Cognitive Enhancement and Anthropotechnological Change: Towards an Organology and Pharmacology of Cognitive Enhancement Technologies

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Abstract: This article focuses on cognitive enhancement technologies (CET) and their possible anthropological implications, and argues for a reconsideration of the human-technology relation so as to be able to better understand and assess these implications. Current debates on cognitive enhancement (CE) often start from an instrumental and anthropocentric view of technology and a (neo-)Darwinist account of the human, consistently disregarding the intimate intertwinement of the human and technology as well as the fundamentally technogenic nature of the process of anthropogenesis. Yet, an adequate assessment of CET requires an in-depth and up-to-date conceptualization of the human-technology relationship as well as the technogenesis of the *anthropos*. Employing Bernard Stiegler's recently devised philosophico-anthropological framework of general organology as well as his theory of technology as a *pharmakon*, this article proposes to develop an organology and pharmacology of cognitive enhancement. What is typical about new cognitive enhancement technologies is their interiorizing (instead of the traditionally exteriorizing) nature, which can be expected to totally reshape current organological configurations. Starting from the premise that CE is a phenomenon that should be understood fundamentally from its unfolding within the current conjuncture of *cognitive capitalism*, I will present the issue of *cognitive proletarianization* as being of crucial importance for considering CE. I conclude by providing some methodological guidelines for the development of a *positive* pharmacology of CET, focused on *de*proletarianization and specifically related to the improvement of attention, suggesting that CET should be considered in this respect as technologies of the self à la Michel Foucault.

Keywords: cognition, cognitive enhancement, cognitive capitalism, anthropology, human-technology co-evolution

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Introduction

The relationship between humans and techno-science is expected to change dramatically in the coming decades, most particularly because of the emergence of a whole spectrum of new technologies that, in contrast to technological developments until recently, will not so much alter the environment in which humans live as, instead, intervene in the human itself, i.e., into his body and mind. In the wake of the growing interest within academia of the ideas and utopic projections of so-called 'transhumanist' and 'extropian' thinkers like Nick Bostrom, Anders Sandberg, Julian Savulescu, Max More, John Harris, Simon Young and many others, a debate has risen in recent years about the idea of human enhancement (HE), i.e., about the possibilities, the prospects and the risks of improving the human through the application of science and technology, in particular through the use of the so-called NBIC technologies[1], which carry the promise – apparently – of enabling the substantial improvement of 'human performance' (Roco and Bainbridge 2003).

However you look at human enhancement technologies (HET), they *will certainly* have huge consequences for the way the human-technology relationship will evolve in the future. This means that we have to seriously reconsider the intersection between technology and anthropology, emphasizing the technicity of the anthropos and the anthropo*logos*. Techno-Anthropology is an emerging discipline that proposes to deal with questions concerning the changing intersections between technology and anthropology. This article aims to contribute to this discipline through an exploration of the *original technicity* of the anthropos in view of developing a *methodology* for studying and critically assessing – in particular 'intimate' – human-technology interactions. This methodology, termed practical organology, will be developed from a Stieglerian perspective on the original technicity of the anthropos.

One of the most promising, and in any case, most exciting areas of HE is cognitive enhancement (CE): the improvement of the cognitive capacities of the human mind(-body).[2] This has become a highly controversial field since emerging waves of new technologies are bound to have huge impacts on both the individual and the societal level. Notably, it is claimed that those technologies have the potential to fundamentally change our cognitive system or even 'human nature' itself, opening up a 'trans-human' or 'posthuman' future (More and Vita-More 2013). Ethical and societal debates range from issues such as risks, benefits, and safety to questions about autonomy, agency, identity, and the possibility or desirability of 'reshaping' human nature (Savulescu and Bostrom 2009).

Until now, the ethical and political debate on CE has been largely informed by theoretical approaches building on neoliberalism, utilitarianism, and analytic philosophy (cf. Bostrom and Roach 2008). These approaches most often rely on a neurocentric and (neo-) Darwinist account of human cognition, consistently disregarding, as I argue in this article, the intimate intertwinement of the human and technology and the fundamentally technogenic nature of the process of anthropogenesis (of which the genesis of the human cognitive apparatus is undoubtedly the most remarkable aspect). Yet, an adequate assessment of cognitive enhancement technologies (CET) and their effects upon human cognition requires an in-depth and up-to-date conceptualization of the human-technology relationship, one that should be based, I uphold, on a profound understanding of the *fundamental technicity* as well as the *technogenic origin* of the human cognitive system, i.e., the fact that it is deeply constituted and conditioned by, as well as evolved in intimate interaction with, technology. In the current debate, this anthropo*techno*logical dimension is underdeveloped if not totally absent.

In my research I aim to contribute to exploring this dimension. In this contribution, however, I have to limit myself necessarily to providing only some building blocks for a yet to be developed anthropotechnological framework that could guide the ethical and political debate on CE. After a brief review of the dominant, neurocentric and (neo)Darwinist account of human cognition figuring prominently in the current debate, I will employ Bernard Stiegler's recently developed theory of 'general organology' to propose an organology of cognition in which the brain as the central cognitive organ is theorized explicitly in its intimate relationship with both the technical organs with which it continuously interacts and with the social *organi*zations in which it is always embedded. Within this organological framework -- and this is important for considering

the issue of enhancement -- the technical organs are conceived by Stiegler as having the character of *pharmaka*, i.e., as being *both* poisoning and remedying in the sense of simultaneously possessing both the ability of supporting *and* of undermining, in our case, cognitive capacities (because, as I will show, they fundamentally compensate for an 'ontological lack'). Starting from the premise that CE is a phenomenon that should be understood fundamentally from a politico-economic perspective, in particular as a project that unfolds within the current conjuncture of *cognitive capitalism*, I will then, from both an organological and a pharmacological perspective, present the issue of (cognitive) *proletarianization* as being of crucial importance for considering CE, both in their particular forms and in a general sense. I will conclude this article by providing some methodological guidelines for the development of a *positive* pharmacology of CET, focused on deproletarianization and specifically related to the improvement of attention, suggesting that CET should be considered in this respect as technologies of the self in the sense of Michel Foucault.

The Neurocentric and (Neo-)Darwinist View of Human Cognition

Remarkably, given their focus on the technological 'upgrading' of the human cognitive apparatus, most contenders within the current debate on CE share a neurocentric and (neo-)Darwinist view of human cognition that is derived from the contemporary cognitive and neurosciences. This is a view that consistently disregards the role of technology in human cognitive processes (Bostrom and Sandberg 2009; Buchanan 2011)[3].

Most if not all of today's cognitive science is decidedly *neurocentric*, and this is of course especially true of the cognitive neurosciences. The brain is invariably understood as a self-sufficient cognitive engine, as the exclusive seat of cognition. What the Marxist historian of science John D. Bernal already stated in 1929 is still common belief in today's neurosciences: "After all it is the brain that counts, and to have a brain suffused by fresh and correctly prescribed blood is to be alive - to think" (Bernal 2010, 31). Since cognitive science's 'turn to the brain' in the eighties, which was largely a consequence from the development of new imaging technologies for studying the brain, "most cognitive scientists place the study of the brain firmly at the heart of cognitive science" (Bermúdez 2010, 93) and "are convinced that in some fundamental sense the mind just is the brain, so that everything that happens in the mind is happening in the brain" (Bermúdez 2010, 6). According to Patricia Churchland, a leading contemporary philosopher of mind and cognition, "Mental activity *is* brain activity" (2002, 30).[4] Another well-known philosopher of mind, John

Searle, asserts, referring to the famous 'brain in a vat' thought experiment popular among analytic philosophers of mind:

> The brain is all we have for the purpose of representing the world to ourselves and everything we can use must be in the brain. Each of our beliefs must be possible for a being who is a brain in a vat because each of us is precisely a brain in a vat; the vat is the skull and the "messages" coming in are coming in by way of impacts on the nervous system. (Searle 1983, 230)

And as Daniel Dennett writes in *Darwin's Dangerous Idea*: "Of course our minds are our brains, and hence are ultimately just stupendously complex "machines"; the difference between us and animals is one of degree, not metaphysical kind" (1995, 370).

More recently, prominent MIT philosopher of cognitive science Paul Thagard claims that "we should identify minds with brains" (2010, 9) since, he argues, "human thought is accomplished by the human brain" (2005, 18) and therefore "the mind is what the brain does" (2010, 42). Feelings such as hope but also modes of perceiving and reasoning are just brain processes, according to Thagard, and even concepts themselves are to be understood as "neural processes rather than ideal entities" (2010, 36), he confidently claims, apparently unaware of Husserl's refutation of such categorical naturalistic misunderstandings. As for the Darwinistic convictions of Thagard, shared by most of his colleagues, he asserts his agreement with Darwin that "humans are just another biological species evolved through natural selection" and reminds us that "our treasured thoughts and feelings are just another biological process" (2010, 42). Many more authors could be cited here, but it should be clear that the view that seems overwhelmingly dominant in today's cognitive science is that cognition is "BRAINBOUND," as the British philosopher of cognition Andy Clark puts it (Clark 2011, xxvii). And the consensus among cognitive scientists, philosophers of cognition, *and* most proponents as well as opponents of CE is that this brain is a product of Darwinian evolution, i.e., evolution via natural selection.

Although it is increasingly criticized both from within and outside the cognitive (and also the brain) sciences themselves (Legrenzi and Umiltà 2011; Tallis 2011), the neurocentric view on cognition is still the dominant one by far. Even more so, the brain is popularly (as well as professionally) perceived nowadays as containing the key to understanding almost every aspect of

human life, just as the genome seemed to be a decade ago. Thus the neurosciences have become the most revered (and lavishly funded) sciences in recent times and the prefix 'neuro-' is attached to almost every thinkable discipline and practice (from neuro-ethics and neuro-theology to neuro-marketing and neuro-capitalism). A person's self-understanding is also becoming more and more "brain-based," as Nikolas Rose has argued, coining the term 'neurochemical self' for the emerging view human subjects have of themselves (2007, 188). Over the last decade, science as well as society at large have come into the grip of a "neuromolecular gaze" (Rose and Abi-Rached 2013, 4)[5].

In this article, it will be emphasized that it is the crucial role of technical artifacts that is especially and consistently neglected within the cognitive sciences and the CE project embracing the view of these sciences. Cognition is not simply what occurs in the brains of individuals. It also resides in the relations between individuals and particularly in the technical artifact that makes the relations between the bodies and minds of these individuals possible. What is becoming ever more clear, not in the least because of the discovery of so-called neural plasticity (more on this in sections 3 and 5), is that the technical environment is just as important for understanding human cognition as are the neural processes in the brain (Stiegler 2008a, 26-7) because the brain is continuously changing through its interaction with this environment.[6]

The Organology and Pharmacology of Human Cognition

Human cognition cannot be conceived in terms of an individual faculty localized in the brain. Instead, it is a fundamentally social phenomenon, the product of social organizations, which are themselves thoroughly conditioned by technical systems through which individual brains (or psyches) interact with each other and articulate themselves (Stiegler 2010b, 34). The brain, and this is fundamental to Stiegler's techno*logical* and techno*genic* conception of human cognition, is only one of the three elements that constitute the phenomenon of human cognition as a whole.

What most of today's theories of human cognition behind the speculations about the prospects of CE tend to overlook is the technogenic origin of human cognition. Such a proposition posits that human knowledge is technological in essence and that the human cognitive apparatus is characterized by what Stiegler calls 'original technicity.'[7] Human cognition essentially depends on technical artifacts, i.e., the human cognitive apparatus exists only in an intimate relationship with its artificial memory supports and its cognitive operativity is constituted by the very material

characteristics of these supports as organized inorganic objects (Stiegler 2009a, 164). The use of prostheses to enhance human cognition is not at all a recent phenomenon. On the contrary, human cognition is originally prosthetic. What defines the human cognitive apparatus in comparison to that of other animals is the fact that it does not consist of a neural system only, but of a neural system deeply intertwined with a technical system. That is to say: it must be understood fundamentally as an *original coupling* of brain and prostheses, i.e., as composed of a neuronal structure intrinsically connected with a system of technical artifacts. What is crucial to apprehend here is that this coupling – the intimate relationship of the brain and its prostheses - is "older" (i.e., more original) than either the human brain or 'its' technical supports themselves (Stiegler 2009a, 164).

Stiegler understands 'the human' principally as a *process*, that is to say as a process of *individuation* in which three organ systems continuously evolve in intimate interaction with each other: (1) the biological organs, of which the brain as the seat of the psyche is most important, (2) the social organs or organizations, like schools, tribes, nations, companies, etc., and (3) the technical organs, like stone tools, writing techniques, automobiles and computers (always constituting a technical system) (Stiegler 2013, 419-20).[8] The metastable equilibria constantly produced in the configurations between these three organ systems are what drives the human process of individuation, which must be understood as a threefold dynamic of psychic, social and technical *co*-individuation. The relationship between these three organ systems is of a *transductive* nature, meaning that the relata do not exist apart from their relationship with each other but continuously co-constitute themselves reciprocally in the process (Stiegler 2010a, 104).[9]

Cognition, then, must also be understood as a *process* of psychic, social and technical co-individuation, a process that is principally open and interminable, never 'complete' but always 'in coming.' Although it is impossible to attribute some sort of causal primacy to any of the three organ systems, since we are dealing with metastable equilibria, Stiegler nevertheless contends that this individuation process is 'driven' in the final analysis by the evolution of the technical organs, i.e., by the dynamic of technical individuation. This is so because, as Stiegler shows through the work of the French paleoanthropologist André Leroi-Gourhan, the human being has evolved from a process of *technical exteriorization*. The human is the effect of an evolutionary process based not so much on biological transmission via genes as on the *extra*-biological transmission of technical artifacts embodying exteriorized (and materialized) individual experiences (Stiegler 2004, 46).

Homo sapiens is not so much a product of bio-evolution, as (neo)Darwinists maintain, but of techno-evolution, and this is particularly true of the human cognitive apparatus.[10]

Organologically, over the course of human evolution and subsequently of human history, the constant appropriation or *adoption* of new technical organs by individuals involves the periodic *de-* and *re-*functionalization of their cognitive apparatuses, i.e., their brains (as it does the de- and re-organization of the social organs). The brain as the principal organ of human individuation, and as the organ of fabrication and use of technical objects, is and has always been in a transductive relation to its technical objects, and more encompassingly, to the technical milieu in which it is always already embedded. This transductive relation evolves, evolutionary and historically, precisely in the form of periodic re- and defunctionalizations of the human brain in response to the appearance of new technical organs (Stiegler 2005a, 217). It is the brain's neural plasticity, evolved over the course of more than two million years of human-technology co-evolution, which forms the condition of possibility for these periodic cycles of organological de- and re-functionalization (Stiegler 2010a, 97). This neural plasticity enables the psychic organs to interiorize the *abilities* related to the *possibilities* that are opened up with the exteriorized artifacts, i.e., the technical organs (96).

The principal openness and interminability of the process of human individuation, its *being* structurally "without-end," is grounded in the "fact," according to Stiegler, that the human is a being *without origin*, a being that has a lack or fault *at* or *as* its origin (2004, 43). This thoroughly accidental understanding of the human being's "de-fault of origin" (*défaut d'origine*) is probably Stiegler's most fundamental thought and absolutely crucial to grasp in order to understand his conception of cognition. It is due to this de-fault of origin that the human being is – by necessity as it were – a technical being, a being whose 'ontological' structure is technologically, i.e., accidentally constituted, changing all the time. Because of their lack of intrinsic qualities, humans are fundamentally in need of artificial supplements, i.e., technical prostheses. They are characterized by an *original prostheticity* (2004, 45).[11]

Fundamentally prosthetic, i.e., fundamentally in need of prostheses, the human is a being that finds its being *outside* of itself – the Greek word *pros-thesis* means something which stands in front of or outside of that which is placed in front of it (2004, 192). Humans exist only in the form of a lack, they exist only *as* lack, that is to say only *by default*. This means that they only 'are' in (constantly) becoming. Humans can only 'achieve' or 'complete' themselves by de-fault(s), i.e.,

through prostheses. But this actually means, according to Stiegler, that humans can always only *in-complete* themselves, in the sense of constantly 'displacing' that which makes them de-faulting and which, by putting them into movement, permits them to continue the course of their individuation. As Stiegler writes: "That which 'drives' man is his de-fault" (2005b, 82). That is to say: the de-fault of origin is man's ultimate motor and motif, that which drives his individuation process and appears as such as his very condition, and *therefore* as "that which should be" (*ce qu'il faut*), as Stiegler writes in a wordplay that works only in French (2013b, 105).

For Stiegler, technologies as prostheses are intrinsically ambiguous in the sense that they can both foster and intensify or ruin and erode processes of psychic and social individuation, i.e., they can both support and undermine psychosocial individuation processes. Differently put: technologies can be conducive of both individuation and disindividuation. It is for this reason that he theorizes them fundamentally as *pharmaka* (Stiegler 2013a, 421-2). *Pharmakon* is a Greek word meaning both poison and medicine. Technologies as *pharmaka* can simultaneously poison processes of psychocollective individuation *and* be employed to cure these very same poisoned processes. The only way to cure the "poisoning" or "toxifying" effects of technological *pharmaka* is via these very same *pharmaka*: by developing new practices around and on the basis of these *pharmaka*, i.e., practices of care (Stiegler 2010a, 85). Whether *pharmaka* act as a poison or function as a medicine – i.e., as a therapeutic – depends then on the presence or absence of a practice of care (Stiegler 2013b, 31-2, 96-7).

An organology of *cognition*, I suggest, should theorize human cognition as resulting from the tripartite and transductive articulation of psychic organs, technical organs and social organizations. Cognition thus conceived is fundamentally a process of co-individuation necessarily involving these three organ systems, and in which the technical organs – as *pharmaka* – can both support *and* subvert the cognitive individuation process. The subversion of the cognitive individuation process via the technical organs, which leads to disindividuation, is referred to by Stiegler with a notion originally derived from the Marxist tradition but interpreted more decisively in a Simondonian fashion, which is that of *proletarianization*. The danger of proletarianization, which belongs to the very technicity of human existence *as such*, is also inherent (and even more dangerously so) in CET.

Cognitive Proletarianization: Disenhancement of Cognitive Capacity

Within Marxism, proletarianization is generally understood in terms of the separation between producers (laborers) and the means of production (technologies) as well as the exploitation of labor by capital enabled through capital's ownership of the means of production and its expropriation of the fruits of that labor. The famous proletariat then consists of all those who are in this way exploited by capital (Marx and Engels 2002, 219).

Although this 'juridico-economic' aspect of expropriation and exploitation is crucial for Stiegler as well, the more fundamental characteristic of proletarianization for him as a thinker of technology, thereby following Simondon (1989, 117-8), consists in the loss of knowledge and know-how of the laborer – and by extension of every subject engaged in whatever sense in technical innovation processes, especially under capitalist conditions – to the technical organs, onto which this knowledge and know-how is progressively transferred (Stiegler 2011, 104). Through increasing delegation of tasks to technical organs, which is what happened in the course of the mechanization and industrialization process of industrial capitalism in the nineteenth and twentieth centuries, laborers have been turned more and more into simple servants of increasingly complex machinery, externally designed by engineers employed by capital as well. This has led to a dissociation with the sociotechnical milieu, excluding the laborers from participation in the evolution of this milieu (Stiegler 2010b, 38).

From the perspective of individuation, the process of proletarianization can be described as an increasing *dis*adjustment, or divorce of the processes of psychic and collective individuation from the process of technical individuation, causing them to *dis*individuate. Organologically, it involves the progressive dominance of the technical organs over the psychic organs and the social organizations, due to the fact that the technical exteriorizations of which these technical organs consist are not re-interiorized by the psyches and the social organizations. This happens when they are not properly *adopted*, in Stiegler's terminology, but when psyches and social organizations are instead led to *adapt* themselves to these exteriorizations, which produces psychic and social heteronomy instead of (always technologically conditioned) autonomy (Stiegler 2013b, 32).

Proletarianization takes place when processes of psychosocial individuation are *short-circuited* by processes of technical individuation. *Cognitive* proletarianization occurs when the human cognitive apparatus, as well as the social organizations involved in cognitive processing, are more and more *superseded*, and thereby short-circuited, by cognitive technologies as the artificial cognitive organs intended to *support* the processes of cognition. In *replacing* the psychic

and collective organs, however, they come to *subvert* them (Stiegler 2013b, 104). This actually entails a destruction – or at least a disenhancement – of cognitive capacity (which necessarily requires the 'wholesome' interplay of all three levels).

As Stiegler suggests, cognitive proletarianization is precisely what has taken place on a massive scale over the last three decades, in which so-called cognitive capitalism has successfully pursued the control of cognitive labor and its immaterial products through the networks of digital information technologies. A characteristic feature of the past three decades, the period of the digitization and informatization of society and the becoming hegemonic of what Hardt and Negri (2000) and other post-operaists have called immaterial labor, has been the proletarianization of noetic life (Stiegler 2013b, 103).

While the nineteenth century brought the proletarianization of the producer and the twentieth century has been the age of the proletarianization of the consumer (of its *savoir-vivre*), according to Stiegler, the twenty-first century is bent to become the epoch of the proletarianization of the intelligentsia, of engineers, scientists, and scholars, i.e., of their theoretical knowledge (*savoir-théorique*). The more the knowledge and knowhow derived from their cognitive processes is implemented in computer and cybernetic systems of all sorts, the more those who work with their minds – the "knowledge workers of the world" – are forced to *adapt* their cognitive activity to the digital systems whose instrumental parameters they have nevertheless helped to establish (Stiegler 2013b, 102). Moreover, they find their cognitive activity increasingly modulated and controlled by these systems, to the point that it tends to disappear almost entirely. Whereas industrial capitalism proletarianized the muscular system, today's cognitive capitalism proletarianizes the nervous system, i.e., the brain as the central organ of cognition (Stiegler 2010b, 45).

The bulk of today's cognitive technologies – including explicit CET – are designed for the purpose of enhancing cognitive performance exclusively in terms of the speed and efficiency with which information is processed. Although this is not necessarily a bad thing, it becomes problematic when the cognitive activity of the psychic organs involved in the process is bypassed or short-circuited such that their ability to reflect or critique – the truly noetic i.e., 'thinking' dimension of cognition – is systematically impeded. In Stiegler's view, this is exactly what is happening under the influence of cognitive capitalism, in which the cognitive has increasingly been reduced to its instrumental rational dimensions (to use a term from Max Weber) and reasoning has

turned more and more exclusively into calculating, given the fact that the criteria for selection of the fruits of 'immaterial production' have become exclusively dictated by the market, i.e., subjected to the arch-criterion of short-term profitability (Stiegler 2010b, 46; Stiegler 2004, 112). It is this capacity for reflection and critique which is particularly under threat and which does not seem to be the most pressing issue in current research on CET, notwithstanding the great expectations about superhuman intelligence of many a transhumanist author (Bostrom 2014).

Although hardly discussed, let alone noticed, in the mainstream debate on CE, the dominant use of cognitive technologies today – that is to say in the context of cognitive and consumer capitalism and the so-called "attention economy" – is concerned with the capture and control of attention and the streamlining of attentional and cognitive processes according to the needs of capital accumulation (increase of speed and efficiency, quantification and 'calculabilization' through informatization, etc.). This is largely achieved nowadays through the delegation of functions previously residing in the psychic organs to technical organs embodying artificial intelligence in all kinds of forms (from simple pocket calculators, electronic agendas and personal digital assistants to administrative systems, expert systems of all kinds and financial algorithms), without – and this is crucial – there being any interiorization involved that would allow the psychic organs to actively re-functionalize themselves and form new, more autonomous transductive relations with these technical organs. Such re-functionalization, according to Stiegler, is very well possible, on the condition of creating educational institutions that would take care of teaching the adoption of such technologies for attaining increased autonomy, i.e., for struggling *against* cognitive proletarianization (Stiegler 2010a, 97).

Interiorization and the New Forms of Proletarianization

As already mentioned, what uniquely characterizes the technologies commonly referred to as the NBIC technologies -- the technologies that are supposed to converge more and more and are specifically intended for improving human performance -- is that they deviate from the age-old evolutionary path of technical exteriorization and instead open the path of technical interiorization. Whereas earlier technologies were external objects surrounding us and in front of us, the new technologies enter inside us, fusing to a greater or lesser extent with our biological constitution. Information technologies more and more intersect with our nervous systems and biotechnologies intervene in the biomolecular and genetic mechanisms underpinning our organismic functioning.

Increasingly, these technologies will no longer be separable from our bodies and minds, no longer tools *externally supporting* them but mechanisms *internally transforming* them. We could say then that these new technologies are becoming 'one' with our organism, and this *intimately* affects, as Franco Berardi perceptively notes, the way that our bodies and minds express themselves and relate to the world (2011, 23).

What seems to be at hand with these technologies is a kind of return of the technically exteriorized into the human body itself, i.e., a re-entry into the biological and neurological 'basis' from which it originated, in the sense of a modification and transformation of the psychosomatic organs that make up one of the three organ systems in the organological configuration that underpins the human process of individuation. NBIC technologies allow the technological re-arrangement and even redesign (or so it is claimed) of the biological and neurological interior. Instead of organizing the exterior inorganic, these technologies engage in a dis-organization and/or re-organization of the interior (e.g., genetic, biochemical, neural) organic. This 'interiorizing turn' of technology will, in all probability, inaugurate a new phase in the process of human individuation in that it will substantially transform the conditions under which this individuation will take place. As such, NBIC technologies can be called transformational technologies (Stiegler 2008b, 37). In this context the well-known figure of the cyborg – the 'cybernetic organism' that is a hybrid of the organismic and the cybernetic, of biology and technology – comes online.

As I would like to claim here, an analysis of the impact of cyborglike technologies – and of interiorizing CET more generally – on human freedom and responsibility requires an organological approach, the one laid out earlier above, although it needs to be adapted to be able to account for the specific human-technology relations emerging from technological interiorization. As Stiegler suggests, the 'interiorizing turn' of technology obliges us to completely rethink the relationship between freedom and technology, or in the terminology he prefers: between human autonomy and technical heteronomy. More precisely, it forces us to completely rethink the heteronomous, i.e., technical conditions of human autonomy (Stiegler 2014, 152).

What is more, this pharmacology needs to be carried out from the perspective of political-economy, since enhancement is a project that crucially emerges within the context of an economic system: cognitive capitalism. This larger context is not addressed or seriously taken into account in mainstream debates on CE. In Stiegler's analysis, however, it plays a central role: cognitive capitalism unfolds itself ever more decisively and indisputably as a process of *generalized*

automation in which, as Berardi writes, "human minds and flesh are integrated with digital circuits" (2009b, 35), and "the digital nervous system incorporates itself progressively in the organic nervous system, in the circuit of human communication" (36), recodifying it according to its own operational logic and speed. CET allow for the increased adaptation of the organic nervous system to the demands coming from the digital nervous system, be it through installing 'implants' that facilitate the governance and control of the former by the latter or through neurotechnological modification or transformation of the organic nervous system itself to make it more compatible with the digital nervous system.

What is essential to keep in mind here is that all cognitive (enhancement) technologies – *as* technologies – are *essentially automatisms* that in one way or the other associate with the human cognitive apparatus for the purpose, apparently, of enhancing cognition and improving (features of) the cognitive process. But *as such* – and being *pharmaka* – they can also hamper, disturb or undermine the process of cognition. What is new in the case of the interiorizing enhancement technologies as automatisms is that they enter the psychic or neural organ itself or at least couple with it in a very intimate way, i.e., on the neurological level, such that this organ is directly modified internally or transformed or at least directly 'solicited' and 'played upon.' This is wholly unprecedented because all cognitive (enhancement) technologies until now have been technical exteriorizations that were only subsequently interiorized via the indirect way of learning processes (skilling and education).

To be able to understand and critically assess, organologically, what is going on here we need to zoom in on the characteristics of the psychic or neural organ itself (i.e., the human brain) – *as transductively connected to the two other organ systems* – and ask the question of how the organological configuration and the transductive relations between the three organ systems that constitute this configuration change when the possibility of directly intervening in this centrally important organ system announces itself. The question here is what kind of dangers this possibility brings with it for cognition, because obviously these interventions, as *pharmaka*, not only enhance, but also 'disenhance' cognition. What new kinds of proletarianization are opened up with the emergence of the interiorizing CET that are expected to spring from the NBIC revolution?

To get a grip on this issue, the organological perspective suggests that the brain, over the course of human-technology co-evolution, has evolved into the organ in which – through *neurogenesis* or *synaptogenesis* – transformations in the sociotechnical milieu are translated into

the neural structures that constitute the material substrate of the psychic organ. This phenomenon, by which the human brain 'attunes' itself to its sociotechnical environment, is possible thanks to the human brain's *cerebral* or *neural plasticity*. As Katherine Hayles (2007) writes in an article discussed by Stiegler on the role of new media in the formation of juvenile attention profiles "humans are born with a nervous system ready to be re-configured as a function of their environment" (cited in Stiegler 2010a, 74).[12] Human brains can react, at the neuronal level, to changes in their technical environments, changes that result (that is to say: until now) from the incessant process of technical exteriorization.

Neural plasticity, as synaptic efficacy, can be seen in fact as a mechanism of individuation that makes each brain a unique object. It is a process of neural individuation underpinning what Stiegler theorizes as the process of psychic individuation. However, as Stiegler shows, the neural plasticity enabling the process of neural individuation can only adequately be understood from the fact that the brain is always already implicated, as it were, in an organological configuration that ties it transductively to both technical organs and social organizations. Neural plasticity is that which allows for the constant de- and refunctionalization of the psychic organs under the influence of changes in the technical milieu that result from the process of technical exteriorization, reconfiguring social organizations. It explains/enables the interiorization of technical exteriorizations inducing transformations in the social organizations.

As such, it could be said that for Stiegler the brain is not (just) an organic (biological) organ but, indeed, (also) an organo-*logical* organ, in the sense that it – as a technicized organ supported and 'moved' by a process of technical exteriorization – is also an organ of sense and meaning, an organ that projects and opens onto a world (*Welt*) and not just, as in the case of animals, an environment or *Umwelt*, to use a term from the Estonian biologist Jacob von Uexküll. And only as an organological organ, in its transductive relationship with technical organs and social organization, can it be a *noetic* organ, an organ of knowledge and cognition in the human sense. The neurocentric conception of cognition affirmed by contemporary cognitive and neurosciences cannot, therefore, account for the noetic nature of the human brain. It can only address its (sub-noetic) animalistic functionalities.

Neural plasticity means that the brain can be 'programmed' by technical organs. In fact, the adoption of technical exteriorizations and the acquisition of new capacities and attentional modes based on it (as the process of interiorization) occurs through the reorganization of neural circuitry

(as 'engrammation'), which enables the refunctionalization of the psychic organ. In this way, brains can easily adapt to new technical environments.

Methodologically Researching Anthropotechnological Change: Towards a Practical Organology and a Positive Pharmacology of Cognitive Enhancement

What does all this mean for researching and evaluating CET and their effects on the human cognitive system? And more generally, what does it imply for studying the process of anthropotechnological change that will result from, and is explicitly intended by CE, as a social project (for some at least even aiming toward the attainment of transhuman (trans-anthropic?) or posthuman (post-anthropic?) capacities)? A Stieglerian approach to this question would entail the development of a *practical organology*, allowing the methodological study of how the organological configurations underpinning human cognition as a *process* of individuation change as a result of the introduction within these configurations of the new technical organs represented by the new and emerging cognitive (and neuro-) enhancement technologies. For each such technology, practical organology should examine how the introduction or implementation of this technology in organological configurations or circuits can be expected to affect the transductive relationships holding between the three organ systems. It should explicate their particular *organo*-logics.

Most crucially, since technical organs can be understood as *pharmaka*, each such technology possesses certain *pharmaco*-logical characteristics that should be made explicit. They carry a poisoning (or negative or decapacitating) as well as a curative (a positive or capacitating) potential, and the ultimate aim of a pharmacological analysis should be the institution of what Stiegler calls a *positive* pharmacology, i.e., a pharmacology in which the *pharmakon* in question is turned into a *therapeutic* device that supports the development of individual and collective capacities in an autonomous and creative manner and thus becomes the support of individual and collective practices through which the toxic, heteronomizing and proletarianizing effects of the technical object – its *negative* pharmacology – can be countered and obviated. A positive pharmacology would consist in the constitution of a practice or a system of care (in Greek: *therapeia*), in the form of a sociotherapy with and for the *pharmakon*, culminating in the formulation of prescriptions and norms of how to take care *of* and *with* it such that it intensifies the

processes of psychic and collective individuation, supports the process of socialization and increases autonomy and the capacity for critique and questioning.

Such a positive pharmacology necessarily involves the establishment of criteria for deciding between the 'good' or curative and the 'bad' or 'toxifying' effects of the *pharmakon*. As for the allegedly enhancing or improving characteristics of the various CET currently being proposed, from a Stieglerian perspective an important question to be asked with respect to these technologies as technical organs is how they affect the possibility of maintaining autonomy or producing new forms of autonomy for the psychic organs and the social organizations: not only for individual autonomy but also for collective autonomy. Reversely, we should also investigate what their heteronomizing and proletarianizing potentials are.

Like all technologies but more explicitly so, enhancement technologies affect the things that "a body can do," to use Spinoza's famous expression as quoted by Gilles Deleuze (cited in Deleuze 1988, 23). CET mainly affects what the psyche or the cognitive apparatus 'can do' (and the psyche or soul *is* what the body can do, according to Spinoza). They deliberately affect cognitive capacities like perception, concentration, attention, memorization, intelligence, speech but also reasoning, understanding, imagination and sense making. A practical organology should look at the effects of particular enhancement technologies on all these capacities but for lack of space here I shall only briefly focus on the example of attention. As a cognitive capacity, attention is prominently exploited within cognitive capitalism and the current 'attention economy' and therefore seems to be particularly overburdened nowadays considering the global epidemic of so-called attention disorders that are affecting more and more swaths of the population, mainly young people, and which forms an increasing reason for concern worldwide. As we've already seen, it is also the capacity (also frequently referred to as concentration) that appears to be most urgently in need of enhancement.

But what would count as an enhancement of attention? And what as a disenhancement? Of course this depends on what kind of attention one values, or what kind of attention is valued by society at large. In this regard, it would be instructive to consider the politico-economic backdrop in which the enhancement project – as an industrial project – essentially unfolds today: that of cognitive or informational capitalism, to repeat this point once again. In cognitive capitalism, human subjects are addressed predominantly if not exclusively as both producers and consumers of information or of 'semiotic goods.' It puts the psychic organs or 'souls' of individuals to work,

as Berardi (2009a) has pointed out, and constantly solicits their attention towards consumption, as Stiegler emphasizes in all of his work, a consumption that largely involves the consumption of informational goods. Both production and consumption in cognitive capitalism means the processing of information by the psychic or cognitive apparatus.

The economic imperative behind informational, cognitive, or semiotic production and consumption is profit maximization, increasingly short-term profit maximization, and this drives the ever increasing expansion and acceleration of the semiotic or informational flows in the infosphere which produce the ever growing discrepancy between cyberspace and cybertime as Berardi evokes in his recent books. This puts ever more pressure on the 'processing power' of the cognitive apparatuses of individuals. What's more, in cognitive capitalism cognition functions less and less in a truly noetic sense as it is increasingly reduced to calculation (Stiegler 2010b, 46): the very identification of knowledge with information indicative of the submission of all knowledge to the constraints of its commodification and marketization (Stiegler 2013a, 82). Cognitive capitalism thrives on exploiting what Maurizio Lazzarato has called "the cooperation between brains" (2002, passim; see also Moulier-Boutang 2011, 53, 57, 77, 124, 140), a cooperation controlled – organologically – through digital networks. Cognitive and neuro-enhancement technologies enable the enhancement of the "attention-power" (Moulier-Boutang 2011, 118) of these brains, principally by adapting their attentional capacities to the attentional demands posed by the kinds of cognitive labor and consumption activities that the cognitariat and the consumtariat are summoned to engage in.

It should be obvious that in this techno-economic conjuncture certain modes of attention are systematically promoted while others tend to be systematically discouraged because they are less productive or less 'efficient.' Attention for cognitive capitalism is a resource that has to be exploited most efficiently. And in the competitive society set up by neoliberalism, this attention is under permanent competitive stress. The overall imperative of this society is that of performativity, as Jean-François Lyotard argued already in 1979 in *The Postmodern Condition*, performativity being the optimization of the techno-economic system in terms of efficiency and in light of the goals of profit maximization and the growth of power (Lyotard 1984, xxiv). That is what today's decision makers impose upon individuals and the society at large. Neoliberalism, which has universalized the imperatives of competition and profit-maximization to all domains of life and thereby totalized the performance principle, demands of individuals and collectives to be

operational in line with the demands of performativity and to *adapt* unconditionally to what it calls 'the market.'

It is clear that digital and other (e.g., neural) CET can greatly facilitate this adaptation as they allow for the 'enhancement' of the interoperability of the human cognitive system and the digital networks through which market imperatives are transmitted. "Informatics and biotechnical technologies allow bodies to connect in a continuum ruled by automatisms" (Berardi 2009a, 197). This interoperability, one might surmise, requires the enhancement of certain attentional capacities, quite likely at the cost of others that are less 'in demand.' Berardi, for instance, convincingly argues that the constant attentive stress and competitive pressure imposed upon cognitive laborers erodes their sensibility, i.e., their capacity for empathic understanding and pre-linguistic, non-codified comprehension, while increasing their sensitivity to the codes and standardized discrete signs with which they are continuously bombarded (2012, 125). As it is this kind of sensitivity that makes them more compatible *with* and therefore more competitive *in* the digital infosphere, it can be expected that such a capacity will most likely become a privileged target for CE, to the detriment of the subject's sensibilities. This will strengthen their 'connectivity' to the networks yet almost certainly impair what Berardi calls their capacities for 'conjunction,' i.e., the ability to bond with others in irregular and unpredictable non-codified ways and to interpret non-verbal signs.[13]

For Berardi, the change from conjunction to connection, which is particularly apparent in what he calls the 'connective generation' of those born after 1980, represents nothing less than an anthropological shift in the sense of a deep mutation of humanity's cognitive structures:

> [I]n order to make the conscious organism compatible with the connective machine, its cognitive system has to be reformatted. Conscious and sensitive organisms are thus being subjected to a process of mutation that involves the faculties of attention, processing, decision, and expression. Info flows have to be accelerated, and connective capacity has to be empowered, in order to comply with the recombinant technology of the global net. (Berardi 2012, 123-4)

This anthropological shift has to be understood anthropo*techno*logically, and that is to say organologically and pharmacologically. As *pharmaka*, the CET that are currently being developed, primarily and most insistently with a view to better *adapt* the human cognitive system to cognitive

capitalism's needs, can also be engaged, through *adoptive*, *therapeutic* processes of deproletarianizing re-appropriation and eventually re-design, to counter cognitive capitalism's control of the cognitive apparatus and ultimately to overcome capital's hold on human consciousness and creativity and to set the anthropological shift on more desirable and progressive paths.

Concluding Remarks

In closing, I would like to suggest that the organological and pharmacological approach toward CET, especially with respect to the development of a positive pharmacology, should consider them explicitly in terms of *technologies of the self* in the way Michel Foucault (2000) has described them, that is to say as technical instruments for the care of self and others. And then it should both theorize and practice them as supports for new, desirable modes of subjectivation beyond those of cognitive capitalism, which favors the proletarianized knowledge-producer on the one side and the proletarianized consumer subject on the other. And it should reflect on the possibilities for (re-)appropriating and (re)designing CET such that they will become the possible supports for a new individual and social autonomy, for new practices of freedom, for new modes of questioning and criticizing human existence and in general for the elevation of the collective libidinal economy, for what Stiegler calls an "*otium* of the people," that is to say a "spiritual" culture that transcends *negotium* as the sphere of production and consumption, to which cognitive capitalism restricts cognition as well as research in CET (2011, 118). Only thus can these *pharmaka* become true supports for a genuine 'enhancement' of human 'cognition,' and of much more beyond just 'cognition.'

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Notes

[1] NBIC stands for Nanotechnology, Biotechnology, Information technology and Cognitive sciences.

[2] Sandberg and Bostrom define cognitive enhancement as "the amplification or extension of core capacities of the mind through improvement or augmentation of internal or external information processing systems" (Sandberg and Bostrom 2006, 201). [Entry is missing in bibliography. Please add to reference list.] Cognitive enhancement technologies include neuropharmaceuticals ('smart drugs'), neural implants, brain-computer interfaces, genetic engineering technologies, and deep brain stimulation.

[3] Buchanan for instance argues that many participants in the human enhancement debate share an obsolete, pre-Darwinian view of human nature and that we should instead base our arguments on "an accurate understanding of evolutionary biology," which for him is (Neo-)Darwinist (Buchanan 2011, 8). But what he does not consider for a moment is the fact that, as we'll see below, evolutionary biology in the case of humans is totally different from that of animals, because humans – *as* humans - have not evolved Darwinistically but through a different, technogenic process of evolution.

[4] Churchland is also resolutely Darwinist in supposing that the human brain is a product of biological evolution: "We reason and think with our brains, but our brains are as *they* are – hence are cognitive faculties are as they are – because our brains are the products of biological evolution" (2002, 40).

[5] However, this 'neuro-hype' is largely based on a mythological and anything but 'evidence-based' belief in the explanatory potential of the neurosciences, as neuroscientist Felix Hasler (2012) argues in his brilliant book *Neuromythologie*, in which he shows, among many other things, that human cognition encompasses much more than just functioning brain tissue.

[6] Since the cognitive sciences tend to systematically neglect this, Stiegler accuses them of remaining stuck in metaphysics, which he defines as a forgetting of the inherently technological, i.e. accidental nature of thinking, a forgetting that begins with Plato's dismissal of the role of writing as the artificial *conditio sine qua non* of philosophical thought, i.e., as the fundamental dependence of *anamnesis* on *hypomnesis*, on artificial memory supports or *hypomnémata* (Stiegler 2010a, 111-12).

[7] This means that the human is a *fundamentally accidental* creature, to put it paradoxically, lacking any foundation or origin in nature.

[8] The term 'individuation' comes from the French philosopher of technology Gilbert Simondon, who has been very influential on Stiegler's work (Stiegler 2013a, 403-5).

[9] The notions of metastability and transductivity are also derived from Simondon (Stiegler 2013a, 419).

[10] A Darwinist could invoke the so-called "Baldwin effect" to account for technological evolution. This effect, also known as "organic selection" or "ontogenic evolution" and first proposed by the American psychologist James Mark Baldwin at the end of the nineteenth century to explain apparently Lamarckian, behavior-driven evolution in animals within Darwinist parameters, refers to the role that behavioral (und thus phenotypic) adaptation can play in biasing and amplifying natural selection by enabling organisms to modify the selective environment affecting their future offspring. By moving into environments different from those of their ancestors, the descendants of those organisms are confronted with a different set of selection pressures that favor different genetic dispositions. So selection follows behavior here in a certain way but without violating Darwinist principles of evolution (Kirschner and Gerhardt 2005, 76-7). The Baldwin effect is now generally accepted even by the most ardent representatives of neo-Darwinism (Dennett 1995), Some evolutionary theorists of a less orthodox inclination, like Terence Deacon (1997) and Eva Jablonka and Marion Lamb (2006), have recruited this effect to help explain the evolution of the human mind and language. However, although techno-evolution in the sense of Stiegler also implies modification of the context of selection, the mechanism is considerably different because it involves the artificial *creation* of such contexts, namely in the form of technical milieus, and through *technical* exteriorization and inheritance, i.e., via *artificial, non-biological* evolutionary factors, which are totally absent in 'Baldwinian evolution,' since it is ultimately gene-based (i.e., supported by genetic factors). Moreover, in these technical milieus natural selection has given way to artificial or cultural selection in the sense of a process of "self-domestication" as Peter Sloterdijk has pointed out in his theories of anthropogenesis (cf. 2001, 177, 186). Nevertheless, it is obvious that the technological 'environments' created by the human species through technology significantly bias genetic flows, thereby altering the course of evolution. And this could be interpreted, from a 'Baldwinian-Darwinist' perspective, as a form of behavior-driven evolution. In that respect, the Baldwin effect can certainly be said to be operative in a certain way within techno-evolution *sensu* Stiegler.

[11] And *because* of their deficient 'nature,' they are 'condemned' to constantly invent their own qualities (Stiegler 1998, 193-4). This constitutes humanity's destiny, which unfolds as their history.

[12] See Hayles 2007.

[13] The faculty of sensibility appears more and more as a 'disturbing factor,' disrupting and slackening the smooth flow of information exchange, "useless and even damaging in an integrated connective system. Sensibility slows down

processes of interpretation and renders them aleatory and ambiguous, thus reducing the competitive efficiency of the semiotic agent" (Berardi 2011, 41).