendencies.

The concept of allocating technics its own tendency is not new. Numerous theorists have explored technology from this perspective; among them, Guattari, De Landa, and even earlier, Simondon, whose concept of the progressive "concretisation" of technics is important for the development of Stiegler's argument.[49] For Simondon, the technical artefact constitutes a series of objects, a lineage or a line; at a cursory level, we can see this by the fact that machines appear across generations. At the origin of the lineage is a synthetic act of invention, constitutive of a technical essence.[50] This essence is recognised by the fact that it remains stable throughout the evolutional lineage, and not only stable, but productive of new structures and functions by progressive saturation. Machines speak to machines before they speak to man, as Guattari puts it,[51] and the language is not human.

But Leroi-Gourhan's technical tendency is universal; it is transcendent. And if there is a universal logic driving the evolution of technics as a system, how can we explain technical diversity? Evolution is all about diversity; it is in fact only in the process of differentiation that the logic of evolution is discovered. Similarly, Stiegler maintains that it is only in technical differentiation that the logic of epiphylogenesis can be

48 Leroi-Gourhan, cited in Stiegler, *Technics and Time*, 61.

49 Félixe Guattari, *Chaosophy*, ed. Sylvère Lotringer (New York: Semiotext[e], 1995); M. DeLanda, *War in the Age of Intelligent Machines* New York: Zone, 1992); G. Simondon, *Du mode d'existence des objets techniques* (Paris, Aubier, 1958).

50 Stiegler, *Technics and Time*, 77.

51 Guattari, *Chaosmosis*, 40.

discovered. For Stiegler, there is no "ghost" in the machine, no platonic essence we are striving towards. "The organising principle of the technical object is in this object qua tendency, aim and end."[52]

Confronted with diversity, Leroi-Gourhan posits two other dynamics at work at the lower, "ethnic" level, which diffract or instantiate the technical tendency: invention and borrowing. Invention, of course, does not occur in a vacuum; it is guided by technical archetypes. The inventor is really just combining the best technical forms for its realisation. Similarly, borrowing—from other cultures, from existing technical forms—is guided by archetypes. In fact, as Stiegler points out:

> Whether this evolution occurs by invention or by borrowing is of minor importance, since this … in no way contradicts [the] systemic determinism in its essence.[53]

What is important for Leroi-Gourhan is whether or not the invention is acceptable and necessary to that group of people. Human societies have a characteristic capacity to "accumulate and preserve technical innovations,"[54] and also to discard or forget them. This is connected with his concept of the social memory. To put it simply, technical objects are either taken up by human society or they are forgotten. In a sense (and here I am diverging from Leroi-Gourhan's thesis) society constitutes an "adaptive pressure" on the technical lineage. Technical objects are not a fact, but the result of human need and human choice.

But how far can we take this essentially zoological analogy? For at base, technical evolution marks a break with genetic evolution. At some level, and at some point, the analogy must stop. For Eldredge, as we have seen, it stops at intelligent design. So how are we to understand this dynamic—from a

52 Stiegler, *Technics and Time*, 79.
53 Stiegler, *Technics and Time*, 52.
54 Leroi-Gourhan, *Gesture and Speech*, 10.

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biological, a zoological or a social perspective? For Leroi-Gourhan, the dynamic is essentially zoological.

Stiegler wants to abandon the zoological metaphor altogether. He wants develop a theory of technological evolution which is not the "partner" of human beings or human society. It is not the partner of any other system. For Stiegler, the technical object lays down its own laws; its logic is entirely and radically its own, and it is to be discovered only in its historical differentiations. The inventor, for Stiegler, is not even a "combinatory" genius; he is but a passive observer, reading a message that already exists in the technical object.

But before we come to Stiegler's thesis, I would like to conclude this section by briefly exploring the popular science of memetics. Given its origins in the work of evolutionary theorist Richard Dawkins, memetics has been heavily influenced by evolutionary biology.[55] It uses a biological analogy to explain the transfer of non-genetic information between human beings, and between human beings and technical artefacts. Based on the concept of the gene, it postulates the existence of another evolutionary agent—a replicator—to explain cultural change over time. This agent is called the "meme." Like many of the theories we have explored (and, Stiegler would argue, philosophy itself), memetics "forgets" the material substrate that contains this privileged entity.

Dawkins defines a meme as a "unit of cultural inheritence," a piece of information propagated through imitation, undergoing a process of selection where the most efficient, rapid and successful replicators survive. Common examples include TV jingles, recipes and religious beliefs. The meme stands for a process of selection in any given human population to benefit *itself,* not the host, which is also the basis for Dawkin's selfish gene. Like the cybernetic concept of information as a "ghost-like, disembodied entity that can flow between carbon-based organic components and silicon-based

[55] See Richard Dawkins, *The Selfish Gene* (Oxford: Oxford University Press, 1989).

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electronic components,"[56] the meme is a theoretical construct; it cannot be seen or touched, although its effects, memeticists would argue, can be observed.

> Everyone has had the experience of someone else expressing opinions similar to their own or behaving like they do. [To memeticists] this suggests that there are multiple copies of the information underlying that belief or behaviour in the population.[57]

Memetics is useful for explaining how intellectual capital is inherited over time, and even more importantly, as Aunger observes, for explaining cultural similarity. Memetics is not good at explaining how the great body of human knowledge has *accumulated* so rapidly over the last few centuries.[58] I contend that it also ignores, or at best downplays, the role of material technical artefacts in human culture. As I have been arguing in this essay, this is understandable; for over two thousand years, philosophy has repressed technics as an object of thought. Like many of the theorists we have explored here, memeticists assume that technical artefacts are not *agents* in the evolution of human culture; human beings cannot *learn from* technical artefacts; and at base, that technical artefacts are not a fact, but the result of human thought (or in this case, memes). In the literature on memetics, material cultural artefacts like books, pots and computer screens are referred to as "environmental contingencies" (Boyd & Richerson), "containers" (Blackmore) and "vehicles" for selfish replicators (Dawkins). Human culture has evolved so rapidly due to a disembodied entity that we transmit to each other like radio signals—the meme.

56 N. Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature and Informatics* (Chicago: University of Chicago Press, 1999) 1-2.

57 Robert Aunger, "Conclusion," *Darwinizing Culture: The Status of Memetics as a Science*, ed. Robert Aunger (Oxford: Oxford University Press, 200) 205-32.

58 See R. Boyd and P. J. Richerson, "Memes: Universal Acid or a Better Mouse Trap?" *Darwinizing Culture*, 143–162.

> That which is preserved and transmitted in cultural evolution is *information*—in a media-neutral and language-neutral sense.[59]

This media-neutral and language-neutral agent has been used to explain the rise of civilisations, of consciousness, culture, and even the concept of "self."[60] The transmission of memes between generations occurs predominantly by what may be called "social learning"—teacher to learner, master to apprentice, from human brain to human brain. Technical artefacts like computers and books are temporary way-stations.

> Most culture is information stored in human brains—information that got into those brains by various mechanisms of social learning.[61]

As has often been observed in the literature, memetics is itself a successful meme. There are numerous criticisms of memetics that I have not explored here; the interested reader should start with Dennett and Aunger. I simply wish to observe that memetics will not be useful to any project which seeks to account for the differentiation of technical artefacts in different technical systems. It assumes from the outset that humans cannot learn *directly from artefacts*—reading from the text of matter—and that technical artefacts have no causal or productive role in human evolution. Humans invent technics; technics does not pre-exist or constitute the human.

To return to our original diagram, and the break from genetic evolution—for a memeticist, retroactivity and horizontal transfer are processes that take place within human thought, and human thought alone. From Leroi-Gourhan's perspective, and also from the perspective of memetics, the inventor is a "combinatory genius," someone who recombines and blends different memes in an innovative way, or as Leroi-

59 Daniel C. Dennett, *Darwin's Dangerous Idea: Evolution and the Meanings of Life* (New York: Simon and Schuster, 1995) 353.

60 See S. Blackmore, *The Meme Machine* (Oxford: Oxford University Press, 1999).

61 Boyd and Richerson, "Memes: Universal Acid or a Better Mouse Trap?" 143-4.

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Gourhan might put it, selects from different technical archetypes. The technical artefact is the *product* of a recombinant thought process.

Anticipation and the Technical Object

But does this capacity of anticipation not itself presuppose the technical object, asks Stiegler?[62] Think of the discourses describing and explaining technical processes (engineering discourse, for example)—do these not presuppose the technical object?

In fact, they not only presuppose the object itself; they presuppose its past, its current state, its limits and its possibilities. Technical objects belonging to different "branches" of the evolutionary tree and "dreamed-of" technical objects are part of the same evolutionary structure. Invention, in this sense, is not purely human. Anticipation is itself a technique, acquired like any other. As Guattari puts it, technico-scientific thought, the ability to use or create technical artefacts, presupposes a "certain type of mental or semiotic mechanism,"[63] and this mechanism is itself inherited. For example, the invention of the first third generation computer language presupposed not only the computer itself, but an extant machine language, an extant assembly language, an extant "natural" language, the limits and the logic for combining these, and the technical necessity for combining them.

As Eldredge put it in an interview with the author (2004):

> One of the craftsman I have used to restore my old cornets started out as an apprentice in the German company Alexander Gebr. For the first year, he got there before dawn, lit the fire, swept up and, I guess, made the coffee. He wasn't allowed to touch anything for that entire first year-and then was given the simplest of tasks. By degrees he was taught all the intricacies of

[62] Stiegler, *Technics and Time*, 81.

[63] Guattari, *Chaosmosis*, 36.

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> how to make a trumpet from sheets of brass-and by the end of his five year apprenticeship, he was a master trumpet builder. Put another way, the best cornetist who ever lived never heard of a cornet, much less saw or played one. You have to live in a place where cornets have already been dreamt up and manufactured, and music conceived for cornetists to play.[64]

Knowledge of technical objects—how to use them, how to create them, and how to "improve" them—is itself inherited.

Stiegler takes this argument further: if it is explicitly as technical consciousness that man invents himself, and it is within this consciousness that anticipation of the technical object occurs, then the technical object is anticipated by none other than itself. This is what he means by epiphylogenesis. The epiphylogenetic structure is not engendered by the human subject in the course of its evolution, as it is for Leroi-Gourhan, it is "engendered by the object in the course of its evolution."[65] Technics has engendered its own milieu, and this milieu both describes its past and circumscribes its future.

To return to our argument from the last section: retroactivity and transfer appear as none other than anticipation itself, the process of invention within circumscribed trajectories. They are not a "problem" for technical evolution; they are its mode of inheritance, a techno-logical maieutic. Stiegler, then, is pushing this concept further; the ability to anticipate presupposes the technical object in that anticipation is itself a discourse, an acquired technology. This calls for a new definition of technology; technology is:

> therefore the discourse describing and explaining the evolution of specialised procedures and techniques, arts and trades—either the discourse of certain types of procedures and techniques, or that of the totality of techniques inasmuch as

64 Eldredge, interview with the author 2004.

65 Stiegler, *Technics and Time*, 78—emphasis added.

> they form a system: technology is in this case the discourse of the evolution of that system.[66]

The definition necessitates, in my hypothetical genealogy of a technical object, an appreciation that the discourses describing and explaining specialised techniques and procedures (engineering discourse, for example) both anticipate and mark a limit to the technical object. It also necessitates an awareness of what has already come to pass, and how this past circumscribes any future object. In our theory, we will keep the inventor's role, but it will be qua an actor listening to cues from the object itself, "reading from the text of matter."[67] The inventor will be situated between heterogeneous Gillean systems: economic and political discourse, industrial discourse; but most importantly, the inventor will be situated within the evolution of technology itself.

De Landa has a similar project: to explore the history of intelligent machines from the perspective of the machines themselves, to trace the externalisation of mental or semiotic processes which are themselves already techno-logical. This transfer will take place within an extant technical system. He posits the figure of a "robot historian" tracking the machinic phylum for "bifurcation" points:

> [the robot historian] would, for example, recognise that the logical structures of computer hardware were once incarnated in the human body in the form of empirical problem-solving recipes … these may then be captured into a general-purpose, "infallible" recipe (known as an "algorithm"). When this happens we may say that logical structures have "migrated" from the human body to the rules that make up a logical notation (the syllogism, the class calculus) and from there to electromechanical switches and circuits.[68]

66 Stiegler, *Technics and Time*, 94.
67 Stiegler, *Technics and Time*, 75.
68 Manuel De Landa, *War in the Age of Intelligent Machines* (New York: Zone Books, 1994) 4.

This concept of a "traceable" migration path from humans to technical objects is quite similar to Leroi-Gourhan's concept of exteriorisation, the freeing of memory. Yet De Landa does not offer a logic for the human drive to invent ourselves in the technical; nor does he offer a specific explanation of how technical phyla are different from biological phyla. It is precisely these differences which will be of interest to us, and it is precisely these differences which have in fact given us the logic of technical remembering (epiphylogenesis).

So we have established a logic to articulate the evolution of a technical object. But one question remains—what is a technical object? For both Eldredge and Stiegler, this is a crucial question.

Defining the Technical Object: Form, Function and Operational Process

> In both biology and material cultural systems, history is indeed staring you in the face when you look at a wombat or a cornet. But there is no way to divine that history unless you compare a series of objects that you assume a priori are related.[69]

Niles Eldredge demarcates lineages for his trilobites on the basis of shell shape. Certain shapes emerge at certain points in time, and these shapes diverge irrevocably into different branches of the phylogenetic diagram. This technique is called comparative anatomy, and it works under the assumption that similar morphological structures in different organisms have a common evolutionary origin. Aside from comparative anatomy, there are several other ways to determine evolutionary relationships: comparative embryology, molecular, behavioural, physiological, chemical and fossil data are also used. A particularly popular technique involves DNA sequencing, which compares the precise sequence of nucleotides in two samples of DNA.

[69] Eldredge, interview with the author, 2004.

This is how biology builds the concept of a species. It locates certain recurrent and inherited characteristics that distinguish it from other species. For example, human beings have 46 chromosomes, we have an upright posture and a pronounced temporal cortex. This distinguishes us from chimpanzees, who have 48 chromosomes and a smaller brain. For certain biologists (Eldredge and Stephen Jay Gould in particular) you can hence call the resulting species an "entity"—a large-scale system. The individual is nothing outside of its history and its inherited characteristics.

> What we're saying is that species are entities. They have histories, they have origins, they have terminations, and they may or may not give rise to descendent species. They are individuals in the sense that human beings are individuals, albeit very different kinds of individuals. They're large-scale systems that have an element of reality to them, and that's a big departure in evolutionary biology.[70]

But to regard a species as a large-scale system, biologists must necessarily assume that particular morphological or genetic characteristics constitute its unity. These characteristics are inherited by each generation, they become "entrenched," they constitute a lineage or a line.

The analogy cannot be so easily transferred to technical machines, however. If we define technical lineages by their form (as Eldredge has done by collecting a particular kind of musical instrument based on the way the pipe is wound) then the lines become tangled. The form is simply not maintained in any sensible fashion over time—it jumps around and changes depending on the technical innovations available to it. The bell jumps from right to left, the valves change from the earlier Stolzel form to the later Perinet form. It becomes difficult to "rank them in any sensible order of ancestors and

70 Niles Eldredge, "A Battle of Words," *The Third Culture*, ed. John Brockman (New York: Simon & Schuster, 1996) 121.

descendents."[71] The same applies to computing, for example. If we define a computer by its form—an electronic machine conveying information encoded as binary logic across silicon circuits, then the analogue computers from the late '30s and early '40s seem completely unrelated. They used neither silicon nor binary logic, and were based on brass gears, wheels and shafts that had more in common with Eldredge's cornets.

If we define a technical lineage based on function, the problem recurs. Let's return to computing as an example. At the end of the nineteenth century, the word "computer" meant a human operating a calculator. Early in the twentieth century, these "computers" became large group of mostly female humans performing mathematical calculations by hand or on slide rules, housed in large warehouses.[72] At the time, these groups were organised for one express purpose: to perform calculation-intensive operations for the military, primarily ballistic analysis and the creation of artillery ranging tables. The "function" of a computer was to produce mathematical data for the military. This changed radically over the next 50 years, going through several stages I do not have time to elaborate here. The result today is that a computer has a multitude of different functions—the very least of which is the production of artillery ranging tables. For a start, computers are personal devices that manage and create our everyday working environment. They are nodes in a greater network—the internet. They are the engines of a new form of capitalism, and arguably, a new social order. The list goes on, but the fact remains: the function of the "computer" has changed beyond recognition since the turn of the twentieth century. To trace a phylogenesis based on human function would result in a greater mess than Eldredge's retroactive cornets.

So if we can't trace a lineage based on form or function, how can we distinguish one technical system from another? As

71 Eldredge, cited in Walker, "The Collector," 41.

72 P.E. Ceruzzi, *A History of Modern Computing*. (Cambridge, MA: MIT Press, 1998), 2.

Eldredge himself discovered by applying the scientific method to technical evolution for the first time, there is an undeniable evolutionary dynamic going on. Technical machines come in generations, they transform themselves in time, they adapt and adopt characteristics. We have established that this dynamic is not genetic, that its mode of transfer in fact constitutes a break from genetic evolution. We have established that this break revolves around transfer and retroactivity. We have demarcated a "third milieu" to which both the technical artefact and techno-logical memory belong, based on Stiegler's concept of epiphylogenesis. But the problem remains: which entity, or which group of "characteristics" are we tracing here?

For Gilbert Simondon, we need to understand the genesis of technical objects independently of the human functions which establish use behaviour. For if one seeks to establish a lineage based on use "no set structure corresponds to a defined use."[73] The object will invent itself independently of any fabricating intention. For example, while Tim Berners-Lee invented HTML to organise the text documents of CERN (Centre Européenne pour la Recherche Nucléaire), it has since become the lingua franca of a global mnemotechnical system. It has adapted and evolved, and it has both incorporated and engendered new functions and new material technologies in the process.

The uses and functions of a technical object can never be known, these will only be realised in the evolution of the object itself. The technical object is not concrete, it is not determined in its uses. This is why the influence of "working prototypes" on the engineering community is so important; the fabricating intention has little relationship to the object itself, and it is the object as a working prototype that will engender new structures and functions. Technical machines, maintains Simondon, evolve by a process of functional overdetermination. After they have been given a materiality, after the "synthetic act of invention" has taken place,

[73] Cited in Stiegler, *Technics and Time*, 69.

> each component in the concrete object is no longer one whose essence is to correspond to the accomplishment of a function intended by the constructor, but a part of a system in which a multitude of forces operate and produce effects independently of the fabricating intention.[74]

Subsequent evolution is accomplished by a process of "concretisation," the condensation of various functions in a single structure oriented toward efficiency: the base of a light bulb must seal it for operation within a certain range of temperatures and pressures while also fitting in standard sockets.[75] But we are still left with a problem: how do we identify the lineage of machines themselves? How do we identify their family resemblance?

In evolving, the technical object constitutes a series of objects, a lineage or a line. This lineage, of which the synthetic act of invention is the ancestor, cannot be identified by a particular material form or human use. For Simondon, it can only be identified by a group of procedures or processes that remain stable throughout the evolutional lineage. It is these procedures, implemented in the most diverse domains of use, that constitute the unity of the lineage. This is why there is a more real analogy between "a spring engine and a crossbow than between the latter and a steam engine."[76] Both are implementations of procedures to work with tensile forces, both are the externalisation of an originary heuristic. There will be a variety of such procedures embodied in any given object—it is not a matter of locating one. Nevertheless, that which resides in machines is certainly only "human reality, the human gesture set and crystallised into functioning structures."[77] To demarcate

74 Cited in Stiegler, *Technics and Time*, 75.

75 Andrew Feenberg, "Heidegger, Habermas, and the Essence of Technology," talk given at the International Institute for Advanced Study, Kyoto 1996: http://www-rohan.sdsu.edu/faculty/feenberg/kyoto.html.

76 Cited in Stiegler, *Technics and Time*, 70.

77 Cited in Stiegler, *Technics and Time*, 67.

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a technical object or family of objects, one must first locate these procedures and processes.

So where does this leave us in our prolegomena to the history of a machine? After Eldredge, we have established that technical objects transform themselves in time, they engage in horizontal transfer and retroactivity. After Stiegler, we have established that this dynamic constitutes a break from genetic evolution, and that this break in turn constitutes its own milieu. We have defined the technical object based on a group of techniques or processes that have remained stable throughout its evolutional lineage. And after Leroi-Gourhan and De Landa, we have suggested that these techniques originate in human processes, human processes which are themselves already technological. The family resemblance will only be seen in the workings of the technical object itself, and not its intended human function. However, any technique, once externalised into a technical artefact, will engender new structures and new techniques. If a technique may be defined as itself a technical being, then its incarnation qua material artefact may be seen as "the being passing out of step with itself,"[78] a becoming individualised.

What remains to be created is a practical example of this theory, the story or the diagram of a particular technical machine. This story has yet to be written.

[78] Gilbert Simondon, "The Genesis of the Individual," *Incorporations* eds. Jonathan Crary and Sanford Kwinter (New York: Zone Books, 1992) 314.