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Unweaving the Program: Stiegler and the Hegemony of Technics

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1 - Technics as the origin and destiny of the human

Technics has become the master metaphor of our times, the basis of a new theology: a constellation of concepts, models and paradigms (such as information, system, program, prosthesis, language, machine, writing, and code) without which it would be impossible to think “life”, “mind” and (particularly) the “human”. In the human sciences, culture and language have also been progressively engulfed by the universe of technics: the artificial realm of institutions, rituals, knowledges, symbol systems and practices that makes humans functional, speaking, meaning-making creatures; that is, what makes humans *human*. The essence of the human, it seems, is the technical; which is paradoxically the *other* of the human: the non-human, the manufactured, unnatural, artificial; the inhuman even. Humans suffer from a distinguishing congenital lack; they are the only kind of animal that undergoes such an extended period of latency. According to one of the dominant theories, our premature birth is an evolutionary consequence of narrower hips, developed for bipedal walking, and larger craniums. Because of this innate immaturity, the early human infant has been referred to as an “external foetus” (Bostock qtd. in Schore). The human brain also develops externally, and its exceptional neural plasticity is a fundamental factor in the process of enculturation, skill acquisition and technical incorporation.

In the various fields concerned with the study of human evolution, technics has been central to the definition of the species. The sciences of human evolution are developing increasingly persuasive scenarios in which factors such as techniques, material culture, tool making, and niche engineering come to play a crucial role in the genesis and development of certain morphological and cognitive features that are distinctly human. For example, Stanley Ambrose has argued that brain hemisphere specialisation might be the result of the continued bimanual coordination required for tool making (“Paleolithic Technology”); in a similar vein, Lewis Wolpert has argued that causal belief (a cognitive ability exclusive to humans) might have developed from a long history of interaction with tools (“Casual Belief”).

Technics and Time (three volumes, with two more projected), the philosopher Bernard Stiegler has

made an original and provocative contribution to this ongoing rethinking of the relation between technics and the human. Stiegler argues that this is *the* key philosophical question of our times, and “constitutes what is most properly to be thought” (Vol. 1, 10). We are thus confronted with

... the urgency of an elucidation of the relations holding, at an ontological level (if one can here still refer to ontology), between anthropology and technology. This, at a time when technology has disquietingly cast doubt upon, while perhaps for the first time directly confronting, the very form of this question: what is the nature of the human? (88)

Stiegler closely follows Heidegger in posing technology (as the present stage in the history of technics) as an epochal rupture that demands an overcoming of the foundations of western metaphysics. [1]

Modern technics inflicts violence upon *phusis*; technics is no longer a modality of disclosure in accordance to the growing of being as *phusis*. Technics becomes modern when metaphysics expresses and completes itself as the project of calculative reason with a view to the mastery and possession of nature, itself no longer understood as *phusis*. And yet the being that we ourselves are is much less placed in a situation of mastery over nature by technics than it is subjected, as an entity belonging to the realm of nature, to the imperatives of technics. (Vol. 1, 10)

Heidegger is a central figure in *Technics and Time*. Stiegler integrates concepts of Heidegger’s existential analytics (being-towards-death, facticity, etc.) while also moving against the grain of phenomenology, positing a constitutive structure beyond the horizon of the phenomenon: a framework at once material and transcendental that supports consciousness, meaning and experience. Stiegler also examines a range of other thinkers (Husserl, Simondon, Derrida, Leroi-Gourhan, Rousseau, and Kant, mainly). He is primarily concerned with the temporal aspect of technics as constitutive of consciousness, thought, culture and psychosocial individuation—the human for short. Technical supports (inscriptions, representations, language, and material culture in general) constitute the factual texture of existence, the *already-there*, the historical; they are fundamental to the human, grounding its distinct capacities to recapitulate the past and anticipate the future, both individually and collectively. Stiegler reproaches Heidegger for being “inattentive” (251) to the primacy of technics. He asks rhetorically:

If the already-there is what constitutes temporality in that it opens me out to my historicity, must not this already-there also be *constitutive* in its positive facticity ... in the sense that its material organization in form constitutes historicity itself, prior to and beyond history? (240)

The relation between technics and time has two dimensions. The first half of the question concerns the constitution of technics *in* time, and involves the evolution of technical systems (Gille and Simondon), the process of humanisation (Leroi-Gourhan) and the historical interplay between them leading to the present epoch, which is marked by a global “industrialisation of consciousness”. The second half of the question examines technics as constitutive *of* time: how technics is fundamental to the existential structure of the human, grounding the possibility of memory and anticipation. Through the Greek myth of Prometheus and Epimetheus, Stiegler conceives of technics as a *thanatology*: “technical life—that is, dying” takes place between the realm of the immortal gods and that of animality (that is, “living without knowledge of death”) (186). Deep in the heart of “epiphylogenetic” inscription, the anticipation of death is born. Stiegler thus rearticulates Heidegger’s assertion that *Dasein* is a “being for death” to incorporate the substratum of its facticity as properly technical:

This is not a “program” in the quasi-deterministic biological sense, but a cipher in which the whole of *Dasein*’s existence is caught; this epigenetic sedimentation, a

memorization of what has come to pass, is what is called the past, what we shall name the *epiphylogenesis* of man, meaning the conservation, accumulation, and sedimentation of successive epigeneses, mutually articulated. Epiphylogenesis is a break with pure life, in that in the latter, epigenesis is precisely what is not conserved ... Epiphylogenesis bestows its identity upon the human individual: the accents of his speech, the style of his approach, the forces of his gesture, the unity of his world. This concept would be that of an archaeology of reflexivity. (140)

Individual finitude has its counterpart in perceptual finitude, the cycle of retention and protention that grounds the flow of consciousness in its microtemporal scale, and which Stiegler reconceptualises, through a critique of Husserlian phenomenology, as also fundamentally conditioned by technical supports.

Stiegler's approach, then, is twofold. Firstly, his repetition of the history of metaphysics aims to uncover technics as the suppressed, foundational supplement: the originary prostheticity of thought. For example, Stiegler locates in Rousseau's and Leroi-Gourhan's accounts of the appearance of the human a suppression of technics; a forgotten origin that must be veiled over by a second origin: a miraculous birth of the human proper (as intellectual substance or symbolic consciousness). Stiegler, on the contrary, argues that technics is the decisive event in the historical genesis of the human; in fact, both the human and technicity proper appear at the same moment.

Secondly, Stiegler inhabits the work of certain figures (in particular Simondon, Husserl and Leroi-Gourhan) from whom he adopts and adapts some key conceptual tools, such as tendency, individuation, tertiary retention, exteriorisation and program. There is a less successful attempt to engage with a range of scientific and technological developments; in particular genetics and biotechnology, which will be discussed here shortly. The application of technics as a theoretical framework, in a traditional sense, is not entirely commensurable with the deconstructive side of Stiegler's project. On one hand Stiegler uses technics to think beyond the *aporia* at the heart of philosophy, the limit of thought at the origin of the great fault-lines of western thought. Mario Sei writes of

the impossibility of furnishing a foundation for knowledge that is not circular, and which, more generally, hinders us from contemplating the possibility of a thought or a consciousness that does not reside, always and in every case, in the *a posteriori* of its contents. (338)

Stiegler, then, considers technics as exteriorisation in the sense of "concretisations of sense and deposits for extra-organic memory traces" (*ibid.*). As such, technics opens the way for thinking beyond this *aporia*, as the condition of possibility of all individuation, be it of consciousness or a collective "we". An important context here is the approach of Derrida and, more generally, of deconstruction. Deconstruction approaches technics through careful hermeneutical work aimed at unveiling the logic of supplementarity: to trace the originary but forgotten term, the expelled other in the metaphysical determination of some central figure of thought (logos, speech, reason, nature). Deconstruction cannot offer a theory of technics; only of technics as a figure in the context of a particular determination (technics *in* Heidegger, technics *in* Leroi-Gourhan, etc.) Most importantly, deconstruction approaches technics as a case of writing. The technical universe of writing is mobilised as a series of metaphors to imagine the essence of all technical activities and things. In *On Grammatology*, Derrida writes:

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

Although Derrida believes that writing cannot be subsumed under technics, he leaves the other option open: to think technics under the model of arche-writing. Stiegler sets out to *materialise* the trace partly in an effort to historicise the Derridean approach; to use it as a basis for an empirically oriented view of technology in the context of a politics and a project of intervention into the mechanisms of education and cultural production. But technics has some difficulty playing both the role of metaphysical figure, a transcendental vanishing point of the real, and that of a unifying framework that sets out to trace the essence and logic of technics across its concrete differentiation and diversity. Stiegler's argument might be more successful if we limit its scope to media and cognitive technologies. Stiegler's framework also comes to underpin a historical narrative of epochal ruptures leading to a final crisis in which technology comes to play an apocalyptic role, threatening "us" with cultural dissolution, biotechnological takeover, and phenomenological collapse. As *Technics and Time* progresses, this historical-empirical aspect comes to predominate, becoming the cornerstone of the critique of industrialisation and of a formulation of a politics of the *we*. This is not a lapse of rigour, nor what Ekman diplomatically describes as "insistent leanings in empiricist directions" (52), but the trunk of Stiegler's argument; without it, *Technics and Time* would consist of a handful of exemplary but discrete, localised deconstructive exercises.

At times Stiegler's argument veers towards a kind of reductionism and essentialism about technics. One of the targets of this paper is this tendency to shrink the history of technology into a logical trajectory that thinks technics in terms of writing and related metaphors. This logic rests on a series of ontological ruptures, in particular a radical division between the living and the nonliving. As we shall see, these issues are interwoven with a number of other problems. In particular, I focus in Stiegler's mobilisation of informatic models applied to processes of enculturation, the barrier between the living and the nonliving, and to figure the technical contamination of the living. The notion of "program", a central tool of Stiegler's project, will be given special attention. There is also some tension arising from Stiegler's attempt to combine distinct approaches (such as Leroi-Gourhan's, Simondon's and Derrida's) that find their genesis in quite different philosophical concerns and fields of application.

I will conclude by advancing an alternative myth to that of Prometheus: the Sumerian story of Inanna and the transmission of technics into civilisation. This myth suggests another way of approaching the question of technics, with perhaps a more interesting or liberating conclusion: there is no technics, no technology above and beyond pure differentiation.

2– The organised inorganic who

What is technics, then? For Stiegler it is, first and foremost, "organised inorganic matter".

... to draw out the possibilities for an analysis of technical dynamics that is reducible neither to mechanics not [sic.] to biology nor to anthropology. I shall show... how various contributions to a theory of technical evolution permit the hypothesis that between the inorganic beings of the physical sciences and the organized beings of biology, there does indeed exist a third genre of "being": "inorganic organized beings," or technical objects. These nonorganic organizations of matter have their own dynamic when compared with that of either physical or biological beings, a dynamic, moreover, that cannot be reduced to the "aggregate" or "product" of these beings. (Vol. 1, 17)

After assigning technics its own autonomous ontological realm, Stiegler moves on to its human genesis. The dynamic of technics is for Stiegler as much anthropological as it is technological. There is a symmetrical *mise-en-abyme*: technics is the inscription of the living on the nonliving, the continuation of life by means other than life (15, 50), while the technical also incorporates the organic as its "neuronal" support (Vol. 2, 256). The human is marked by prosthetic existence, "characterised in its forms of life by the nonliving—or by the traces that its life leaves in the

nonliving" (Vol. 1, 50). This process of inscription, reflection and progressive sedimentation begins at the very dawn of the human (that is, of technics proper). So, Stiegler says, this is where we must begin.

If we now wish to address the problem of the nature of the human, and if the nature, the essence, or the principle of a being lies in its origin, then we will have to question the origin of the human, with the risk, once again, of having to call into question the very possibility of an origin The question of origin is that of principles, of the most ancient, of that which, ever since and forever, establishes what is in its being. The question of origin is the question of being. (95)

To fix an origin means to commit oneself to a certain view of technics, of its essence. But this quickly leads us to an *aporia* (the originary question at the very limit of thought) that can only be thought (or "endured") through a "passage to the limit" (98). Socrates attempts this passage by way of a myth (Persephone, in Plato's *Meno*). In response, Stiegler offers two myths: he revisits Prometheus and Epimetheus, and fashions an anthropotechnical creation story out of Leroi-Gourhan's theories on human evolution. The technical tendency has its origin in zootechnics, "the relations established between the human *qua* living matter and inert matter *qua* the "raw material" out of which technical forms appear" (Vol. 1, 46). Yet technics *proper* and the human appear together, *all at once*. Epiphylogenesis begins with the *exteriorisation* of the cortex, the event that plunges the living into extra-genetic, human existence—and into technicity proper. It is an exteriorisation that does not imply a preceding interior (a natural or originary form, property or quality). Mobilising Derrida's (non)concept of *différance*, Stiegler claims that the human is invented

... at the very moment of its passage, from *phusis in difference* (life in general) to the difference of this difference. *Différance* is neither the *who* nor the *what* but their co-possibility, the movement of their mutual coming-to-be, of their coming into convention. The *who* is nothing without the *what*, and conversely. ... The passage is a mirage: the passage of the cortex into flint, like a mirror proto-stage. This proto-stage is the paradoxical and aporetic beginning of "exteriorization." It is accomplished between the Zinjanthropian and the Neanthropian, for hundreds of thousands of years in the course of which the work in flint begins, the meeting of matter whereby the cortex reflects itself. Reflecting itself, like a mirror psyche, an archaeo- or paleontological model of reflexivity, somber, buried; freeing itself slowly from the shadows like a statue out of a block of marble. The paradox is to speak of an exteriorization without a preceding interior: the interior is constituted in exteriorization. (141)

The origin of the human and technics is, then, simultaneous, a double origin that is at the same time a non-origin. It is a dynamic in which the elements are constituted in their relation.

... the issue is one not of a cause but of a *coup*, whose dynamic development is marked simultaneously on tools, on the cortex, on the group, and on the territories that it impregnates, occupies, or cuts across. Depending on whether one sees the boundaries or decodes the slow, mixed, apparently contradictory movements, stratified tendencies penetrating into one another, one's observations split into divergent paths. (174-175)

Yet the "essential element, the first coup, engendering all the others and being transformed in transforming all the others in its wake" is the *inorganic organisation of memory* (174). Flint is the original "vector" of epiphylogenesis, at the dawn of hominisation (175). The human "invents himself in the technical by inventing the tool—by becoming exteriorized techno-logically" (141). Thus, flint "is the first reflective memory, the first mirror" (142).

The first stage of exteriorisation gives rise to culture, the possibility of cumulative collective memory. The “epigenetic layer of life” (individual experience) “far from being lost with the living when it dies, conserves and sediments itself...” (140). This represents an “emancipation” from genetic programming (150), a point that Stiegler stresses repeatedly.

This inaugural moment will be a model for future developments, informing later ruptures in the history of technology (writing, cinema, informatics, etc.) that are also critical shifts in the dynamics of the *who* and the *what*. There must be a coherent structure shaping our questioning of technics as an intelligible question for *us*. Stiegler follows Heidegger in an approach to the history of technology that subsumes it to a history of Being; a history marked by distinct breaks, but with an overall distinguishable direction and internal logic. Stiegler contextualises this history a lot more than Heidegger does, incorporating a clear sense of social, economic, cultural, and political determinants; yet there is a recurring tendency to abstractness, to consider the *what* and the *who* in a vacuum, in terms of a progressive logic of deepening and acceleration.

It is also important to emphasise that Stiegler’s argument is strongly *genetic*. Future developments will repeatedly be referred to this moment of genesis in which the dynamic of technics is set in place. “[T]he supplement is an always-already materialized trace ..., not simply a formal entity whose analysis could be absolutized outside of its material *genesis* itself. The logic of the supplement is the *différential* logic of already-formed matter: a logic preceding the opposition of form and matter” (Vol. 2, 4).

Although Stiegler is ambiguous about the scientificity or historical accuracy of his myth, the choice of flint is telling, as it reveals the basic metaphoric scaffolding of epiphylogenesis and the analytical elements it mobilises (exteriority, surface of inscription, reflection, etc.) Can this flint-cortex dynamic be a viable way to approach the genesis of the human and technology?

Although stone tools are the most predominant type of evidence in the archaeological record, they were not the first technical invention. Stonecutting most likely developed alongside a range of other innovations in food preparation, shelter, storage, transportation, and tracking and hunting. Early tools were probably made of bone and wood; if animal technics is any guide, the first tools were found objects, instances of “natural” technics. The human body itself could be considered the first mirror or surface of inscription, as technical developments required new techniques, and practices of incorporation, transmission, and enculturation. [2]

Part of the problem with Stiegler’s take on this early history lies in his engagement with Leroi-Gourhan’s work, beginning with the striking claim that *Gesture and Speech* is “the last word on paleoanthropological thinking— ... replete with questions as yet untouched by any real research” (84). The relations between technics, language and human evolution have been an intense focus of research and speculation in the more than forty years since the publication of *Gesture and Speech*, and some discussion of this work could have enriched the argument, perhaps yielding a different picture. Without underrating the importance and originality of Leroi-Gourhan’s work, three things are apparent. Firstly, Stiegler adopts as central to the historical part of his argument precisely some of the shakiest of Leroi-Gourhan’s hypotheses: *program*, *exteriorisation*, and *tendency*. Secondly, these theories are lifted from their original empirical contexts to support a very different set of claims. Lastly, Stiegler follows Leroi-Gourhan in drawing a picture of evolution as a coherent trajectory. In his appraisal of *Gesture and Speech*, Tim Ingold characterises Leroi-Gourhan’s approach as “resolutely orthogenetic”, assuming “a certain inevitability about the whole process” of human-technics coevolution (417):

... Leroi-Gourhan aims to encompass the entire history of human technology within an all-embracing evolutionary argument coached ... in the vocabulary of successive “liberations”, and running all the way, without break or interruption, from the most primitive fish to the advanced automaton. (433)

For Stiegler, this seemingly inevitable progression will be articulated through the mobilisation of metaphors of writing, language, trace, surface, and inscription. Thus, the conceptual resources of technology are employed to think *about* technics. The fact that the question of technics is embedded in that of language is a central aspect of this approach. Language is “indissociable from technicity and prostheticity: it must be thought with them, like them, in them, or from the same origin as theirs: from within their mutual essence” (Vol. 1, 145). One of the outcomes of this is that the prosthetic universe is reduced to the schema of writing and language, those most *essentially technical* activities. It explains also why Stiegler’s focus is skewed towards a certain range of technologies: photography, archiving, cinema, and mass media. Although we could imagine a Stieglerian approach to, say, weaving, perfume manufacture, telescopes, water wheels, etc., such technologies appear inconsequential under the shadows of the historical ruptures that mark the development of the human-technics dynamic. At times it seems technics must have some cognitive or evident phenomenological aspect to count as relevant. Thus the Stieglerian framework has some difficulty addressing aspects relating to the body, matter, and the material configurations of technologies; and how these are articulated outside of and beyond inscription. Conversely, at the other end, Stiegler’s framework becomes visibly overstrained when theorising developments such as informatics, biotechnology, money, and networks. [3]

Writing is associated with materiality in the inscription (as organised inorganic matter). This dynamic has two sides: the writing of the human by/in technics, and the human writing on/in technics. Although a necessary move, I argue next that this attempt at materialising the trace runs into some difficulties.

3 – Technics and the mnemonic

Epiphylogenetic inscription represents a third type of memory beyond the genetic and the individual. How can we reconcile this mnemonic function with inscription? And how can we tie all this with the rupture between zootechnics and (human) technicity? It is known that primates are also capable of learning and transmitting techniques, and that primate cultures display forms of collective “memory”. In both the cases of primates and humans, technical skills are *acquired specialisations*, which van Schaik & Pradhan define as “behaviours that do not develop reliably as a result of the interaction between innate predispositions and environmental affordances, and therefore have to be acquired by the individual animal through independent innovation or some form of socially based learning” (646). Nelson and Nelson say that this form of learning

... involves the internalisation of the imitated actions, which enables deliberate recall and manipulation of the action out of context. In humans it may also involve manipulation and regeneration of imitated actions mentally to form new ways of doing things. (1641)

They also identify particular stages in the techno-cultural “cycle”: acquisition, retention, invocation or use, and transmission to others (1636). It is generally accepted that, in all other animal species, technical behaviours (such as building nests and hives, and using tools) are reliable outcomes of development processes interacting in a milieu (note that this is different from saying that they are “genetically programmed”), whereas in primates and humans specialisations can be gained and retained by social transmission (Boesch and Tomasello). [4] However, this genetic/nongenetic, nature/culture barrier is nowhere as ontologically stark as Stiegler wants it to be (a point we will take up in more detail in section 4).

Techniques and artefacts, then, involve socially transmitted knowledge and mechanisms of cultural retention. But to what extent is this “memory”? And to what extent is memory always already mnemotechnical? The first question is about cognitive metaphors and their problematic applicability in this context. The second question suggests we think memory beyond inscription: as a trans-individual, trans-temporal dynamic of retention and transmission. This much Derrida

seems to suggest with his notion of arche-writing:

And thus we say “writing” for all that gives rise to an inscription in general, whether it is literal or not and even if what it distributes in space is alien to the order of the voice: cinematography, choreography, of course, but also pictorial, musical, sculptural “writing.” One might also speak of athletic writing, and with even greater certainty of military or political writing in view of the techniques that govern those domains today. All this to describe not only the system of notation secondarily connected with these activities but the essence and the content of these activities themselves. (9)

The notion of arche-writing seeks to capture a certain type of organized sequence of events, and opens a series of complex questions. Although it is an immaterial structuring force, the Deidean approach does not necessarily eschew matter as much as suggest a different approach to it. Stiegler responds with his own notion of *program*.

But there is program. The “natural” memory of the epiphylogenetic being who is not always already artificial does not exist, having been produced by programs that are largely memory’s prostheses. There is *only* that. And the *who*, in its indetermination, programs itself. (Vol. 2, 186)

If we take inscription as the program’s material substratum, or at least its material dimension, we should first ask about its location. But cultural knowledges cannot be located in any specific place or reduced to any material organisation. Non-literate societies require complex mechanisms of cultural cumulation, and even in high-tech societies (*particularly* in them) knowledge is widely and immanently distributed. It can be more aptly understood in terms of processes and events than as the exhumation of traces. As Breard argues in the context of the development of expert systems for biotech labs, the procedures of technoscience incorporate forms of latent and tacit knowledge that are remarkably opaque to formalisation, transmission, grammatisation, and programming. They emerge at points, intensities arising from the delicate and contingent interactions of bodies, protocols, machines and institutions. [5]

Michael Tomasello argues that *sociality*, not *technics*, is the central evolutionary factor in the cultural dynamics of transmission, retention and accumulation. According to Tomasello (and Stiegler would agree), what distinguishes humans is cumulative cultural evolution. The basis of this process is *transmission*, not *inscription*. (And here must be careful not to collapse “social” into “transmission”, and “technical” into “inscription”; we must also be careful not to do the opposite, and collapse transmission into technical and social into inscription). It is clear from Tomasello’s conclusions that sociality exceeds technics, although it is not entirely uncontaminated by it. As van Schaik & Pradhan claim, social gregariousness “is far more likely to produce the maintenance of invented skills in a population” (645). Corballis argues that certain environment pressures during early human evolution, such as an exposed territory that increased visibility by predators, “may have led to selection for enhanced social cooperation and cohesiveness”, with an emphasis on “efficient communication” (Corballis). Tomasello’s observations seem to fit in this picture. Cumulative culture results from species-specific modes of transmission; and these modes of transmission are, in turn, dependant on particular cognitive skills, chiefly “the understanding of conspecifics as intentional beings like the self” (56). It is likely that this socio-cognitive scaffolding was a co-originary factor in the evolution of technics, as well as in the establishment of “cultural memory”.

In a discussion of the cognitive sciences (Vol. 2, 162-177), Stiegler explicitly addresses transmission as a necessary condition for epiphylogenesis. The issue is raised in the context of emergentist theories of cognition, and with reference to ant societies. Stiegler’s intention is to defend his notion of program against emergentism. Even if the individual agents in the anthill are reactive (i.e., they have no internal, decoupled representations) “there must be a model of

collective behaviour inscribed somewhere, at least temporarily” (167). It is known that ants leave traces (pheromones) on the environment, which Stiegler takes as a form of inscription. That is, this “mapping of the collective” (167) is programmatic because of the existence of “engrammes” (185).

The main point is that this organisation of memory is not epiphylogenetic because (although there is an inorganic support –if we are ready to concede that pheromones are inorganic) two conditions are not met. Firstly, “there is no question of a transmission of individual or collective experience.” This point is rushed and seems to smuggle in the criterion of intentionality. But elsewhere (“The Dead Seize the Living”), Stiegler expands on this notion of “experience”:

Knowledge is, strictly speaking, the experience of the sensible, which does not involve the animal world: the latter, in my terminology, does not have experience, for experience is what can be transmitted as the experience of the singularity of the sensible, that is to say, to the extent that experience is always itself singular and unexpected. (*Dead Seize the Living* 3)

Rather than cognitivism, the framework is phenomenological. Yet, this explanation assumes what is trying to prove, and is somewhat circular: in the final analysis we encounter an already (technically) constituted subject in which transmission becomes the condition of possibility, not just of experience, but of the *singularity* of experience – an experience which is always already given in what seems a miraculously constituted (human) lifeworld that is uniquely contingent and open. Again, the *aporia*.

Secondly, Stiegler says there is “no organization of the inorganic through a technical tendency— but rather a structural coupling of the animal group and its surroundings” (167). That is, ant technics is not sufficiently deterritorialized, consisting of coupled representations. The appearance of the tendency (the subject of section 5) already implies a certain level of organisation, a threshold of complexity arising from the interplay of milieus. However, this point is not clear. It is not certain if Stiegler here is relying on an implicit distinction between coupled and decoupled representations (which invokes the interior/ exterior structure that characterises the intentional subject of classical cognitivism), or on a somewhat circular argument: there is no technics because there is no tendency, and there is no tendency because there is no technics (and here the *genetic* strategy finds its limitation). [6]

The focus on the “lower” rungs of the animal kingdom is a common strategy to emphasize the gap between humanity and animality. However, in a footnote, Stiegler addresses in passing the subject of primate technics. He observes that great apes have mechanisms of acculturation and transmission of experience, and concludes that “the process I am calling *epiphylogenesis* here originated well before the advent of the human—which confirms that the issue is not that of “the human” but of the process of which he serves as the transmitter” (n44, 255). Elsewhere, he writes: “[T]he appearance of the human coincides with the rise of a sudden hegemony of the epiphylogenetic within the developing process of differentiation” (Vol.2, 161).

Of the three original conditions of epiphylogenesis, then, only that of inscription is left as essential, given that zootechnics already involves transmission and the programmatic, while the tendency is born at a critical threshold that already has the inscription as a necessary condition. This means that this rather phantasmagoric notion of inscription, the last reduct of technics, is called to do an inordinate amount of conceptual work, from objective trace to archive, from shaping force to engulfing facticity. What’s more, for the historical narrative to be possible, Stiegler must commit to a rather static model of inscription that tends to undermine his own repeated emphasis on the “paper”, the medium as a shaping and differentiating force. The reader is likely to experience some frustration at how this emphasis on the recording surface translates into a series of grand claims about inscription that are not backed up by any detailed microanalytical work, or any attempt at a microphysics of inscription that starts from the material and technical specificities of each medium. It seems that paper, flint, the cinema screen, magnetic

tape, digital storage, and even the brain, to mention just some, all function in essentially the same way. Or, to be more precise, their differences arise from a stable set of criteria, such as speed.

Inscription, as we have mentioned, is one part of the story, and it must be considered jointly to the notion of *program*, to which we turn next.

4 – The program as extragenetic trace

The *program* comes to play a progressively central role in Stiegler's account of history and individuation. With the epiphylogenetic break a new kind of program appears, coinciding with a particular form of memory: "namely, exteriorised programs no longer inscribed in the organism itself" (Vol. 2, 70-71). The individual, then, "develops out of three memories: genetic memory; memory of the central nervous system (epigenetic); and techno-logical memory (language and technics are here amalgamated in the process of exteriorization)" (Vol. 1, 177). The model of the extragenetic program is the genetic program. Stiegler places these three forms of memory along a conceptual continuum that projects onto the genetic level a model of "program" and "memory" that erodes the purity of life at the foundation of epiphylogenesis. This continuum implies also a theoretical commitment to the conceptual resources of informatics and molecular biology. [7] But it is not clear how informatic and anthropological contexts map out onto each other, beyond the vague metaphor of a stored sequence of instructions coded according to a grammar or set of rules. For a start, both the notion of program and the informational model behind it have been seriously challenged from within molecular biology and the philosophy of biology (see Sarkar for an influential critique). We must be careful not to assume a clear consensus in what is a busy and complex debate involving various traditions and approaches. However, in the context of Stiegler's philosophy, these debates suggest a much more complex picture than the one he takes for granted.

Stiegler assumes genetic programs are determinate in their structure and operations, whereas cultural programs are open to indeterminacy. Animals are "programmed" by their genetics, whereas "we" remain undetermined, thrown into a space that is at once contingent and determined by the historical logic of technics. In this section we will examine two aspects of the notion of program that are particularly problematic: the divide between genetic and nongenetic, and the program as an agent of enculturation.

What are we to make of the claim that epiphylogenesis represents a break into a non-genetic kind of existence? Although the metaphor can be traced back to the early 1960s, the French biologist François Jacob was the first to widely popularise the notion of a "genetic program" in a work first published in 1970, *The Logic of Life* (Keller 162). In Jacob's own words, the model of the program "equates the genetic material of an egg with the magnetic tape of a computer" (qtd. in Keller 162). Jacob's work seems to be Stiegler's main source, and the extent of his engagement with genetic theory. He cites the same quote by Jacob three times (Vol. 1, 140; Vol. 2, 151; Vol. 3, 339-340): "the programme cannot receive lessons from experience." This assertion nowadays should be heavily qualified, to say the least; yet Stiegler uses it with axiomatic insistence to establish an ontological rupture between the genetic and nongenetic, a fundamental cornerstone of his theory. Stiegler even claims this proposition is the foundation of molecular biology, the axiom on which its "scientificity rests", and which is somehow "suspended" by biotechnology and genetic engineering (Vol. 2, 151). It is not clear where he gets this idea from. Even more implausibly, he declares it is the "very law of life" (151). In this respect, Ben Roberts is correct to point out that "the opposition between epigenesis and epiphylogenesis only reproduces in a different form the more traditional opposition between nature and culture" (§9).

Whereas Derrida considers the history of the *grammē* as that of life itself, Stiegler holds that technics (as one of the names of the *grammē*, or the "trace") constitutes a break with "pure" life. "The passage from the genetic to the nongenetic is the appearance of a new type of *grammē*

and/or program" (Vol. 1, 138); which Stiegler immediately compares to "cultural codes" (akin to genetic codes—again, we see the uncritical extension of these concepts across the genetic-cultural border). This is a decisive stage in the history of *différance*, an articulation whereby life exteriorises itself into a foreign deposit. "The *grammē* structures all levels of the living and beyond, the pursuit of life by means other than life" (137). Stiegler suggests that the *grammē* "as such" is consciousness (138), a temporal structure of retention/protention, forgetfulness/anticipation that finds its constitutive condition of possibility in the technical trace. Mark Hansen argues that Stiegler, unlike Derrida, posits originary technicity as the proper (or better) name for the trace. Whereas Derrida believes that arche-writing precedes the history of technics, and cannot be reduced or conflated to it, Stiegler projects technics deep into the heart of life *qua* gramme itself, thus forgetting "Derrida's ethical insistence on maintaining a distinction between technical conditions and phenomenological experience ..." (15). As a result, Hansen argues, Stiegler's philosophy falls prey to a "general overvaluation of technics" and a "desire to ground time exclusively in technical inscription or registration" (17).

It could be suggested that DNA itself is already a form of technical inscription and registration; a form of organized inorganic memory that accumulates the experience of previous individual existences (and thus learns from experience). Is there not technicity at the heart of life itself, in the very definition of an organism? Isn't the living always already biotechnical? Stiegler seems to point in this direction at the end of Vol. 3, when he speaks of the relation between the materiality of the recording surface and the conditions of reproducibility. In film,

the reproduction is first: there is no production first which would later be reproduced. What makes the matter of the film is precisely the film, the material support inasmuch as it is manipulable and duplicable at will, because *it is reproduction to begin with*: the film is produced through the manipulation of the reproducible. (Vol 3., 353)

Likewise, life "is originally a capacity of reproduction and not of production, also it is in fact a reproduction without an original production" (Vol. 3, 355). This undermines the Aristotelian schema in which technics has no capacity of self-production. "The capacity of reproduction of the living being is a proliferating spring of diversity precisely because reproduction is never a simple copy but the transformation of what is reproduced" (Vol. 3, 355). This conceptualisation of the living is grounded on the metaphor of inscription (genes=film *qua* recording surface), and defers the question of the origin of negentropy (a nagging problem for information theory and the life sciences). Although the ontological gap between the living and the dead is challenged (which goes against the conceptual foundations of epiphylogenesis), differentiation is still explained with reference to the material support, and ignores epigenetic conditions (a critique we shall expand in what follows).

In the cultural realm, programs also have a central role in the reproduction of the enculturated individual. Their role is that of determining behaviour and imprinting the individual with external schemas. Patrick Crogan notes that Stiegler follows the general drift of previous critiques of the culture industry by thinkers like Althusser and Metz, which are based on "the assertion of a form of materially exterior "conditioning" of human interiority operative through these technologies of representation"; a parallel, Crogan adds, that Stiegler seems to be unaware of (46).

One chief feature of these programs is that they can migrate and be transferred across different contexts; that is, they are transcultural, or trans-ethnic (Stiegler does not seem to adopt the difference Leroi-Gourhan makes between the cultural and the ethnic). The expansion, creation and preservation of knowledge

which is also a ceaseless program writing, is the dynamic of memory's liberation. ... [E]piphylogenesis engenders the proliferation, in life, of a type of memory as irreducible to zoology as to psychology, in the course of which the becoming ethnic is

written—but also effaced as ethnic. (Vol. 2, 71)

This is one of the reasons why the technical tendency is “universal” and tends to dilute ethnic specificity, to the point of provoking “disorientation”; that is, altering the internal, collective mechanisms by which a culture constitutes and represents to itself time and space—what Stiegler calls cardinality and ordinality (encompassing technologies such as geometry, cartography and time keeping). The suspension of old programs marks the arrival of new epochs, of which the whole of human history consists; “at the risk of needing to envisage a “human” program, only to find it too suspended, or rather to have always been oriented towards its own suspension” (71).

This is being posed very intensely today because the exteriorization of the human as such has reached its limit, meaning that contemporary technical *epokhality* is radical, equal to the most powerful ruptures that humanity has ever known, capable of overturning humanity’s apparently most stable constituent elements and threatening to bring the ethnic constitution of groups to an end, through the delegation of programmatic operations in machines themselves. (74)

But what exactly *is* a program? Stiegler inflates this notion to the point of meaninglessness. “Program” covers pretty much anything: TV programs, “even an entire network”, film synopses, newspaper layouts, best sellers, CDs...

The very idea of the “program” must be expanded, in fact, to include many differing kinds of activities: academic and scholarly programs, political programs, programs for work, all must be applied to everything that formalizes rhythms, repetitions, habits, and customs, including the most complex. (182-183)

These programs (again) work in a way analogous to genetic mechanisms:

A great diversity of mechanisms consisting of supports, networks, programs and interfaces receive, process, and diffuse a great diversity of generalized memories. Videographers’ or cinematographers’ film stock, phonograph records, archive photographs, documents written and preserved on paper, all constitute the bases of transposable data for informatic media *for the same reasons as species’ molecular and genetic sequences*. (182; emphasis mine)

Classical information theory might have no problem with this, but recent developments in various fields where informatic models have been applied should force us to seriously reconsider this notion (not to say abandoning it completely). The notion of program assumes there is an informational content that can be transferred across material and temporal contexts—give or take a few “accidental” modifications. The performance of the program must be judged *negatively*, in terms of concordance to an ideal norm. A program is never iterated “perfectly”; there are “gaps”, “differences”, “forgettings”, a universe of negative normativity. Despite Stiegler’s initial insistence on materiality and the specificity of the surface, the program reintroduces an informatic paradigm that clearly ignores the materiality of the trace, and considers tertiary retentions mainly as form-givers.

In his appraisal of Leroi-Gourhan’s legacy, the anthropologist Tim Ingold also expresses some objections along these lines.

The metaphor of transmission is misleading, for it implies that memory is somehow detachable, as a corpus of ideal information, from the material bodies that it animates, such that it can jump from one to another. In reality, memories, like the bodies to which they belong, undergo continual generation and regeneration in the context of individuals’ life activities within an environment. (429)

It follows that “the development of the generalised capacity is inseparable from that of the specific

competence" (430). According to Ingold, Leroi-Gourhan's notion of social memory does not stand to scrutiny, as there is only one form of "embodied memory ... corresponding to the unity of the organism whose morphology and behaviour are inseparably biological and social" (430).

Stiegler wants to keep to a classic notion of the "program" while introducing indeterminateness, contingency, openness, change and variation. He claims that it "is necessary to maintain the concept of the program" by "conceiving the programmatic differently—as an element of improbability" (Vol. 2, 168). However, the two perspectives are incompatible, as long as we think (as Stiegler does) from *within* the program. The indeterminateness of the Stieglerian "program" has nothing to do with context or epigenetic conditions, not even with the specificities of neurons and bodies, nor with any of the other dimensions across which the program might operate. It is a feature of programs themselves, a consequence of their unfolding as temporal objects (Vol. 2, 186). At the end of Chapter 3 of Vol. 2, the question is deferred to a transcendental model of consciousness that, departing from Husserl, argues for the primacy of tertiary (technical) supports. Yet the fundamental role of epigenetic conditions is ignored. Cultural reproduction hinges on a complex process of exhumation that is irreducible to consciousness or to the programmatic model of genetic determinism.

At this point a brief comparison with the fate of the program in biology could be instructive. In the last two decades or so the notion of a straightforward unidirectional flow of information (from the nucleus into gene products such as proteins) has been seriously put into question. For a start, it has been discovered that cellular mechanics have a central role in shaping proteins. As Levins and Lewontin explain: "No DNA sequence contains all the information necessary for the specification of a protein." Once translated, the resulting polypeptides must fold into a three-dimensional structure, and "[t]he particular folding that occurs depends on cellular conditions, on the presence of so-called chaperones and other molecules and cellular structures." Furthermore, the gene does not always contain the "full information sufficient to determine the sequence of aminoacids in the polypeptide" (333).

The evidence points to the existence of a complex epigenetic inheritance system that comprises both genetic and nongenetic dimensions. Moreover, developmental system theory suggests that there is a "developmental matrix" that co-determines the final genotype, and which extends as far as the organism's niche (see Griffiths). An outstanding example of this developmental approach is Anne Fausto-Sterling's study of the sociobiological production of gender, *Sexing the Body*, which advances a powerful case against (among other things) the informatic paradigm applied to enculturation.

The preservation, transmission and imprinting of cultural patterns depends on a complex interplay of material, neurophysiological and technical variables that could be likened (as long as we don't push the metaphor too far) to the epigenetic mechanisms of the cell and beyond. The same considerations that apply to biological mechanisms, and which ultimately render the "program" metaphor null and void in that context, apply to the anthropological. Stiegler follows Leroi-Gourhan in retrojecting onto the entirety of human history, and across an indiscriminate range of contexts, distinctly modern technological understandings that hinder the analysis. The question of the "program" must give way to the much more pressing issue of transmission, reproduction, exhumation, repetition, reactivation, and restitution into the present-future. Stiegler attempts to account for this by borrowing Simondon's theory of individuation (see section 5). The epiphylogenetic model, however, is heavily oriented towards practices of inscription rather than incorporation (granting that Stiegler does not distinguish between the two). Following Lenoir, we can define inscription as everything "we say and write, the representations we construct" and the codes we circulate. Practices of incorporation refer to "the norms, behaviours, skills, and schemas of physical enaction that modulate the embodiment of these culturally constructed inscriptions and the performances of actual bodies" (373). It requires a vast investment of energy and time to make sure that inscriptions are read the "right" way, that things are used correctly, that techniques are learned properly—in short, to carry on the vital negentropic work of culture. Tools,

programs and inscriptions do not remember; whole societies do—the same way that, as Latour says, “B-52s do not fly, the U.S. Air Force flies” (182).

5 – Riding the Tendency

Leroi-Gourhan’s notion of “tendency” comes to provide the missing conceptual link in Stiegler’s theory of technical differentiation. Epiphylogenesis by itself is too static, an abstract sedimentation. It needs the tendency as the *driving force*, the motor of technical change. Leroi-Gourhan’s original formulation is inspired by Henri Bergson’s notion of *élan vital*, a lifelike force that impels the process of evolution from within (Audouze 286). This is why Stiegler often characterises it as an agency that shapes and directs. According to Stiegler, the force or dynamics of technics is *internal* inasmuch as it does not proceed from the human *qua* organising force, a “forming intention” or a “wilful mastery”: “... the tendency operates, down through time, by selecting forms in a relation of the human living being to the matter it organises and by which it organises itself, where none of the terms of the relation hold the secret of the other” (Vol. 1, 49; emphasis omitted).

The tendency “offers ... an explanation of all possibility of evolution ...” (58). Leroi-Gourhan defines the tendency as “a movement within the interior milieu, that gains progressive foothold in the exterior milieu” (58), a movement that “is close to what determines the morphogenesis of organisms in their milieus” (59). The tendency arises from two sources: interior and exterior, intentional and physical. The *interior* milieu

is social memory, the shared past, that which is called “culture.” It is a nongenetic memory, which is exterior to the living organism *qua* individual, supported by the nonzoological collective organization of objects, but which functions and evolves as a quasi-biological milieu ... (57)

Thus the tendency is logically posterior to epiphylogenesis. Once in place, the tendency produces a rupture: the appearance of a new internal milieu, “a technophysical and technocultural milieu, whose laws of equilibrium are no longer known” (60). Technical dynamism shows an “irresistible negentropy” that drives the “increase” of the interior milieu (61). In this long process of evolution leading to *Homo sapiens*,

[t]he unity of the human becomes tenuous: one can hardly see any other permanence ... than the fact of technicity. The continuity of the human would be due only to the permanence of “liberation” having become “process of exteriorization,” ... (149)

According to this picture, technical differentiation produces a “technical subgroup”, i.e., social differentiation. In the first two chapters of Vol. 1, Stiegler takes us through a long, careful reading of Leroi-Gourhan, raising some objections and complementing certain aspects of the theory with observations from Simondon and others. The tendency, however, is portrayed as discarnate, outside force with its own internal necessity.

The technical system, the universal tendency that it carries, are no longer the partners of the “other systems”; the technical object lays down the law that is its own, it affirms an auto-nomy with regard to which, in the industrial age, the other layers of society must regulate themselves, with an actual possibility of negotiation. (73)

Some of Leroi-Gourhan’s colleagues have raised certain criticisms regarding the *limits* of the tendency; technologies, for example, are often rejected on the grounds of incompatibility with cultural systems of representation (Audouze 285-6). Even in the wired age, there are concrete limits to technological transfer and adoption, as much as there are physiological and phenomenological limits to the colonisation of consciousness. For instance, taking Simondon’s queue, we could hypothesise the very *concreteness* of the organism as a limit to technological

disaggregation.

Stiegler's discussion of Leroi-Gourhan already anticipates some of his own conclusions: our present day is affected by a radical form of technical discontinuity, inasmuch as technology advances faster than the dynamic of the internal milieu. The internal milieu is in danger of "diluting" into the external milieu, which has now become a system of worldwide technology comprising telecommunication, computer networks and modes of transport (Vol. 1, 62).

Stiegler's attempts to draw Simondon (in particular the notions of concretisation and individuation) into the picture occasion further difficulties. On the surface, both Simondon and Leroi-Gourhan acknowledge a certain internal logic to technical differentiation; yet the ways in which they conceive of this logic are fundamentally at odds. Simondon's approach is that of an engineer focusing on the necessities of the internal organisation of artefacts; what he calls their "functional synergies" (34). Industrial objects are concrete (as opposed to the abstractness of traditional, human-powered technics) because they are more sensitive to internal resonances, and relatively more independent of the shaping forces of the other forces and milieus. However, we could see how the notion of the tendency (in its evolutionary sense) can be applied: a lineage can be glimpsed only retroactively, as a rational series. Also, for Simondon, the motor force of technical change is human labour and human finality. Stiegler quotes Simondon: "without finality, *driven and realized* by the living, physical causality could never alone produce a positive and efficient concretization" (Vol. 1, 78). There is no tendency for Simondon, no vital force, and he would have strongly disagreed with the conclusions Stiegler proceeds to draw: "The industrial object has brought us to the suppression of the intentional anthropological part of the technological dynamic" (78). And: "Technical evolution stems completely from its own technical object. The human is no longer the *intentional actor* in this dynamic. It is its *operator*" (66). This is not a matter of criticising how "incorrect" Stiegler's interpretation is, but of returning to Simondon to open up a critical space.

Simondon departs from a notion of the technical object apprehended in terms of its internal principles, as well as its interactions with the environment, other machines, and humans. Where Stiegler sees a post-industrial human interpellated by a hegemonic, demonic web of industrialised consciousness, Simondon's diagnosis is rather different. For him the predicament is that until now humans have played the role of technical individuals and regarded themselves as such, "whereas in actual fact it was man who provisionally took the place of the machine before real technical individuals could be made" (101). Now humans must learn to assume a non-individual function as either "element" or "director of the ensemble" (97), someone who "participates in [the machine's] regulation" (137). This is the source of our cultural malaise. In this respect, alienation not only has a socio-economic dimension (the one Marx analysed), but also a "psycho-physiological sense", inasmuch as "the machine no longer prolongs the corporeal scheme" (136). Industrialisation, in a sense, marked the limit of corporeal exteriorisation. Simondon sees in the shift from the thermodynamic to the information age a passage from "technocratic excessiveness" to a more stabilising and negentropic philosophy of technology, a shift which (he hoped) would bring a positive cultural change. "The [informatic] machine is a measure of organisation and information; it resembles life and cooperates with life in its opposition to disorder..." (9). Stiegler, on the other hand, sees the looming cultural destruction as entropic.

In Vol. 3, Simondon's ideas are taken up again, this time from the point of view of *individuation*. Stiegler here acknowledges that Simondon does not have a concept of tertiary retention that would allow him to think the role of the already-constituted technical objects in the psychosocial genesis of identity (Vol. 3, 157). To fit this into Simondon's framework, Stiegler takes the mnemotechnical layer as a "pre-individual".

... what makes possible this coindividuation [of the *I* and the *We*] is the already-there preindividual medium... [which is] the individuating conservation (transformational) of the being through a becoming sustained by the permanence of the

substrata that are the tertiary retentions ignored as much by Simondon as by Kant and Heidegger. (Vol. 3, 165)

A more careful consideration of Simondon's theory of transductive individuation would reveal the impossibility of wedging in such a permanent trace. As Andrew Mackenzie argues, transduction "suggests a way of thinking about technologies processually, that is, as *events* rather than objects, as contingent all the way down ..." (4). That is, not as the encounter of preconstituted substances, but as a *primary relationality* that constitutes an individuation—in this case human-technics (11). As such, transduction highlights "relationality, singularity and generativity" (16).

Simondon's discussion of memory is a good case in point. Rather than collapsing one into the other, as Stiegler does, Simondon sees a complementary but irrevocable discrepancy between technological and human forms of memory. Simondon sums up this divergence as follows: "The memory of the machine triumphs in the multiple and the disordered: human memory triumphs in the unity of forms and in order" (*Modo de Existencia* 140).

What characterises human memory is the selection of forms, the capacity to schematise experience. Machine memory (such as magnetic tapes or photographic film) can "conserve for a very long time monomorphic documents that are very complex, rich in detail, precise" (138). The conserving function of the technical medium "completely lacks structure; film does not register in a better way well defined figures—for example, geometric images—than the disordered image of grains of sand in a cup..." In fact, often well-defined figures are stored less clearly than "disordered uniformity" (138). From this information, human perception reconstructs "the forms, perceptual unities, in the vision or audition of recorded documents." In human memory, the conservation of forms is only a limited aspect of the power of selection and schematisation (139).

Both forms also show different types of plasticity. "Plasticity in machine memory is a plasticity of the support, whereas in human memory it is the plasticity of the content itself" (140). This means that the contents of human memory can be reordered so as to serve as the *code* for new acquisitions, "to interpret them and fixate them: in humans, and more generally in the living, *the content turns into codification*, while in the machine, codification and content remain separate as condition and conditioned" (141). Although both types of memory are self-regulating, human memory works according to an "implicit vital codification that constitutes experience" (141), involving schema of meaning only applicable to the living. This is a qualitative difference that cannot be reduced to a difference of speed; in fact, it remains irreducible to any feature of technical supports. This difference places certain limits to the hegemony of the machine over consciousness. Simondon offers a more utopian perspective in which both forms of memory are integrated in the context of human ends, in terms of synergy and "partial convertibility" (141). Simondon offers the example of an automated telephone system that sorts out and calls up results stored in various magnetic tapes. This vision of an integrated existence forms part of a worldview in which "the ensemble of open machines assumes man as permanent organizer and as living interpreter of the inter-relationships of machines" (*Mode of Existence* 4). Simondon compares it to the relationship between a conductor and an orchestra, in which the conductor can direct the musicians "only because, like them, and with a similar intensity, he can interpret the piece of music performed." For each of the machines, the human is the "real, inspiring form of the group's existence as a group; he is the central focus of interpretation of all of them in relation to each other. This is how man functions as permanent inventor and coordinator of the machines around him. He is among the machines that work with him" (4) as the "responsible and creative conscience" of technical beings (6).

6 –Inanna Meets Prometheus: An Alternative Origin

Technics emerges from Stiegler's account as a force within historical change, furnishing the

determinant conditions of sociality, communication and consciousness. Under the logic of the tendency, the human is an after-thought, a residual presence that cannot be thought save *in* technics and *through* or *with* technics. Technics is mystified, conceived as an overpowering ontological agency that is opaque to reason precisely because it provides its invisible and aporetic foundation. As Geoffrey Bennington writes: "... arguing against a metaphysical determination of technics, [Stiegler] is here telling a perfectly metaphysical story with a pre-history, a catastrophic fall, and a need to overcome that fall" (183). Technics, he adds, "is a philosophical concept, and to that extent can never provide the means to *criticize* philosophy" (184).

Faced with this emergency, Stiegler's analysis ultimately lapses into a standard humanist position, appealing to liberal schemas of technical action grounded on the performance of an intentional, deliberative agency. The crisis in the educational system, for example, is "due to the lack of analytical criteria and synthetic theorems that might allow the constitution an appropriate epistemic dispositive of retentions" (Vol. 3,249). Stiegler intends to provide some of the schemas that might allow us to make these corrective interventions on the machinery of cultural production and shape their future course.

But differentiation and multiplicity pose a problem for a Stieglerian approach. For a start, the focus is narrow, restricted to certain functions, effects and contexts: memory, anticipation, recording, the production of cultural identity, the individuation of the *I* and the *we*, etc. A concern with the fate of the human generally overrides the need for a more encompassing framework that might capture technology in all its complexity and breadth. But is it possible to have a philosophy of technics that departs from the fact of irreducible heterogeneity?

The work of Edward Tenner (*Our Own Devices*) is a good place to start. In a series of pan-historical studies, Tenner unravels the tangle of dimensions that traverse even the simplest of artefacts (shoes, helmets, chairs) and techniques (walking, bottle-feeding, typing). Choosing common technologies with long lineages and equally long histories of intercultural borrowing and imposition, Tenner suggests that cultures, bodies and technologies are mutually co-determined in the context of a dizzying, hybrid ontology of matter, cultures, corporations, the biomechanical specificities and thresholds of the human body, aesthetic values, discourses, rituals, empires and morals. His study reveals a most curious feature of technics as object of philosophical enquiry: artefacts and techniques are always found articulated, embedded in assemblages that are irreducible; they are not technical but *machinic* in the strict sense in which Deleuze and Guattari use the term. (It is quite interesting to compare Stiegler and Tenner on the question of writing, as Tenner's approach reveals all the blind spots that Stiegler's framework cannot account for). In a similar vein, Bruno Latour argues that "technical" is a good adjective, and "technics" a lousy noun (190):

[T]here is nothing that we can define philosophically or sociologically as an object, an artefact or a piece of technology ... The noun "technique"—or its upgraded version, "technology"—does not need to be used to separate humans from the multifarious assemblies with which they combine. (190-191)

Assemblages are characterised by a shifting and processual becoming that traditional ontologies cannot account for.

I will attempt to offer an alternative to Stiegler's Promethean myth by way of another myth about the origin of technics.

This is a Sumerian tale retelling how technics came to be in possession of human civilisation, and it is more than two thousand years older than the story of Prometheus. We will read the story creatively, as a reflection on technics.

This story was written on clay tablets dating from 2700 BCE, although most likely the story has its

source in earlier oral tradition. It is the oldest written account of the origin of society, an intriguing narrative that describes how the powers, crafts, and decrees of society came to civilisation. [8]

The legend tells of a journey holy Inanna, goddess of desire and war, undertakes to visit Enki, lord of wisdom and of the *abzu* (the watery abyss upon which the earth rests, and also a word for semen). In Ancient Sumer, Inanna, whom the Babylonians would later know as Ishtar, was an important part of the state religion, and early kings claimed a relationship to her in order to reinforce their status and superiority. Along with the sovereign gods An and Enlil, Enki is one of the chief figures in Sumerian mythology, entrusted with keeping the *me*, an untranslatable Sumerian word often taken to mean the divine powers or decrees upon which civilisation rests. Georges Roux writes: “[Enki’s] main quality was his intelligence, his “broad ears” as the Sumerians said, and this is why he was revered as the inventor of all techniques, sciences and arts and as patron of the magicians” (89). [9]

After she makes herself look glorious and beautiful, Inanna sets for Enki’s place of worship at the city of Eridu, the oldest city in the land. But Enki, who is an omniscient being, learns of her pending arrival and prepares a feast of beer and butter cake to welcome her. Inanna and Enki party heavily and begin to play drinking competitions. In no time, Enki is handing out the *me* to Inanna:

Holy Inanna received heroism, power, wickedness, righteousness, the plundering of cities, making lamentations, rejoicing. [Enki said:] “In the name of my power, in the name of my *abzu*, I will give them to holy Inanna, my daughter.” Holy Inanna received deceit, the rebel lands, kindness, being on the move, being sedentary. ... Holy Inanna received the craft of the carpenter, the craft of the coppersmith, the craft of the scribe, the craft of the smith, the craft of the leather-worker, the craft of the fuller, the craft of the builder, the craft of the reed-worker.

The list goes on to total more than a hundred *me*, many of which have not been successfully translated. [10] Loaded with her booty, Inanna then boards the Boat of Heaven and sets for Uruk (or Erech), the city she protects. When Enki realises what he has done, he sends his right-hand man to stop her. The emissary reaches Inanna and repeatedly attempts to turn her boat over with the help of an array of intriguing creatures, including giant fish and “the fifty *lahama* of the subterranean waters”, only to return defeated to Enki’s abode and be sent out again. Finally, Inanna reaches Uruk and receives a hero’s welcome, with great feasting and rejoicing. The *me* have been brought into the city, it is implied, to be shared by all the people there.

The list of *me* can be considered an inventory of what the anonymous author/s of the myth reckoned to be the cultural goods, the main knowledges, practices, offices and virtues of Sumerian civilisation. A modern reader may be struck by the disparity of the *me*, the apparent lack of categorisation and the often poetic juxtapositions. Often the *me*’s principle of classification is clear, as with the cluster of crafts, or the lists of priestly offices and symbols. Another group of *me* is centred around sexual intercourse, and includes quivering, kissing and prostitution—the latter also an institutionalised religious practice (the cultic prostitute). Another group enumerates what may be considered virtues (wisdom, attentiveness, respect, awe and reverent silence), along with holy purification rites, the shepherd’s hut and “piling up glowing charcoals”. Other *me* seem to refer to powers, (deceit, speech, venturing at will into the underworld), the states of bodies and their capacities to affect and be affected (on the move, sedentary; rejoicing, strife, triumph, comforting, counselling, kissing). Writing is accounted for as the craft of the scribe. And at least three of the groups are concerned with administrative offices, one of which seems the highest (“divinity, the great and good crown, the royal throne”).

Yet other groups of *me* are less clear to define, either because they are linked by associations now lost or vague, or because the Sumerians were not interested in our kind of logic. Is the list of *me* a

purely random, capricious enumeration? If not, then what is the relationship between the art of song and the plundering of cities?

If the grouping follows an organisation, it is certainly not one in which the elements share essential attributes or resemble each other in an ideal or “natural” sense. Yet they must all *meet* at some point for human life (from its most basic corporeal aspects to the most overarching social structures) to be possible. The *me* are akin to nomads sharing a territory, elements on a smooth plane. It is possible to read the myth as an acknowledgment of the external origin of technics, as an image of the permanent circulation of nomads and new settlers bringing an influx of knowledges and practices. The *me* are elements in a space yet to be defined and assembled. For this, these irreducibly exterior elements must enter into relations of alliance or alignment. Beneath the ever-shifting configurations of alliances between states, cities and patron gods that characterised political life in Ancient Mesopotamia, we can glimpse the endurance of the *me* as the nomad, intense virtues, the molecules of life. Regardless of the disparity of the forces at play, an alliance is always between elements of the same value. It is a non-hierarchical, precarious, and adaptive mode of cooperation, in which the actors are equals but distinct. In the alliance between the institution of the temple and that of the cultic prostitute, prostitution might be used as a holy practice in the temples, yet prostitution itself always remains *exterior*. It has been borrowed from the outside; and thus it harbours another logic, is of another origin. The players earn their power precisely from (and through) this exteriority. Inanna herself incarnates the alliance between certain powers and capacities that seem inalienably exterior, yet deeply related in the mythologies of many cultures, including the postmodern west: desire and war, sex and violence, love and ferocity.

Consequently, the network of alliances that underpins civilisation takes place at pre-individual levels (not between individuals, classes or among societies). Crafts, skills, states of being, capacities, affects, offices: the alliances of civilisation cut across all levels of the material and historical, the social, individual and cosmic. Heroism and wickedness, forthrightness and deceit: each is a positive differentiation in itself, wielding an excessive power. They can take over bodies as much as forsake them. A body, in a sense, does not pre-exist these impersonal, migrant qualities, offices, passions—affects without subjects, offices without state.

Can we read the story of Inanna and Enki as a philosophy of technics? Yes, as long as we also read it as the story of the impossibility of technics, or at least of its modern western image which finds its inception with Bacon and Descartes. Both the stories of Inanna and Prometheus make evident the link between techniques, magic and transgression that is a persistent motif of the premodern technocultural imaginary. Both Inanna and Prometheus achieve their ends by trickery and deceit. In both cases bringing power to humanity demands a glaring transgression, the crossing across borders and into zones (the waters of the *abzu*, the heights of the heavens) that are off-limits to mortal beings. It also involves a violation of hierarchy, the infringement of established political structures. In the figures of Enki, Inanna and Prometheus technics is presented as inseparable from cunning and artifice.

But then the stories diverge. For a start, there is the question of the *receptacle*. How does Inanna carry the *me* across the waters? How are they stored? If Prometheus carries fire (or a glowing coal), a cardinal symbol of natural technics, what are Inanna’s means? The Sumerian tale says nothing about the material receptacle of the *me*. They are “given” to Inanna, so they are transferable, transportable; perhaps not across space but between different orders of the cosmos.

The question of the receptacle is the question of inscription and writing, the coding, storage and transmission of knowledge. For Inanna there is no default, no exteriorisation leading to a dark and tragic dialectic of mirrors and ghosts. Prometheus is Heideggerian, Inanna is Deleuzian. The human is neither a congenital lack, nor the product of forgetfulness—nor anticipation for that matter. The question of how was civilisation, or the human, or anything possible before the arrival of the *me* cannot be asked, for all these things were already finished, ontologically full and

positively differentiated.

Technics might be at best an analytical convenience, at worst the transcendental bogeyman of western lore: the *Ge-stell*, the demonic skeleton that rules “our” lives, the lives of the *we*. Against this encroachment of Technology, this industrialisation of the Human, the only possible politics is a reactionary form of humanism; a retreat to the “ethnic”, the hut, the Black Forest in which the Human receives another name (*we*), but remains recognizably human.

For Inanna there is no *we*, since “we” is already constituted by *me*, the powers and passions that (on one hand) articulate matter, form, bodies, civilisations and, yes, technics; and (on the other) are articulated *in* them, as liminal regions, singularities. Innana’s philosophy of technology is as much a biophilosophy as it is a politics. This is why she should be a much more skilful guide to the future than Prometheus and his forgotten brother.

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Endnotes

1. I will attempt to respect the distinction between technics and technology (this latter as an epoch of technics) that Stiegler incorporates: technology as the historical period in which technics “functionally integrates scientific knowledge” (Vol. 3, 2004:336). I will not be dealing much with this aspect of Stiegler’s project, except to criticise the overall historical narrative that helps ground the distinction. I believe such a distinction is untenable, but will adhere to it for argument’s sake. For a start, it departs from an imaginary opposition between *techne* and *episteme* projected onto Greek philosophy.
2. Corballis (1999) argues that such an early technics might have been gestural language. With the advent of bipedalism, argues Corballis, the “hands and arms are freed from any involvement in posture or locomotion.” Gestural communication has some strategic advantages: Gestures are silent, spatial and iconic. (Also, we might suggest, indexical). The shift to speech was most likely gradual, a process in which speech did not replace gesture but complemented it. This connection was never lost, and it is strong even today. Vocal communication required extensive alterations to the vocal tract, as well as a shift from predominantly subcortical to cortical control over vocalisation. It also “requires more precise programming of motor sequencing, since the message depends exclusively on temporal sequencing.”

Corballis makes the connection between speech and tool-making: “... speech would have freed the hands yet again, allowing our ancestors to verbally instruct others in manual arts, such as the use and manufacture of tools, while at the same time demonstrating them.”

Thus, Corballis suggests that “technology might have resulted, not from an increase in brain size or intelligence, but from a switch from manual to vocal language that allowed them [our early ancestors] to use their hands for the manufacture of tools and weapons and their voices for instruction.” Corballis also points to the sequential nature common to language and techniques.

3. [3] “The informatization of knowledge is only possible because informatics, as a technique for the recording, reading, and diffusion of information, in a kind of writing” (Vol. 2, 108). Money is a “primordial tertiary retention” (Vol. 3, 173). Genetic sequences, enzymes and other biomolecular materials are “tertiarized” retentions that make manipulation possible. This manipulability is a characteristic of tertiary retentions. “It is these tertiarized biological retentions what constitutes the primer matter of the industry of the living being” (Vol. 3, 351).
4. Once in place, innovations can be remarkably resilient. A famous case, often cited in the literature, concerns a group of Japanese macaques studied in the island of Koshima, Japan, in the 1950s. To watch them better, the researchers lured these monkeys out into the open with sweet potatoes. Normally the monkeys cleaned the dirt off the potatoes using their hands; but one day a female macaque decided to wash the potato in a stream of freshwater. The habit soon spread and was passed on to younger generations. Shortly after, a further innovation was introduced: the monkeys used saltwater instead of freshwater, apparently because they liked the salty taste better. Many years later, the descendants of these macaques were observed still washing potatoes in saltwater. This does suggest that primates are also emancipated from genetic programming (assuming we wished to frame the question in those terms).
5. This understanding of technics as a mode of deliberation and action emerging from contingent situations resonates with pre-Socratic conceptions of *techne* and *metis*. In the ancient Greek tradition, these two terms connoted “a way of thinking and a pattern of intellectual behaviour” (Wheeler 25), the mental capacity manifest in technical activity. Both *metis* and *techne* are intimately related, and sometimes used as synonyms. Says Everett Wheeler: “Although primarily a word of Homer and the epic tradition, *metis* is a thought process which implies a complex but coherent body of mental attitudes, combining flair, wisdom, forethought, subtlety of mind, deception, resourcefulness, vigilance and opportunism with various skills and experiences acquired over time. *Metis* principally emerges in shifting, disconcerting, and ambiguous situations, where precise calculation and rigorous logic either fail or lack time to operate” (25).
6. Stiegler’s comment that “it is strange that the cognitive sciences have not integrated the technical event qua exteriorization of memory ... into their modelling” (Vol. 2, 163) is itself strange. It would have been more interesting and fruitful, in the context of his argument, to address some key recent developments that place something like tertiary retentions at the heart of cognitive philosophy. I’m referring to “extended mind” or “distributed cognition” theory, which has emerged as an influential critique of the traditional computational model that so dissatisfies Stiegler and others. This view argues that the limits of the mind cannot be circumscribed to the boundaries of the skull. Cognition extends outwards into the environment, incorporating technical supports such as writing implements, symbolic systems, and the objects-signs we use to navigate through our everyday worlds. All these should be included as parts of the cognitive process—literally as part of the mind. The thesis, as originally formulated by Clark and Chalmers (“The Extended Mind”), avoids any explicit metaphysical commitment, but clearly challenges both Cartesian notions of the subject as self-transparent intellectual substance, and standard computational models in which the mind is believed to hold internal representations. This approach can shed some light not only on diachronic processes of cultural accumulation, but also on synchronic aspects of cognition in which information is “off-loaded” onto the environment. In *Natural Born Cyborgs*, Clark writes:

... our nature as individual intelligent agents is determined by the full set of conscious and unconscious tendencies and capacities that together support the

set of projects, interests, proclivities, and activities distinctive of a particular person. Just who we are, on that account, may be as much informed by the specific sociotechnical matrix in which the biological organism exists as by those various conscious and unconscious neural events that happen to occur inside the good old biological skin-bag (33).

This approach has also been applied to modelling large sociotechnical systems; we can cite Hutchins' study of navigation (*Cognition in the Wild*), in which bodies, techniques, artefacts, procedures, cultural norms are considered as functions of an integrated cognitive ensemble. Robert Wilson (*Boundaries of the Mind*) has developed its implications for a model of memory:

Both our day-to-day acts of remembering and the systems that those acts involve are locationally wide, drawing as they do on the symbolic and nonsymbolic environments that we individually and collectively create, from the more obvious forms of external storage devices, such as notepads, diaries, books and memos, to the daily routines we form to structure our lives and the habits that form us and the structure of our lives. ... [This] is a claim about what is at the heart of memory, what memory is: It is a locationally wide ability that creatures like us have that allows us to make use of the past in acting for the future (196).

It is not my intention here to offer a comprehensive overview of this approach (or to what extent it is a true break with classical cognitivism), but to question Stiegler's assertion that philosophy has ignored materiality across the internal-external barrier. In fact, these new approaches suggest a more balanced way of thinking the technical support without Stiegler's reductive focus on writing, and without having to accept the kind of heavy ontological commitment that his approach demands (one of the reasons, perhaps, why his work has been ignored in the cognitive sciences and philosophy of mind).

7. Derrida's remarks on cybernetics at the beginning of *On Grammatology* are the point of reference; these convey the enthusiasm with which French post-structuralism originally received these developments – see Dupuy's *The Mechanization of the Mind* for an account of the love affair of French thought with cybernetics.
8. For this account of the legend, I will be using the translation in *The Electronic Text Corpus of Sumerian Literature* Siren, Christopher. *Sumerian Mythology Page*. <http://pubpages.unh.edu/~cbsiren/sumer-faq.html#A1.3.1>. Accessed 3/6/2001.
9. In *Snow Crash* (1992), Neal Stephenson imagines Enki as the first computer hacker, the *me* being an alien set of programs administered from his temple by a bureaucracy.
10. Here is the complete list, from the Electronic Corpus of Sumerian Literature:

Heroism, power, wickedness, righteousness, the plundering of cities, making lamentations, rejoicing.

Deceit, the rebel lands, kindness, being on the move, being sedentary.

The craft of the carpenter, coppersmith, scribe, smith, leather-worker, fuller, builder, reed-worker.

Wisdom, attentiveness, holy purification rites, the shepherd's hut, piling up glowing

charcoals, the sheepfold, respect, awe, reverent silence.

The bitter-toothed (?), the kindling of fire, the extinguishing of fire, hard work, the assembled family, descendants.

Strife, triumph, counselling, comforting, judging, decision-making.

The office of *en* priest, *lagal* priest, divinity, the great and good crown, the royal throne.

The noble sceptre, the staff and crook, the noble dress, shepherdship, kingship.

The office of *egi-zi* and *nin-dijir* priestess, *icib*, *lu-mah* and *gudu* priest.

constancy, going down to the underworld, coming up from the underworld, the *kur-jara* priest.

Sword and club, the cultic functionary *saj-ursaj*, the Black garment, the colourful garment, the ... hair-style.

The standard, the quiver, sexual intercourse, kissing, prostitution, running (?)

Forthright speech, deceitful speech, grandiloquent speech, the cultic prostitute, the holy tavern.

The holy *nijin-jar* shrine, the hierodule of heaven, loud musical instruments, the art of song, venerable old age.

Works Cited

- Ambrose, Stanley. "Paleolithic Technology and Human Evolution." *Science* 291: 5509 (2001): 1748-1753.
- Audouze, Françoise. "Leroi-Gourhan, a Philosopher of Technique and Evolution." *Journal of Archaeological Research* 10:4 (2002): 277-306.
- Beardsworth, Richard. "From a Genealogy of Matter to a Politics of Memory: Stiegler's Thinking of Technics." *Tekhnema* 2 (1995): 85-115. 15 June 2004.
<http://tekhnama.free.fr/2Beardsworth.htm>.
- Boesch Christophe. & Tomasello Michael. "Chimpanzee and Human Cultures." *Current Anthropology* 39:5 (December, 1998): 591-.
- Breard, Gerardo. *Codificación de Conocimientos sobre el uso de Técnicas Biotecnológicas a través de una Wiki Semántica (WKS) en Laboratorios de la Universidad de Quilmes* (Masters Thesis, Universidad Técnica Nacional, Argentina, 2008).
- Clark, Andy. *Natural-Born Cyborgs: Minds, Technologies, and the Future of Human Intelligence*. New York: Oxford University Press, 2003.
- Clark, Andy & Chalmers, David. "The Extended Mind." *Analysis* 58 (1998):10-23.
- Corballis, Michael. "The Gestural Origins of Language." *American Scientist* Vol. 87 (1999): 138-145.
- Crogan, Paul. "Essential Viewing: Bernard Stiegler (2001) *La technique et le temps 3: Le temps du cinéma et la question de mal-être*." *Film Philosophy* 10:2 (2006): 39-54.

- Derrida, Jacques. *Of Grammatology*. Baltimore and London: John Hopkins University Press, 1974.
- Dupuy, Jean-Pierre. *The Mechanization of the Mind: The Origins of Cognitive Science*. Princeton: Princeton University Press.
- Ekman, Ulrik. "Of Transductive Speed – Stiegler." *Parallax*13:4 (2007): 46-63.
- Fausto-Sterling, Anne. *Sexing the Body: Gender Politics and the Construction of Sexuality*. New York: Basic Books, 2000.
- Griffiths, Paul. "Genetic Information: A Metaphor in Search of a Theory." *Philosophy of Science* 68:3 (2001): 394-412.
- Hansen, Mark B. N. (2004) "'Realtime Synthesis' and the différance of the Body: Technocultural Studies in the Wake of Deconstruction." *Culture machine* 6. <culturemachine.tees.ac.uk/Cmach/Backissues/j006/Articles/hansen.htm> Accessed 07/05/2005.
- Hutchins, Edwin. *Cognition in the Wild*. Cambridge, MA: MIT Press, 1995.
- Ingold, Tim. "'Tools for the Hand, language for the Face': An Appreciation of Leroi-Gourhan's *Gesture and Speech*." *Studies in the History and Philosophy of Biology and Biomedical Science* 30:4 (1999): 411-453.
- Keller, Evelyn. "Decoding the Genetic Program, or, Some Circular Logic in the Logic of Circularity." *The Concept of the Gene in Development and Evolution: Historical and Epistemological Perspectives*, eds. Beurton P. J., Falk R. & Rheinberger H-J. Cambridge: Cambridge University Press, 2000.
- Latour, Bruno. *Pandora's Hope: Essays on the Reality of Science Studies*. Cambridge, Massachusetts: Harvard University Press, 1999.
- Lenoir, Timothy. "Makeover: Writing the Body into the Posthuman Technoscape: Part One: Embracing the Posthuman" *Configurations* 10:2 (2002): 203-220.
- Levins, R. and Lewontin, R. "A Program for Biology." *Biological Theory* 1:4 (2006): 333-335.
- Mackenzie, Andrew. "Transduction: Invention, innovation and collective life" Unpublished. 2 October 2006. <http://www.lancs.ac.uk/staff/mackenza/papers/transduction.pdf>
- Nelson, K. & Nelson, R. "The Cumulative Advance of Human Know-How." *Philosophical Transactions of the Royal Society of London A* (2003) 361:1635-1653.
- Roberts, Ben. "Stiegler Reading Derrida: The Prosthesis of Deconstruction in Technics." *Postmodern Culture* 16:1 (2005).
- Roux, Georges. *Ancient Iraq*. London: Penguin Books, 1989.
- Sarkar, Sahotra. "Biological Information: A Sceptical Look at Some Central Dogmas of Molecular Biology" In Sarkar S. (ed.) *The Philosophy and History of Molecular Biology: New Perspectives* (Dordrecht: Kluwer Academic Publishers, 1996).
- Schore, A. *Affect Regulation and the Origin of the Self: The Neurobiology of Emotional Development*. Lawrence Erlbaum Associates, 1994.
- Sei, Mario. "Técnica, Memoria e Individuação: La Perspectiva de Bernard Stiegler" *LOGOS*:

Anales del Seminario de Metafísica Vol. 37 (2004): 3337-363.

Simondon, Georges. *El Modo de Existencia de los Objetos Técnicos*. Buenos Aires: Prometeo Libros, 2008.

Siren, Christopher. *Sumerian Mythology Page*. <http://pubpages.unh.edu/~cbsiren/sumerfaq.html#A1.3.1>. Accessed 3/6/2001.

Stiegler, Bernard. *Technics and Time 1: The Fault of Epimetheus*. Stanford University Press, 1998.

---. *La Técnica y el Tiempo 3: El Tiempo del Cine y la Cuestión del Malestar*. Hondarribia: Editorial Hiru, 2004.

---. "Desire and Knowledge: The Dead Seize the Living." <www.arsindustrialis.org/desire-and-knowledge-dead-seize-living>

---. *Technics and Time 2: Disorientation*. Stanford University Press, 2009.

Tenner, Edwards. *Our Own Devices: How Technology Remakes Humanity*. New York: Vintage Books, 2003.

Tomasello, Michael. *The Cultural Origins of Human Cognition*. Cambridge & London: Harvard University Press, 1999.

Van Scaik, C. P. & Pradhan, G. R. "A Model for Tool-Use Traditions in Primates: Implications for the Coevolution of Language and Cognition" *Journal of Human Evolution* 44 (2003): 645-664.

Wheeler, Everett. *Stratagem and the Vocabulary of Military Trickery*. Leiden and New York: E.J. Brill Publishers, 1988.

Wilson, R. A. *Boundaries of the Mind: The Individual in the Fragile Sciences: Cognition*. Cambridge: Cambridge University Press, 2004.

Wolpert, Lewis. "Causal Belief and the Origins of Technology." *Philosophical Transactions of the Royal Society of London A* (2003) 361, 1709-1719.