

Does the Concept of Network Imply a Need to Revise the Mechanism of Evolution?

Luís Homem^{1 +}

¹ Centro de Filosofia das Ciências da Universidade de Lisboa (CFCUL)
Faculdade de Ciências da Universidade de Lisboa
Campo Grande, Edifício C4, 3º Piso, Sala 4.3.24
1749-016 Lisboa, Portugal

Abstract. This article attempts a criticism on Hans Moravec's paper "When will computers hardware match the human brain?" received in 1997 by the Journal of Evolution & Technology. The paper, vis-à-vis the depiction of the graphics therein placed, is brought to be criticized.

Investigated in a strategic balanced way regarding Philosophies of Computing and of Nature, with special attention to the conceptual foundations of the Network, containing a critical review of the Philosophy of the Web, the dissertation shall come to clear conclusions of how much the display and approval of the concept of Network is not restricted to Connectionism, while demonstrating a strong grasp to Computationalism.

Transhumanism is shown to glimpse into all types of Evolutionary interpretations. It formally claims as well as often delivers contradictory insights to the concept of Network, either by using typically Emergentist evaluations, or Reductionist views, drawing on both the Physicalist and Computationalist approaches. A great deal of this article holds tentative reasoning about the drivers under the scope of MIPS, the computational parameter chosen by Moravec to illustrate developments through an Evolutionary-function framework.

The oblivion of decisively shaping aspects from Arts and Humanities is too condemned, thus lending credence to the adverse. It was sought good quality of philosophizing in the hope that by submitting such article, a fairly consistent effort towards the natural rise of the Philosophy of the Web is brought about.

Keywords: Transhumanism, Artificial Intelligence, Network, Biogenetic Law of Recapitulation, Computationalism, Connectionism, Naturalism, Evolutionism, Mechanism

1. Introduction

This article is divided into three Subsections pertaining to Section 1 (in media res) which introduces all. The last Subsection serves as Conclusion and it seeks one intellectual construct of the Network in relation with several Philosophical, Natural and Informational trends. The first and the second subsections are named, respectively, "When Will Natural History Match Network Hardware?" and "When Will Network Hardware Match Natural History?". These titles are taken from Moravec's original. Even though the content is taken forward in an evolutionary manner, it is, in essence, recursively contrary.

1.1. When Will Natural History Match Network Hardware?

The graphics belonging to Moravec's paper When will computers hardware match the human brain? are superbly descriptive. They compare 1) Power Rating of Natural and Artificial thinkers; 2) Power/Cost of computers from 1900 to 1997 and 2020, rising 1000x every 20 years; 3) AI Computers, rising from 1 millionth to 1 thousandth MIPS in 1960, then from 1MIPS to 1000 in 1990's; and 4) Computer Chess rating rising steadily from 800 (infant) in 1956 to over 2700 (world champion) in 1997.

⁺ Corresponding author. Tel.: + (351) 21 750 0000 ext. 24324 or 24326
E-mail address: lmhomem@yahoo.com.

In (1) the x and y axis find paths: MIPS (Millions of Instructions per Second) and Megabytes (storage), i.e. Computational Power and Memory. Both axes have logarithmic scales. One scale unit on both the vertical and horizontal axes represent, thus, thousand-fold increases, resulting in one Philosophy of History Bios to Computus linear equiparation, of such style that matches are only found between similar thousand-fold increases; as for the rest, 1 Billion MIPS and 1 Billion Megabytes loosely represent and come together the complexity of mammals such as men or the whale and the storage capacity of the Library of Congress. In (2) we are presented with one thousand-fold increase table alike, this time MIPS per (1997) \$1000 plotted against a timeline from 1900 to 2020. Again, a logarithmic scale is used on the y axis, with each scale unit representing a thousand-fold increase, in which the “analogy and extrapolation” method features now, very simply, one History of Computation trough the grid of one brain power sheer scale. The chart illustrates brain power equivalent to a \$1000 computer in such order as the following: manual calculation, bacterium, nematode worm, spider, lizard, mouse, monkey and human. From the spider to the lizard phase onwards Moravec introduced a series of extrapolation and expected curve trend, the range helping Moravec defend that we’re in a Computus timeline equivalent to the Bios Evolutionist Anthropological timetable, expected moreover, to reach soon one lizard or reptile momentum. In (3) is used the same axis, shortening the timescale to begin in the 1950’s, this time taking into account the fact that the actual computing power available to AI hardly rose in the period from 1960 to 1990 (“barely insect power”) but that computing power started to increase again from 1990 at a factor of two every year up the time the paper was published in 1997. The exception was chess computing which continued to double in power over the whole period. In (4) we find a chart of Chess Machine Performance versus Processing Power, expressed in number of possible play options evaluated by the computer, converted to MIPS. The performance is assessed according to conventional International ratings. The search depth of play in average of Chess positions is equiparated to MIPS. Likewise it’s corresponded the depth of play in average of Chess positions and MIPS to one natural scale from bacterium to man too. We could have just asked in frontispiece “Does Network imply Evolution of Evolution?”. If Evolution is already one strongly Anthropological conceptualization, the more it could be Evolution of Evolution.

In Apocalyptic AI Geraci named who for him represented chiefly this wave. He nominated Moravec himself, Warwick too in Robotics, Minsky, Kurzweil and de Garis in AI. Geraci says AI fails to be understood if not through History, namely Jewish and Christian “apocalyptic categories”, to which we could add Faustian Prophetic Star System Pop Culture, very permeable to Universities. The appropriate movement which has found echo is Posthumanism, or more refined in conceptual coarseness, Transhumanism. It was a convergent process so to find perspectives that usually disagree, commanded by one eye of the eagle posture, agreeable to equidistant investigations. It has soared to one wide arising Campaign, difficult to bypass congruence, convoking the fundamentalist praise, to the extent that Fukuyama has ranked Transhumanism, The World’s most Dangerous Idea. That was too the provocative title by Dennett: Darwin’s Dangerous Idea. None of all the fields has been so decisively plastic other than Philosophy of Nature. Darwin’s work is an enervation of ideas and matter so intrinsically bound together that turns neglected the narrow confines of Biology and springs notably to all fields and Cosmologically, showing defecting the Enlightenment aspiration of turning “as if” Moral Teleological and Anthropological idea into ends in themselves Philosophy. Darwin emancipated, on the contrary, Nature as a system of ends, which could be said to have revolutionized not just judgments of the good, but the Faculty of Judgment itself to presuppose merely formal purposiveness, which was originally ascribed only to judgements of the beautiful. This produced two results: the statement of Dobzhansky – “Nothing in Biology makes sense except in the light of Evolution”, a call over submission from Conservative Theism - and the other was one sort of Hypothetical Imperative of Humanism, which ushered in the first use by Julian Huxley of the word Transhumanism in 1957.

It supervened upon this one ascription of ends void, enhanced all at free play. Perceived both in the object itself and in Understanding and Imagination, any Judgment could merely be conformed to Nature. Henceforth man was one newly entity (1) in the sense of Mirandola’s proposal of “sculpting its own statue” and (2) in the sense of Jonas’ alert that Man, for the first time in History, had to hold, in substitution of the

fire of Prometheus, the Imperative of Responsibility. This Imperative of Responsibility is rendered harsher because of the confluence of the Hypothetical Imperative of Humanism.

In the Transcendentalist arena, the Religious and the Rationalist combine not seldom and very powerfully in Transhumanism. This symbioses and the eye of the eagle self-exemption of contradictions are its trademarks. The combination of the Religious and Rationalist views was never evident, except maybe for the XVIIth century (Spinoza, Leibniz, Pascal) that eventually rose up to Kant's Enlightenment, which in turn gave rise to Naturalism, Mechanism's revenge on Religious Reason, to which end is now a surprise to see, tentatively, that they interweave both in spectrum. This explains why the Campaign is promoted while Darwin's Naturalism is denied.

The Naturalism tradition is philosophically the strongest proponent of the Network, whereas Mechanism could be said to be represented by the Universal Turing Machine, which is not quite simply a Turing Machine, nor the practical existence of the PC (personal computer). The Universal Turing Machine corresponds to the failure of Logicism, the Turing Machine to Computationalism Criticism and the PC or personal computer to the empirical postulate of Computationalism. Some other parallels could be drawn, so to say that the Network is possibly a Logicist dream of Computationalism, stating the Network as possibly the new Computationalism Criticism, or perhaps too simply, a practical new empirical postulate of Computationalism. All these assumptions are at stake at the moment, but all that can be said for the time being is that under the Gradualist evaluation the Network seems to be one exponentiation of the empirical postulate of Computationalism which is the PC, but not to the extent that it has critically found a new State of the Art that transcends the Turing machine, and little less so to assume any Computationalism Logicism comeback aspirations.

Naturalism towards its Foundations found Genetics, and inversely Computationalism towards Implementation found the Network after the PC. In fact, as much as we could say that the Network had first to naturalize, so to enter into Computationalism, so too Genetics is a sort of bridge from Naturalism to Computationalism, insofar as in limit we can say that Computation is a sort of Genetics without Biology. What are, then, the consequences of the rise of the Network to the problem of Mechanism and Evolution?

The question is fiercely debated, as Mechanism is thought to repudiate Naturalism. However, we have to advance that they are, at least, as much non opposite poles as Computationalism to Naturalism, if else only to admit a special leap from Mechanism to Computationalism, not admissible unless we concede one Non Gradualist Philosophy, something amazingly contradictory to Naturalism's own dictatum: *Natura non agit per saltum*, the quintessence of Darwin's Naturalism. This adagio is professed too as a claim of the Network, hazing Emergentist and Reductionist evaluations. Throughout the recent debate, we assume Physicalism that elevated Emergentism having been gently transposed to Computationalism. Biology has given space to Emergentist Physicalism, aliased with a Computationalist imaginary, while Dualism is suffering a strong attack in a sort of Vitalism of Computationalism. We've engaged, surreptitiously, two crossing ideas between the Computationalist and Network premises Moravec is fond to, i.e., the Absolute Transcendental possession of all Knowledge and the fabric of the alike, i.e., not just all objects but Minds too.

1.2. When Will Network Hardware Match Natural History?

Moravec has chosen to separate different Emergentist islands so to focus on MIPS, in the same way a Computer Scientist separates the machine from the application, following a bottom-up approach, according to which we find an escalation from transistors to programming languages which predefine, thus, the processor execution. Physics or Social Sciences are devolved to the sole metric of MIPS. In doing so, it blends the tradition of Reductionism, now of the Computationalist sort. Ontology is consequently reduced by the conversion of two crossed functions, Processor Speed and Data, according to Moore's apparently a priori, but empirical just Law.

This crane swing forward and downward to the base expectedly relates Computationalism with the Code for all Informational Knowledge. Moravec is, though, known for the Moravec's Paradox, settled on evolutionary basis: high-level reasoning requires less Computation power, and low-level sensorimotor kinetic perception requires an enormous volume of Information. The questioning is of how much we didn't think of what we usually don't think about. To Biologists it must have struck their minds the lateness of this

assumption in AI, because even for those who were Transhumanists it was reasonably expected that Computation would have to epiphenomenon Nature, following its steps – Space to Time, Motion to Intelligence, Perception to Consciousness – in a similar way of Haeckel’s Law of Biogenetic Recapitulation. If, moreover, Moore’s Law is read as if subsumed in Biogenetic Law of Recapitulation, allowing for the difference in time, the recapitulation under Computation would correspond to a certain quantity of acceleration of Evolutionary Natural Time based presumption, relative to the Natural Time of Nature before Computation. As much as Culture is a second skin to Nature, Computation would be a second time to Nature, as much as one human embryo is seen passing through typical cell, larva, fish and reptile phases.

Recapitulation is, thus, the Biological concept foremost important to conduce to the correct interpretation. Moravec aims at one a priori and empirical Designed Law. Computer hardware will match the human brain, he asserts, when the human brain Natural Evolution will be recapitulated in Computationalist Natural Evolution, according to the Probabilistic Empirical Information led out so far throughout Computationalism, in a summa of the Empirical and Mathematical Traditions. Moravec isn’t clear though, about saying whether is to be interpreted as Strong Natural or Weak Natural Recapitulation, being the difference to expect that Computationalism is to reply in linearly backwards order the successive major events in the timeline – formation of interface matter, bionic accretion of the first interface molecules, reply of prokaryotes logic, Genetic Programming, ultimately to qualia Robotics (of which Chess isn’t but a screen) - or that, by effects of intrinsic peculiarity of Computationalism, it is expected, on the contrary, to break up from *Natura non agit per saltum* to the opposite: *Computare agit per saltum*. Strong Natural Recapitulation corresponds to Weak AI, whereas Weak Natural Recapitulation does so to Strong AI. Moravec believes in Weak Natural Recapitulation of Computationalism, i.e., *Computare agit per saltum*. The method is of “analogy and extrapolation”. “Extrapolation” referred by Moravec is not just a matter of a degree, but a matter of a kind, surpassing Darwin’s assumption: a matter of degree, not of a kind. As much as Moore’s Law raises a quantity to a certain power under Computationalism solely, Computationalism Naturalistic Evolution is expected to raise a quantity to a certain power, presumably of higher acceleration than that on the basis of Nature’s “alone”, which matches, indeed, with Very Strong AI.

1.3. Conclusion and Remarks

Darwin referred precisely to the absurdity of considering the eye and its inimitable contrivances a product of numerous gradations and natural selection. Real-time imagery is, thus, the first Computationalism Gradualist step. In the 1980’s OCR programs appeared, of around 10 MIPS. Moravec seems to argue that memory encompasses intelligence by contrivances, several and more restricted to the nucleus, alike the biological growth process of any element or being, like the eye, the perfect gateway to the brain once both nerve bundles and neural assemblies are, in effect, conversion mechanisms. The human brain is the only entity of matter in the whole Universe, in a somewhat type of Recapitulation Law too, of Cosmological order and relative to Space, not Time, that replicates in neural enervation the luminous celestial extension of the Universe, and besides in a few cm³ capable of reflecting about the entirety of space. The brain is like the eye to the Universe as the eye is to the brain and it’s reinstated, renewing in extension, *quanta* to *qualia*. The proportion of the eye to the 1,500 cubic centimetre human brain is of about 100,000 times, equivalent to 100 million MIPS. Supercomputers reach a few millions, presently about 3, to the cost of several tens of millions of dollars.

Moravec establishes the analogy of 100 million MIPS in comparison to the human brain’s 100 billion neurons, one neuron being equivalent about “1/1,000 MIPS” [1], which goes to say 1 MIPS worth about 1,000 neurons. This is intended to defend too that Computation will reach Ontology by Cosmological means. Dennett alluded to the Doubt making exception as “the nervous system of the world”. Moravec’s assumptions rely more basically on the speed of natural electrical impulses, as he states that one neuron can have about 1,000 finitely timed pulses per second, about 1,000 times slower than 1 MIPS in a Bios-Computus Logic. It would imply not exactly a support of 1,000 times extra to hardwire it, but accordingly to Moore’s Law, which is not only analogical, but exponential too, it could oblige to one absconded increase in terms of, say, one thousand-neuron or more assemblages. By the same token, it could risk the exponentiation

factor to unreachable ceilings to Moore's Law. If Determinism was to be proved by Ontological Computationalism, no doubt Natural History's Past could be recreated, enticing Eternal Cycle Myths.

The 1/1,000 factor postulated holds a great margin in between, but if the Future could be to the Present of such proportion as eyes are subassemblies to the brain, then not only neurons could rank to MIPS, but MIPS to such thousand-fold increases too. Now, could the relationship between, not exactly the PC and Network, but, essentially and rather, MIPS to Network MIPS (under the neural analogy and extrapolation) suggest a revision of the testament theory that the ratio of Memory to Speed has remained constant during Computing History? Could the passage to the Network imply a second-part of Moore's Law, just as Computationalism follows strict Naturalism? This second part of Moore's Law would contain inverse behaviour meaning that it would decrease Computationalism evolution as the Network increases, contrary to the expected, something of a congenital Paradox, similar to Moravec's own Paradox. If the Human brain could be thought of as enclosing one Network with supremely learning abilities conserved – able, thus to relate every neuron to every other, except by regional pre-marked contrivances – by, say, one exponentiation rate of about 1x 10 Billion (about 1/10 of the Neurology complete map of 100 billion neurons -, being, in this fashion, sympathetically minimally extrapolated), it would mean that to the brain the rate would climb up to 1 billion MIPS, one value very different from Moravec's estimates. If, additionally, the ratio is not sympathetically and exponentially minimal to the best hopes of Strong AI, it would foreshadow a discovery doting great ignorance to Neurology – let's not forget that is Strong AI who says we know of it as much as we were to unveil Astronomy in Modern Age. In this case, figures can go as high as 100 billion MIPS or more, and that is accepting equivalency tout court, maintaining the escalation factor that obliges Moore's empirical Law to be revised in conformity with past reality, not guaranteeing any other spectacular deviation in charts. Is "will", then, an imperative form in "When will computer hardware match the human brain? It is impossible to overstate the Philosophical basics of the Philosophy of the Web in relation to the emergence of the Network, out of which we've just preliminarily approached the imponderability of forecasting MIPS. History postulates itself and Computation power within three decades could be 100,000 times greater than at present. Also the World Production of Data is exploding, with a huge shift to electromagnetic storage to the cumuli of, taking 1999 estimations, out of a grand total of 2,120,000 Terabytes, 1,693,000 Terabytes were magnetic in nature.

In my view, Philosophy of the Web is an assembly of a quadrivium of Subjects most authoritatively significant: Philosophies of Computing and Information, of Nature, of Mind and Moral Law. To this we could add innumerable imaginary triviums. We focused on the first two, hoping to unveil how the Network strikingly discloses the ongoing paradigm debate between Computationalism and Connectionism, analytical and naturalistic traditions, to which quarrel we shall not be bewildered by the idea that orientation towards Network is only made by Connectionist views.

2. Acknowledgements

My personal thanks to the network of CFCUL and to the generosity of Mr. Ian Thomson.

3. References

- [1] *When will computer hardware match the human brain?*, 1998 Journal of Transhumanism, vol. 1, March 1998 (invited by Nick Bostrom) <http://www.transhumanist.com/volume1/moravec.htm>
- [2] Huxley, Julian, (1957), *New Bottles for New Wine*. London: Chatto & Windus
- [3] Darwin, C. R. (1859), *On the origin of species by means of natural selection, or the preservation of favoured races in the struggle for life*. London: John Murray. [1st edition]
- [4] McLaughlin, Brian P., (2004) *Computationalism, Connectionism, and the Philosophy of Mind*, In *The Blackwell Guide to the Philosophy of Computing and Information*, Blackwell Publishing