The Poetics of Artificial Intelligence and Posthumanism[1]

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Abstract Martin Heidegger posits a significant future-directed question concerning the human existence in relation to the essence of technology, a question which builds a way for anticipating the poetics of Artificial Intelligence and posthumanism. What is missing in the Heideggerian concept of modern technology is the part of the human activity, which represents the physical human embedded-embodied mind who thinks, reads, and writes, and acts with gestures and bodily movement. Human brain is the center of these activities. Maryanne Wolf in her *Proust and the Squid* (2007) posits reading as a human invention, and elaborates the human brain's plastic ability in relation to the act of reading. Wolf's models of Proust and the Squid in terms of the intellectual and the biological is closely related to the linguistic and the neurocognitive aspects of the Artificial Intelligence. The complementary examples of human brain's reading processes have analogically elaborated how various neuro-cognitive processes will work algorithmically in the data-processing of the AI. Both cases of reading by Maryanne Wolf are referring to human intelligence's information processing in terms of the human brain's automatic learning which reminds us of machine learning and deep learning algorithms. The development of artificial intelligence in tandem with that of human intelligence may be the last great challenge of humanism and the first great endeavor of posthumanism. Cognitive neuroscience and artificial intelligence have undergone revolutionary changes in the past decades, and they now foreground the embodied and environmentally embedded nature of intelligent action. What is at stake is the ethical articulation of intelligence (both human and artificial) in this "second machine age."

1 This work was supported by Global Research Network program through the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2017S1A2A2050414).

Key words Artificial Intelligence; posthumanism; Martin Heidegger; human brain; ethics,

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Introduction: Heideggerian Technology

In his essay "The Question Concerning the Technology," Martin Heidegger posits a significant future-directed question concerning the human existence in relation to the essence of technology, a question which builds a way for anticipating the poetics of Artificial Intelligence and posthumanism. In this essay, Heidegger traces the origin of this question:

> According to ancient doctrine, the essence of a thing is considered to be *what* the thing is. We ask the question concerning technology when we ask what it is. Everyone knows the two statements that answer our question. One says: Technology is a means to an end. The other says: Technology is a human activity. The two definitions of technology belong together. For to posit ends and procure and utilize the means to them is a human activity. The manufacture and utilization of equipment, tools, and machines, the manufactured and used things themselves, and the needs and ends they serve, all belong to what technology is. The whole complex of these contrivances is technology. Technology itself is a contrivance—in Latin, an *instrumentum*. (288)

On the one hand, Heidegger defines the traditional understanding of "technology" as "a means to an end." He provides the list of the instrumental attributes: "the manufacture and utilization of equipment, tools, and machines, the manufactured and used things themselves, and the needs and ends that they serve," the list of which reveal the whole complexity of interrelationship of contrivance or "instrumentality." On the other hand, Heidegger also includes his focus on the aspect of "a human activity," which has the ends in mind and fulfills them by getting and using the means. Modern concept of technology is completely different from the "older handwork technology," Heidegger claims, in that the instrumentality conditions "every attempt to bring man into the right relation to technology," and therefore everything in technology depends on human manipulating of the means in the proper manner, thus becoming "instrumental and anthropological." Humans get "technology spiritually in hand" in the manner of mastering it, and "the will to mastery becomes all the more urgent the more technology threatens to slip from human control" (289). In an attempt to get to closer to the primal causes of this instrumentality, Heidegger tries to identify the Aristotelian "four-fold causality" in the human activity:

> For centuries philosophy has taught that there are four causes: (1) the *causa materialis*, the material, the matter out of which, for example, a silver chalice is made; (2) the *causa formalis*, the form, the shape into which the material enters; (3) the *causa finalis*, the end, for example, the sacrificial rite in relation to which the chalice requires is determined to its forms and matter; (4) the *cause efficiens*, which brings about the effect that is the finished, actual chalice, in this instance, the silversmith. What technology is, when represented as a means, discloses itself when we trace instrumentality back to fourfold causality. (289-290)

The four causes are the matter (material), the form (shape), the end, and the effect. Humans use instruments for materializing or constructing (the end) the shape (the form) out of the materials (the matter) to produce the final product (the effect) through the process of these complex interconnected causality. In fact, Heidegger views the "significance" of the technology from the context of the "relevance" of an instrumental means to an anthropological human activity. Heidegger posits the responsibility of technology in the context of "bringing something into appearance," by uniting and revealing what was concealed in the history of being and essence. What Heidegger attempts to do in this questioning concerning the technology is to open and reach directly the essence of human being in tandem with technology, by grappling with "the instrumentality" of the means to an end and "the will to mastery" (289) of the human activity, both of which belong together. In short, Heidegger regards technology as "instrumental" (*techné*) which is "the name not only for the activities and skills of the craftsman, but also for the arts of the mind and the fine arts" (294). Heidegger retrieves the word *epistêmê* in linking with the term *techné*, both of which are terms for "knowing" in the widest sense, meaning entirely at home in something as an expert in understanding.[1] In line with Heideggerian questioning or critique of technology, it is my position to regard technology as first “instrumental” in terms of *techné* (technics) and then revealing “the human activity” in terms of *episteme* (knowing). My discussion of the human intelligence and the artificial intelligence will follow from this positionality.

Artificial Intelligence

In the 1960s and early 1970s, Artificial Intelligence (AI) emerged in the US, and the AI programmers of the MIT’s AI Lab led by Marvin Minsky initiated their programs by limiting their research in artificial situations. They were convinced that “representing a few million facts about objects including their functions” would solve “the commonsense knowledge problem” of “storing millions of facts” by predetermining small number of “relevant” features and using the techniques to construct realistic micro-worlds. However, “the frame problem” remained unsolved. Dreyfus (2007) articulates this frame problem in a rhetorical question:

> If the computer is running a representation of the current state of the world and something in the world changes, how does the program determine which of its represented facts can be assumed to have stayed the same, and which might have to be updated? (248)

This AI project with its frame problem unsolved is called Symbolic AI, and John Haugeland called it as “Good Old Fashioned AI” (GOFAI).

Michael Wheeler in his *Reconstructing the Cognitive World: The Next Step* (2005) suggested alternatives for the Symbolic AI: Rodney Brooks’ behaviorist approach at MIT, Phil Agre’s pragmatist model, and Walter Freeman’s dynamic neural model. In his essay, “Why Heideggerian AI failed and how Dixing It Would Require Making it Morea Heideggerian,” Hubert L. Dreyfus provides these models in a genealogical way. (Dreyfus 249-262)

First, Rodney Brooks’ behaviorist approach at MIT. Brooks published a paper criticizing the Symbolic AI represented by the GODAI robots, based on the idea that the mobile robot uses the world itself as its own representation rather than an internal description of the world. The internal description of the world would

1 See my essay on “Sublime and Technology: Nietzsche/Kant/Heidegger,” *JELL* 62.1 (March 2020): 3-20. I discussed how Heidegger posits the responsibility of technology in the context of “bringing something into appearance.” The first part of the questioning for Heidegger has traced the old definition of technology based upon the three key words: “instrumentality,” “causality,” and “revealing,” in line with Heideggerian questioning or critique of technology.

quickly be outdated if the world changes. However, Brook's robots responded only to fixed features of the environment, disregarding the changing significance of the context. The robots are called "animats," which is simple insect-like behavior-based devices like ants, which operate in a fixed world and respond only to the small set of relevant features, thereby failing to solve the frame problem. Brook with Daniel Dennet went on to design and build a humanoid robot, Cog, who was equipped with cognitive ability, including "speech, eye-coordinated manipulation of objects, and a host of self- protective, self-regulatory and self-exploring activities" (Dreyfus 249-251).

Second, Phil Agre's pragmatist model. After the animats (ant-like robot) and Cog (humanoid robot), Phil Agre and David Chapman programmed *Pengo,* a virtual computer game, in which the player and penguins (the Pengi agents) kick large and deadly blocks of ice at each other. Agre's pragmatist model is called "interactionism." The Pengi agents acts in the game world which is constructed of the possibilities for action which triggers the agents to respond in a certain proper way. This interaction between an agent and its objects represents a certain time-extended pattern in the environment of an everyday routine activities. Agre's pragmatist model provides a leap from Brook's behaviorist approach by revealing how our experience feeds back and changes our sense of the significance and the relevance of the next situation, although the relevance was predetermined in putting his virtual agent in a virtual world without new relevancies (Dreyfus 251-253).

Third, Walter Freeman's dynamic neural model. Freeman's dynamic neural model is based upon the idea of "skillful coping" which "takes place on the background coping" without being involved in any form of representation. According to this model, "the mind is essentially inner," although we sometimes make use of the external representational equipment such as pencil, paper, and computers. Our basic way of relating to the external world is by using representations of the mind such as beliefs and memories which are not necessarily inner entities. Therefore, the mind represented by thinking links the inner with the outer representations, thereby becoming the extended mind. When we are coping at our best, we are drawn in by solicitations and respond directly to them, so that the distinction between us and our equipment vanishes. In this context, our mind is "extended" into the world and is involved in the "embedded-embodied" coping with the world, that is, becoming one with the world (Dreyfus 253-255).

As three models reveal, improving the familiarity and the coping with the objects of its research was the first priority of what Artificial Intelligence researchers have in mind. Therefore, this pragmatic perspective of the familiarity and the coping requires skilled activities to achieve a better grip on the situation at stake as well as to get refined and secure sense of the objects and the environment under investigation. What one needs in this context is to know how an organism, animal or human, interacts with the environment, in particular, how the embedded-embodied mind in relation to the biological body copes with the environment in acting in response to one's sense of the situation. In fact, Dreyfus argues that "when one's situation deviates from some optimal body-environment gestalt, one's activity takes one closer to that optimum and thereby relieves the 'tension' of the deviation. One does not need to know what that optimum is in order to move towards it. One's embodied-embedded mind is simply solicited by the situation to lower the tension" (255). This phenomenon of the relief of the tension of the deviation in the extended mind and the environment relation creates "the dynamic relation" moving towards the equilibrium. What is at stake is the challenging issue of facing up to the incompatibility of the human intelligence and the artificial intelligence.

Walter Freeman's neurodynamics model in his *Societies of Brains: A Study in the Neuroscience of Love and Hate* (1995) was such a challenge. Freeman took rabbit's brain as a nonlinear dynamical system and proposes a neurodynamic model, elaborating how the brain of an active animal can find and augment significance in its world, based on the coupling of the brain and the environment. Freeman, as the founding figure of neuroscience, reading from the rabbit's brain, claims in conclusion that brain activity patterns in the cerebral memory system which has no boundaries:

> I conclude that context dependence is an essential property of the cerebral memory system, in which each new experience must change all of the existing store by some small amount, in order that a new entry can be incorporated and fully deployed in the existing body of experience. This property contrasts with memory stores in computers. . . in which each item is positioned by an address or a branch of a search tree. There, each item has a compartment, and new item don't change the old ones. Our data indicate that in brains the store has no boundaries or compartment. (99)

Therefore, the patterns are constantly changing in relation to one another, unlike memory stores in computers. What Freeman offers is a genuine Maurice Merleau-

Ponty's "intentional arc,"[1] according to which there are no linear casual connections nor a fixed library of data. The whole perceptual world of the animal changes when the agent encounters a new significance in "feedback loops." I will deal with this neurodynamics model further in the section, "Human Intelligence: Human Brain avec Human Intellect," particularly in terms of the cognition represented by reading/writing.

Human Intelligence: Human Intellect avec Human Brain

What is missing in the Heideggerian concept of modern technology is the part of the human activity, which represents the physical human embedded-embodied mind who thinks, reads, and writes, and acts with gestures and bodily movement. Human brain is the center of these activities. Maryanne Wolf in her *Proust and the Squid* (2007) posits reading as a human invention, and elaborates the human brain's plastic ability in relation to the act of reading:

> Underlying the brain's ability to learn reading lies its protean capacity to make new connections among structures and circuits originally devoted to other more basic brain processes that have enjoyed a longer existence in human evolution, such as vision and spoken language. We now know that groups of neurons create new connections and pathways among every time we acquire a new skill. Computer scientists use the term "open architecture" to describe a system that is versatile enough to change—or rearrange—to accommodate the varying demands on it. Within the constraints of our genetic legacy, our brain presents a beautiful example of open architecture. Thanks to this design, we come into the world programmed with the capacity to change what is given to us by nature, so that we can go beyond it. We are, it would seem from the start, genetically poised for breakthroughs. (5)

Wolf's understanding of the brain's "plastic design" to "make new connections among structures and circuits" is based upon the process of recollection which is activated in the reading brain in milli-second. The human reading brain, designed to store and retrieve words, can "elicit an entire history of myriad connections, associations, and long-stored emotions" in human evolution such as vision and spoken language. Wolf claims that the two dimensions of the reading brain's

1 Intentional arc is what "project around us our past, our future, our human milieu, our physical situation, our ideological situation, and our moral situation, or rather, that ensures that we are situated within all of these relationships." See Maurice Merleau-Ponty's *Phenomenogy of Perception*. trans. Donald Landes. London: Routledge, 2012. 137.

development and evolution are the intellectual and the biological, using French novelist Marcel Proust as metaphor for the intellectual and the squid as analogy for the biological (5-6). Proust saw reading as “a kind of intellectual sanctuary” where human beings could provoke their intelligence and desires to experience the Real out of their transformed imagination. Scientists in the 1950s used the squid to illustrate “how neurons fire and transmit to each other, and in some cases to see how neurons repair and compensate when something goes awry” (6). These two complementary examples of human brain’s reading processes elaborate how various cognitive or mental processes work in the reading brain, which is the main issue of the current research of cognitive neuroscience in relation to Artificial Intelligence.

The first case of reading is on the level of the intellectual. While reading and interpreting *Proust’s On Reading* (1905), Maryanne Wolf perceives the phenomenon of “Passing over.” In this process of passing over, reading “enables us to try on, identify with, and ultimately enter for a brief time the wholly different perspective of another person’s consciousness,” as well as to “leave our own consciousness, and pass over into the consciousness of another person, another age, another culture” (7). When this passing over happens, the readers cross “original boundaries” that are “challenged, teased, and gradually placed somewhere new,” becoming “other” than “what we are” and “what we imagine we can be” (8). When we speed up this reading process as if we watch the video and move forward the video-tape as fast as we can, we will observe the human “brain’s uncanny ability to learn to connect and integrate at rapid-fire speeds.” Let us read what Wolf is describing concerning human intelligence’s information processing:

> Let’s go back to what you did when I asked you to switch your attention from this book to Proust’s passage and to read as fast as you could without losing Proust’s meaning. In response to this request you engaged *an array of mental or cognitive processes: attention; memory; and visual, auditory, and linguistic processes*. Promptly, your brain’s attentional and executive systems began to plan how to read Proust speedily and still understand it. Next, your visual system raced into action swooping quickly across the page, forwarding its gleanings about letter shapes word forms, and common phrases to linguistic systems awaiting the information. These systems rapidly connected subtly differentiated visual symbols with essential information about the sounds contained in words. Without a single moment of conscious awareness you applied *highly automatic rules* about the sounds of letters in the English writing system, and used a great many linguistic processes to do so. This is

> the essence of what is called *the alphabetic principle*, and it depends on your *brain's uncanny ability to learn to connect and integrate at rapid-fire speeds* what it sees and what it hears to what it knows. (8) (Italics mine)

This "alphabetic principle" in reading process is what Bernard Stiegler calls "a temporalization of the spatial object that is the book."[1] In his *Nanjing Lecture Series 2016-2019* (2020), Stieger comments on what happens during the act of reading in the brain in terms of human intellect, while Wolf was reading Proust's *On Reading*:

> I have argued that these technical supports of the transindividual are tertiary retentions, that is, material exteriorizations of motor behaviors and mental contents that amount to an inorganic memory, external to the cerebral organ and the nervous system, but essential to its functioning from the moment it becomes noetic. I say tertiary retention because psychic memory is composed of secondary retentions and perception is the production of primary retentions, which are the time of perception. To put it more precisely, tertiary retentions condition the play of primary and secondary retentions. What Maryanne Wolf shows, on the basis of an example taken from Proust's *On Reading*, is the way in which these tertiary retentions are arranged and organized during the act of reading. Among these tertiary retentions, there emerges indeed a particular class, which I call hypomnesic, and which are specifically dedicated to the conservation and the transmission of mental contents. Such is the case for writing (253).

Stiegler defines each term, such as "primary retentions," "secondary retentions," and "tertiary retentions" in detail in his *Nanjing Lectures 2016*. When a reader practices reading "an alphabetical writing," a written speech that he/she might read with close attention, can constitute itself as an aggregation of what Husserl called "primary retentions." In the course of this speech that the reader is reading, the reader "retain[s] in a primary way each of the elements that are presented." "Each element that presents itself in each instant aggregates itself to the element that follows it in

1 Bernard Stiegler, in his footnote # 274 to *Nanjing Lectures 2016-2019* (2020), discusses reading and writing in terms of primary, secondary, and tertiary retentions, based upon perception, memory, and retaining. To Stiegler, "reading is a temporalization of the spatial object that is the book: it is in its temporality that we can and must observe the collection of alphabetical textual traces in which reading consists, through which we make selections from possible semantic combinations, while *limiting* them." (355). See Stiegler's *Nanjing Lectures 2016-2019*. ed. and trans. Daniel Ross (2020).

the next instant, and is retained in it, with which it forms the 'now' of the temporal flow: hence phonemes that aggregate to form a word, words that aggregate to form a sentence, sentences that aggregate to form a paragraph and so on – so that a unity of meaning is formed" (Stiegler 18-19). These primary retentions "are *retained* only on the basis of retentional *criteria,* criteria that are formed in the course of my prior experience." Thus, the primary retentions have become past, and constitute "the stuff of my memory" and become *secondary retentions*" (Stiegler 19). Tertiary retention modifies the relations between the psychic retentions of *perception* (*primary* retentions) and the psychic retentions of *memory* (*secondary* retentions). What is called 'reason' (thinking) is a form of attention, which arranges the intermediary of technical retentions (mnemotechnics) between retentions (R, memories) and protentions (P, expectations). This technical retentions are called "*tertiary* retentions" by Stiegler. And alphabetical writing (A), like digital writing, is a type of tertiary retention (Stigler 18).

A = R3 (R/P)

Thinking is constituted by temporally attentional forms (combining *primary* and *secondary* retentions and protentions). Memorization mediates retentions and protentions by mnemotechnical forms of memorization. To make it short, perception is the primary retentions, psychic memory is secondary retentions, and writing hypomnesic is tertiary retentions. And writing as tertiary retentions is the "inorganic memory" which is "external to the celebral organ and the nervous system," thus constructing the material exteriorization of motor-behavior and mental contents. In this context, Wolf's reading Proust's *On Reading* represents the intellectual (or "noetic") processes of human brain in the act of reading, as Stiegler contextualizes.

The second case of reading is biological. Wolf's squid represents human behavioral act of reading on the biological level, revealing "basic attentional, perceptual, conceptual, linguistic, and motor processes" which rest on "tangible neurological structures that are made up of neurons built up and then guided by the interaction between genes and the environment." Wolf's description is self-manifesting:

> [A]ll human *behaviors* are based upon multiple *cognitive processes*, which are based on the rapid integration of information from very specific *neurological structures*, which rely on billions of *neurons* capable of trillions of possible connections, which are programmed in large part by *genes*. In order to learn to work together to perform our most basic human function neurons need

> instructions from genes about how to form efficient *circuits* or *pathways* among the neurological structures. (10)

In fact, Wolf inserts in her text a figure of pyramid to "illustrate how various levels operate together when we read a single word" ("a bear"), with the reading the word "bear" in the top layer and the figures of genes-neurons-brain-speaking child from the bottom layer up above. This pyramid of "neurological structure" functions like a three-dimensional map for understanding how any genetically programmed behavior, such as vision and speech act, happens. The five layers form the reading "circuits or pathways" each time an individual brain acquires a new reading. The French neuroscientist Stanislas Dehaene calls this process of reading brain "neuronal recycling" (10). This biological and cognitive capacity of the human reading brain is intriguing, not only because all the reading activities of the brain occur without a single moment of conscious awareness and follow "highly automatic rules" about the sounds of letters in the English writing system. This is the essence of what is called the alphabetic principle, depending on the "automation" of your brain's uncanny ability to learn to connect and integrate "at rapid-fire speeds" what it sees and what it hears to what it knows.

Human reading brain of human intelligence which artificial intelligence attempts to imitate is also organologically (both as an psychosomatic endosomatic organic organ and as artefactual/technological exosomatic organological organ) inscrutable because of its "rich associations, inferences, and insights emerging from this capacity" and inviting us to "reach beyond the specific content of what we read to form new thoughts," thereby reflecting and reenacting "the brain's capacity for cognitive breakthroughs" (17). Wolf's quotation (from Stanislas Dehaene's *Reading in the Brain*) of Proust's *On Reading* concerning the ability of reading to evoke human thinking is revealing:

> We feel quite truly that our wisdom begins where that of the author ends, and we would like to have him give us answers, while all he can do is give us desires. And these desires he can around in us only by making us contemplate the supreme beauty which the last effort of his art has permitted him to reach. But … a law which perhaps signifies that we can receive the truth from nobody, and that we must create it ourselves that which is the end of their wisdom appears to us as but the beginning of ours (Wolf 17)

Bernard Stiegler, discussing his own concept of "Neganthropology" (86-91) in his *The Neganthropocene*, takes the issue of Stanislas Dehaene's "neuronal recycling" as "the condition of possibility of learning to read" and suggests the interrelationships between the biological organs (brains) and the artificial/technical organs (writing):

> The consequence of this recycling, … is that the noetic cerebral organ, that is, the brain capable of questioning the truth and in return of transforming the world, is perpetually in dialogue with the artificial organs that it creates from flint tools to smartphones, passing of course through writing, and in particular the alphabetical writing that we ourselves have learned to read, and that allows us to be trans-formed by Proust during the passage to the act of reading. (86)

This process of what Stiegler calls "exteriorization" (manifested in the forms of "flint tools," "smartphones," and "alphabetical writing"), through which "artificial memory" is retained and formed, is essential to the functioning of the "nervous memory" of human beings. In fact, Stiegler claims the "feedback loops" between brain (mind) and the artificial organ of alphabetical writing (environment) in which human memory has co-evolved "from the outset (more than two million years ago)" with a "social memory." Stiegler calls this co-evolution of the mind and the environment as "organology" in terms of "Neganthropology" which is not organic.[1] This will lead us to the next section: "Artificial Intelligence and Posthumanism."

Artificial Intelligence and Posthumanism

As we have seen in the above, Wolf's models of Proust and the Squid in terms of the intellectual and the biological is closely related to the linguistic and the

1 Stiegler in his *Nanjing Lectures 2016-2019* (2018: Eighth Lecture) claims that "Neuronal recycling, which makes the noetic brain capable of profoundly disorganizing and reorganizing itself in order to interiorize the possibilities afforded by *the artificial memorization that I call organology*, is the condition of this exosomatic organogenesis in which consists the individuation of the technical organs that constitute an artificial milieu, and where the pursuit of evolution no longer occurs by submitting to biological constraints but through the individuation of social organizations. This is why, beyond the scientific and epistemological stakes of her work, the research of Maryanne Wolf greatly opens up the question of a politics of the organology of the brain in the context of what we are calling the age of disruption, that is, an epoch of innovation in which exosomatization is now completely controlled by economic powers and subject to the constraints of short-term profitability. Hence we must hear the alarm sounded by Proust and the Squid, even if we must not unduly dramatize it: '*the digital brain,' which is being organologically transformed at a dizzying rate, raises the question of the preservation of a capacity for deep reading and therefore for deep attention.* What is being referred to here as 'deep attention,' however, is nothing other than the ability to reason by inheriting the experience of our ancestors and by making a worthwhile contribution to the fruitful growth of this heritage." (256)

neurocognitive aspects of the Artificial Intelligence. The complementary examples of human brain's reading processes have analogically elaborated how various neuro-cognitive processes will work algorithmically in the data-processing of the AI. Both cases of reading of Maryanne Wolf are referring to human intelligence's information processing in terms of the human brain's automatic learning which reminds us of machine learning and deep learning. In the process of Wolf's "passing over," the cognitive mind of the AI algorithm analogically can cross original boundaries" that are "challenged, teased, and gradually placed somewhere new," becoming other than what it is and what it imagine it can be automatically. AI's "inorganic memory," which is "exteriorization" of the human intelligence, thus will construct the material exteriorization of motor-behavior and mental contents in accordance with the algorithm of the "alphabetic principle" in reading its own database. This belongs to what Bernard Stiegler calls "a temporalization of the spatial object" in a mega-macro scale.

The second case of Wolf's squid is revealing "basic attentional, perceptual, conceptual, linguistic, and motor processes" which rest on "tangible neurological structures that are made up of neurons built up and then guided by the interaction between genes and the environment." Analogically, this pyramid of "neurological structure" will function like a multi-dimensional map for the AI in understanding how any algorithmically programmed captured data will formulate the data-processing "circuits or pathways" which can be transformed into "feedback loops," an AI version of "neuronal recycling." This algorithmic cognitive capacity of the AI will follow "light-speed automatic rules" about the data in the system, depending on the algorithmic automata of the AI's ability to connect and integrate "at light speed." In short, the artefactual/technological inorganic organ of the AI performs its "rich associations, inferences, and insights emerging from this capacity," reaching beyond the specific content of what human brains can read to form new thoughts, thereby reenacting "the AI's capacity for cognitive breakthroughs." In fact, requoting Wolf's quotation (from Stanislas Dehaene's *Reading in the Brain*) of Proust's *On Reading* concerning the ability of reading, Bernard Stiegler, discussing his own concept of "Neganthropology" (86-91) in the context of Stanislas Dehaene's "neuronal recycling" as "the condition of possibility of learning to read," suggests the interrelationships between the human intelligence and the artificial/technical organs of the Artificial Intelligence.

As we have seen so far, the development of artificial intelligence in tandem with that of human intelligence may be the last great challenge of humanism and the first great endeavor of posthumanism. Cognitive neuroscience and artificial intelligence have undergone revolutionary changes in the past decades, and they now foreground the embodied and environmentally embedded nature of intelligent action. Via computer and information technology, posthumanism has been able to articulate the retreat of the human agent into a larger ecological environment. The autonomy of the human agent is now confronted with the sublimation of matter into the digital. N. Katherine Hayles, who has been the trailblazer in the posthuman discourse, elaborates a definition of posthumanism in relation to cybernetics and a new attentiveness to the body and the materiality in an interview at UiT Tromso, Norway, in 2014:

> Posthumanism as I define it in my book *How We Became Posthuman* (1999) was in part about the deconstruction of the liberal humanist subject and the attributes normally associated with it such as autonomy, free will, self-determination and so forth. What I saw happening in the 1980s and 1990s was the rise of a new way of thinking about human beings that was in flat contradiction to all these attributes; that was what I called posthumanism. One of its manifestations was the idea that if you capture the informational patterns of the human brain, you could then upload it to a computer and achieve effective immortality. To me this seemed absolutely wrong, even pernicious, because it plays on mere fantasies of cognition and of what constitutes human life. I was, at this point, very concerned to insert embodiment back into the equation. It seemed significant to me that the foremost proponents of this reductionist view of human life, such as Hans Moravec, were not neuroscientists or physiologists, but worked within robotics. As much as the science of robotics has advanced, it still is no way near the capacity to reconstruct the complexity of the human brain and its relation to the body and its surroundings. The embodied nature of human cognition is highly relevant to the question of whether downloading a human personality might ever be possible.

Key issues of her claim are "robotics," "the embodied nature of human cognition" and "the capacity to reconstruct the complexity of the human brain and its relation to the body and its surroundings." It is significant that N. Katherine Hayles's *How we Became Posthuman: Virtual Bodies in Cybernetics, Literature and Informatics* (1999) was written, following after the robot scientist Hans Moravec's *Mind Children: The Future of Robot and Human Intelligence* (1988) and the scientist/inventor Ray Kurzweil's *The Age* *of the Spiritual Machines: How We Will Live, Work, and Think in the New Age of Intelligent Machines* (1999). When asked in the same interview about whether the question of uploading a human personality technologically to the robots in the remote future is possible, Hayles answered with reservation:

> We currently have no computational platform that approaches the complexity of the human neuro-system; neural nets, for example, model synaptic connections but lack any connection to the complexities of the endocrine system and hormonal regulation. And even if we had such a device, the questions of the embodied nature of cognition and varying relations enabled by the sensory system still remain unanswered. Humans are enormously complex systems and we have nothing like that in regard to technological systems.

Now six years have passed since this interview, what is happening? It is quite tricky to catch up with the current trend of AI research, because of the disruptive, transforming, hyper-connective, and speedy development in this field. In fact, in her *How We Think: Digital Media and Contemporary Technogenesis* in 2012, Hayles has already claimed this issue of the human embodiment which "takes the form of extended cognition, in which human agency and thought are enmeshed within larger networks that extend beyond the desktop computer into the environment" (3). For Hayles, "all cognition is embodied, which is to say that for humans, it exists throughout the body, not only in the neocortex. Moreover, it extends beyond the body's boundaries in ways that challenge our ability to say where or even if cognitive networks end" (17).

Hayles's own statement about the posthuman agency is revealing:

> Thinkers such as Gilbert Simondon and later Bernard Stiegler have alerted us to the fact that *humans have always been integrated into their environment and have co-evolved with it*. What is new at the present moment is the unprecedented degree with which we actively build and change these environments. This enables *new feedback loops and new forms of amplification between human evolution and technical developments*. Take, for example, human attention. Humans are equipped with two mechanisms of attention: deep and hyper attention. *Deep attention* has a high threshold for boredom and enables one to engage in a specific task or problem over an extended period time to develop expert knowledge; *hyper attention* requires constant gratification yet enables one quickly to scan significant amounts of data to gain

> an overview or identify certain patterns. Both forms of attention have been with us since the beginning of humankind, and both have specific advantages. Now, with *the development of ubiquitously networked digital devices*, however, we have created a socio-technical environment that systemically privileges hyper attention. This has profound effects on human cognition and stimulates the development of hyper attention. Humans with this ontogenetic adaptation actively reconfigure their technical environments in a direction that requires even more hyper attentiveness. *The biological, technical, and socio-cultural implications of smart phones* are a good example of the mutual amplification of technical devices and human social and neurological co-evolution. This is something I try to get at with the term "technogenesis" in my book *How We Think: Digital Media and Contemporary Technogenesis* (2012). (Emphasis mine)

Hayles's discussion of two mechanisms of human attention (hyper attention and deep attention) here, various types of reading (hyper-reading, distant reading, close reading) in other publications,[1] and co-evolution of humans and their environment, embodiment and ubiquitous networked digital media, prepares the ground for the concept of "technogenesis." Briefly, this can be defined as "the idea that human and technics have coevolved together" (*How We Think* 10), particularly in the mechanism of "feedback loops" where "epigenetic changes in human biology can be accelerated by changes in the environment that make them even more adaptive, which leads to further epigenetic changes" (*How We Think* 10).[2]

Conclusion: On the Way to the Ethics of Artificial Intelligence

The fact that the biological and cognitive function of the human brain in connecting and integrating at rapid-fire speeds without a single moment of consciousness brings the question of the automation. The autonomy of the human agent is now confronted

1 See N. Katherine Hayles's *How We Think: Digital Media and Contemporary Technogenesis* (2012) and "Combining Close and Distant Reading: Jonathan Safran Foer's Tree of Codes and the Aesthetic of Bookishness," *PMLA* 128.1 (2013).

2 N. Katherine Hayles's contribution to the posthuman discourse is immense, particularly in terms of human cognition and technical cognitions, co-evolution of the human and technological environment in terms of "feedback loops," ethics and future of posthumanism. See her "Complex dynamics in literature and science." In: Hayles, N. Katherine. (ed.) *Chaos and Order: Complex Dynamics in Literature and Science* (1991), *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (1999), *Writing Machines* (2002), *My Mother Was a Computer: Digital Subjects and Literary Texts* (2005), *How We Think: Digital Media and Contemporary Technogenesis* (2012), *Unthought: The Power of the Cognitive Nonconscious* (2017).

with the automation which loses its human autonomy and transforms itself into the system of automatism, and the matter is sublimated into the digital. The augmentation and absorption of human agents by the digital now seems inevitable, leaving the question of man and technology initiated by Heidegger still incomplete. Nevertheless, for the past five years, a second AI renaissance has arrived with big data storage and processing and deep learning neural network algorithms. In 2016, there has been the historical Google DeepMind Challenge Go-match between the artificial intelligence and human intelligence, between AlphaGo backed by the Google DeepMind and South Korean Go Master Lee Sedol who was defeated. This match has been in line with the previous historic 1997 chess match between Deep Blue and Garry Kasparov. This Go-match was enhanced and enriched by the principles of machine learning algorithms in tandem with human thinking and human intelligence in an interactive operational conversation.

In this age of what Klaus Schwab called "The Fourth Wave of the Industrial Revolution," the new environment of the unlimited possibilities of hyper-connectivity and convergence emerges, revealing "emerging technology breakthroughs" across the physical, digital, and biological worlds: neural network structured artificial intelligence research, big data driven social media, the rapid adoption of 5G small screen device computer technology, reality augmenting software, and what not. The development of artificial intelligence via computer and information technology, in particular, initiates posthumanism which articulates the retreat of the human agent into the background of a larger ecological environment. What is at stake is the ethical articulation of intelligence (both human and artificial), tools, machines, and forms of life in this "second machine age" described by MIT professors Erik Brynjolfsson and Andrew McAfee.

One may recall Heidegger's essay, "The Questioning Concerning the Technology." At the end of the essay, Heidegger in his own words presents two possible directions for ethical articulation one might take with technology, by saying "The essence of technology is in a lofty sense ambiguous. Such ambiguity points to the mystery of all revealing, i.e., of truth" (314):

> Route 1 (On the one hand): Enframing (Gestell) challenges forth into the frenziedness of ordering that blocks every view into the propriative event of revealing and so radically endangers the relation to the essence of truth.

> Route 2: (On the other hand): Enframing (Gestell) propriates for its part in the granting that lets man endure—as yet inexperienced, but perhaps more

> experienced in the future—that he may be. the one who is needed and used for the safekeeping of the essence of truth. Thus the rising of the saving power appears. (314)

Whichever route they may choose, humans are on the way to the ethics of the Artificial Intelligence.

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