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Mathieu Triclot

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## Ontology and politics of information in the first Cybernetics

Mathieu Tricot, FEMTO-ST/RECITS, UTBM

The title of this conference series, “cybernetics for the 21st century”, is somewhat perplexing, as it raises the question of how “cybernetics” and “21st century” can be put together. The term “cybernetics” not only refers to the distant post-World War II era of the 20th century but it also appears largely out of fashion. As indicated in the invitation text, we would be hard pressed to find the word “cybernetics” in our universities curricula. I teach in an engineering school, and the only one who still talks about cybernetics is the philosopher! Both the prefix “cyber” and the word “cybernetics” seem outdated, belonging to a realm of “obsolete futures”.

Why should we consider a “cybernetics for the 21th century”? I can identify four reasons. Firstly, maybe the “21th century cybernetics” is, in a way, already there. It is clear that the concepts and technologies promoted by cybernetics have become more pervasive than ever. The dissemination of the terms “feedback” and “information” is monumental and disconnected from the declining usage of the signifier “cybernetics”. In other words, we are witnessing what could be called “a cybernetics without cybernetics”, i.e. a diffusion of its concepts and artifacts, but without the outdated label anymore. There was a first cybernetics, associated with figures like Wiener, McCulloch, and Von Neumann, a “second cybernetics”, centered on self-organization and associated with Von Foerster and Varela, among others. Now, we may be at the beginning of a “third cybernetics”, for which we should no longer mention names of personalities, but names of firms like Google, Amazon, Facebook, or OpenAi. Could this be the elusive “21st-century cybernetics,” a third wave that does not say its name?

Beyond the progressive diffusion of information and feedback terminology, the most striking development lies in the new social roles assumed by the artifacts anticipated by cybernetics. These artifacts are now entering society on a grand scale. The first noteworthy instance is what has been called the “Machine Learning tsunami”<sup>1</sup>, based on the resurgence of the neuroconnectionist models pioneered by cyberneticians. But there is also the prospect of an industrial revolution resulting from the convergence of digital technologies and traditional industries. This “new industrial revolution” was indeed one of the original cybernetics’ grand predictions. We can think here of Wiener’s depiction of the automated factory: “The all-over system will correspond to the complete animal with sense organs, effectors and proprioceptors, and not, as in the ultra-rapid computing machine, to an isolated brain, dependent for its experiences and for its effectiveness on our intervention.”<sup>2</sup> This description of the shift from the computer as a simple “isolated brain” to “the complete animal” evokes concrete figures today, such as Amazon’s robotic warehouses or autonomous vehicles. It is only now, with a time lag of 70 years, that cybernetic artifacts are really imposing themselves, with the kind of autonomy and agency envisioned by the first cyberneticians.

This brings us to the second reason for considering a “cybernetics for the 21st century,” not merely as an odd descriptive term for the contemporary era, but as a prescriptive one. We may need a “cybernetics for our times”. One significant aspect of reclaiming the term lies in the fact that the original cybernetics produced a real-time critical discourse on these technologies. Cybernetics presents itself as a multidisciplinary endeavor open to philosophical and critical inquiry. Heidegger

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1 Dominique Cardon, Jean-Philippe Cointet and Antoine Mazières, “Neurons spike back: The invention of inductive machines and the artificial intelligence controversy”, *Réseaux* 211, no. 5 (2018): 173-220.

2 Norbert Wiener, *Cybernetics, or Control and Communication in the Animal and the Machine*, 2nd ed., (Cambridge: MIT Press, 2000), 157.

expressed the fear that cybernetics would “replace philosophy”<sup>3</sup>. However, this overlooks the fact that within cybernetics itself there is a philosophical production, claimed as such. The impetus for revisiting and inheriting cybernetics lies in the significance of this inherent philosophical production endogenous to the technical milieu.

What can we expect from the first cybernetics to "understand and reorient our digital earth"? The third reason that justifies this return to cybernetics is that we find, within this philosophical production, a unique stance regarding the nature of information. Cyberneticians advocated for a non-symbolic, physicalist conception of information, which I refer to as “information-signal” as opposed to an “information-code”<sup>4</sup>. This distinction holds a considerable importance, given that the notion of information is a crucial term of our times, inextricably conceptual and technical. Information has emerged as a new universal equivalent, applicable to everything and which ensures the reduction of everything to computational devices. What can we learn from this alternative view of information to critically assess the current digital technologies ?

But the discourse on information extends beyond ontology and philosophy of science : we encounter, particularly in Wiener's writings, a discourse that links this ontology of information with politics. This nexus of ontology and politics of information seems particularly interesting to re-examine today.

This brings me to the fourth and final reason supporting a return to cybernetics: we cannot pretend that the arguments of the first cyberneticians are applicable as they are to the present state of affairs. The time gap between the first cybernetics and our cybernetics for the 21st century is intriguing in its own right, primarily because the mode of science and technology production has undergone profound changes. Hence, we cannot merely transplant the old cybernetic arguments to the contemporary landscape but must exploit this temporal gap to shed light on the characteristics of the current regime of science and technology.

So we cannot simply transfer the old cybernetics arguments to the present, but use this gap to enlighten the properties of the current regime of science and technology. The first cyberneticians were working at a turning point in the history of science and technology, at the time of the Cold War, with sciences nationalized by the State and enlisted in the war effort. Cyberneticians, beginning with Wiener, took a stand against this transformation and advocated for an alternative way of doing science. Today, we inhabit a totally different mode of production of science and technology, in which the market has taken on an increasingly important role since the 1980s. Consequently, cybernetics becomes relevant not because it fills the gap between the post-war world and the contemporary, but because it exposes it. By revisiting Wiener's arguments, we can assess these changes and their implications.

Hence, this paper seeks to revisit the debates surrounding the nature of information, particularly the intersection of ontology and politics in Wiener's work. It aims to confront these positions with the contemporary moment, as a step toward a "cybernetics for the 21st century." I will proceed in three stages. Firstly, I will provide a brief historical overview of cybernetics to contextualize the movement. Next, I will delve into the debate that took place during the 7th Macy Conference, on the meaning of the terms "digital" and "analog." This debate is a key document to understand the cybernetic conception of information. Finally, I will present a small sample of precepts for an information politics, as they can be extracted from Wiener's writings, and discuss their relevance in light of the contemporary situation.

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3 Martin Heidegger, *Écrits politiques 1933-1966* (Paris: Éditions Gallimard, 1995), 262.

4 Mathieu Triclot, *Le moment cybernétique* (Seysssel: Champ Vallon, 2008), 405-411.

## I.

In the first part of this paper, I aim to highlight three messages. Firstly, it is important to recognize that cybernetics is an object that can be difficult to pin down. Indeed, there have been many "cybernetics", sometimes incompatible with each other. The term "cybernetics" functions as a "floating signifier", which can be reappropriated in very diverse contexts. There have been several cybernetics in the United States<sup>5</sup>, but also in the United Kingdom<sup>6</sup>. It existed as a distinct discipline in the Soviet Union, studied by Slava Gerovich<sup>7</sup>. The experiments conducted by Stafford Beer in Chile are also noteworthy<sup>8</sup>. Additionally, cybernetics found its way into the structuralist social sciences in France, through figures like Levi-Strauss and Lacan, among others<sup>9</sup>. There was also a Chinese cybernetics, as I recently discovered thanks to Dylan Levi King's research<sup>10</sup>.

This uncontrolled diffusion of cybernetics can be attributed, in my view, to a key phenomenon: the failure of cybernetics to establish itself as a science or a discipline in due form, that would still be taught in our universities. This was the original intention of cyberneticians, particularly Wiener. Instead of having dedicated cybernetics departments in universities, the field relied on events such as the Macy conferences. This inherent fragility eased the fragmentation of cybernetics, driven by interpersonal difficulties<sup>11</sup> and a questioning of its scientific agenda, with the emergence of the symbolic artificial intelligence research program. The word "cybernetics" resembles the word "psychoanalysis"<sup>12</sup> in the first half of the 20th century: the first cyberneticians struggled to regulate its use. As a result, it circulated widely, being reappropriated in various contexts, often with conflicting interpretations. For instance, I recall a letter from the artist Nicolas Schöffer, who created "cybernetic light towers" and organized "cybernetic ballets," featuring robots dancing alongside human performers. In 1957, Schöffer reached out to Wiener, who responded dryly, acknowledging the interest but asserting that these endeavors had no direct connection to cybernetics<sup>13</sup>.

The second element to keep in mind when approaching the first cybernetics is the originality of its way of doing science. Cybernetics is a scientific movement that is marked by multidisciplinary. It is a well-known fact that cybernetics brings together mathematicians, engineers, members of the life sciences, psychology and the social sciences. This original style of science is also open to philosophy. The 1943 paper by Wiener, Rosenblueth and Bigelow on feedback as a model for understanding living organisms, which laid the foundation for the cybernetics research program, was published in *Philosophy of Science*<sup>14</sup>. We have an article co-authored by a physiologist, an engineer, a mathematician, and published in a philosophy journal.

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5 Steve Heims, *John Von Neumann and Norbert Wiener, From Mathematics to the Technologies of Life and Death* (Cambridge: MIT Press, 1980) ; Steve Heims, *Constructing a Social Science for Postwar America, The Cybernetics Group, 1946-1953* (Cambridge: MIT Press, 1991).

6 Andrew Pickering, *The Cybernetic Brain: Sketches of Another Future* (Chicago: Chicago University Press, 2010).

7 Slava Gerovich, *From Newspeak to Cyberspeak: A History of Soviet Cybernetics* (Cambridge: MIT Press, 2002)

8 Eden Medina, *Cybernetic Revolutionaries: Technology and Politics in Allende's Chile* (Cambridge: MIT Press, 2014).

9 Ronan Le Roux, *Une histoire de la cybernétique en France (1948-1975)* (Paris: Garnier, 2018).

10 Dylan Levi King, "The Genealogy of Chinese Cybernetics", *Palladium* (2023)

<<https://www.palladiummag.com/2022/10/17/the-genealogy-of-chinese-cybernetics>> (accessed 7 June 2023).

11 Flo Conway and Jim Siegelman, *Dark Hero of the Information Age, In Search of Norbert Wiener the Father of Cybernetics* (New York: Basic Books, 2005)

12 Elisabeth Roudinesco, *L'histoire de la psychanalyse en France - Jacques Lacan* (Paris: Livre de Poche, 2009).

13 Maude Ligier and Mathieu Tricot, "L'art cybernétique de Nicolas Schöffer" (paper presented to the 3e Congrès de la Société Française d'Histoire des Sciences et des Techniques, September 6, 2008).

14 Norbert Wiener, Arturo Rosenblueth and Julian Bigelow, « Behavior, Purpose and Teleology », *Philosophy of Science*, 10, no. 1 (1943): 18-24.

Thus, cybernetics represents a style of science that is open to interdisciplinarity and philosophical reflection. In this regard, cybernetics can be seen as carrying forward the spirit of 1930s physics, which embraced philosophical inquiry. However, cybernetics found itself at odds with the emerging structures of Big Science, shaped by the war. There is, in the very manner of constituting the cybernetic group, on the part of Wiener, a rejection of the enlistment of science in the Cold War. This refusal is expressed in the influential open letter "A Scientist Rebels" in 1947<sup>15</sup>. One cannot understand the form of the cybernetic group without these commitments.

Lastly, if I had to give chronological limits to the first cybernetics, I would propose the years 1943 and 1956. The year 1943 marks a significant milestone with the publication of two foundational articles: the aforementioned work by Wiener, Rosenblueth, and Bigelow on feedback as well as the paper by McCulloch and Pitts on formal neurons<sup>16</sup>. The 1956 date is less obvious: it corresponds to the Dartmouth summer school that launched the symbolic AI program, which was to supplant the cybernetic paradigms in the field of computer science. One could also consider that the death of Von Neumann in 1957 symbolizes the end of the movement, which declines as a research program in the United States. This is the paradox of cybernetics: while the movement achieved remarkable success both technically and conceptually, it failed to establish itself as an independent discipline within the academic realm.

## II.

After this brief overview of the elements that seem to me to be key for framing the history of cybernetics, I come to what seems to me to be one of the most interesting aspects to be re-interrogated today: that is, the debate on the nature of information.

Cybernetics played a pivotal role in establishing the concept of "information," which emerged at the intersection of two technical fields: the first is the theory of telecommunications, or "information theory", with the work of Claude Shannon<sup>17</sup>. Shannon introduced a mathematical measure of the quantity of information. The second field is mechanical computation, where Shannon's measure, based on bits, was promptly adopted, as the new machines were seen as operating on information. However, cybernetics went beyond merely promoting and consolidating a technical vocabulary at the intersection of these fields. It delved deeper by questioning the very nature of this new term of information. One might have expected this question to be dismissed as a philosophical inquiry secondary to technical advancements. Yet, within cybernetics, the question arises, due to the multidisciplinary nature of the field and its ambition to transfer the technical vocabulary of information and feedback to other domains such as life sciences, psychology, and social sciences.

So, what is information? The discussions following Ralph Gerard's presentation at the 7th Macy Conference on March 23, 1950, provide a remarkable glimpse into the debates that permeate cybernetics<sup>18</sup>. The conversation was initiated by Bateson and Licklider, who expressed concern about a confusion in the vocabulary, between digital and analog. Here is what Bateson says: "It should be a good thing to tidy up our vocabulary. We have the word 'analogical,' which is opposed to the word 'digital.' We also have the word 'continuous,' which is opposed to the word

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15 Norbert Wiener, "A scientist rebels", *The Atlantic Monthly* 179 (1947), 46.

16 Warren McCulloch and Walter Pitts, "A logical calculus of the ideas immanent in nervous activity", *Bulletin of Mathematical Biophysics*, 5 (1943): 115-133.

17 Claude Shannon, "A mathematical theory of communication", *Bell System Technical Journal*, 27 (1948): 379-423, 623-656.

18 Heinz Von Foerster, *Cybernetics, Circular Causal and Feedback Mechanisms in Biological and Social Systems: Transactions of the Seventh Conference, March 23-24, 1950* (New York: Caldwell, 1951): 11-57.

'discontinuous.' And there is the word 'coding,' which is obscure to me. First of all, as I understand the sense in which 'analogical' was introduced to this group by Dr. Von Neumann, a model plane in a wind tunnel would be an 'analogical' device for making calculations about a real plane in the wind. Is that correct?"<sup>19</sup>

Von Neumann acknowledges the need for a clarification, admitting its difficulty. Indeed, the discussion goes on for about twenty pages. "Von Neumann: It is very difficult to give precise definitions of this, it has been tried repeatedly. Present use of the words 'analogical' and 'digital' in science, is not completely uniform."<sup>20</sup>

The ensuing discussion offers two valuable insights. First, it highlights what I call the "physicalist" orientation of the cyberneticians. The answers of Von Neumann or Wiener have in common to prioritize the signal or analog dimension over the symbolic dimension of information

"Von Neumann: Thus, both for the man-made artifact as well as for the natural organ, which are supposed to exercise discrete switching actions, the "discrete actions" are in reality simulated on the background of continuous processes. [...] To restate : the organs that we call digital are, in reality, continuous, but the main aspects of their behavior are rather indifferent to limited variations of the input stimuli. [...]

Wiener : May I speak of the real distinction between the digital and the analogical situation ? This is a comment on what Professor Von Neumann has said. [...] The digital element lies in the fact that the things to which we are referring are not precise positions but fields of attraction which impinge upon one another so that the field where there is any substantial indetermination as to whether the thing goes to one or the other is as small as possible."<sup>21</sup>

This is a key point: in the last resort, symbols are always signal, material configurations. As Pitts explains, "we should speak of physical systems in general, not computers."<sup>22</sup> What is the difference between a symbol and a signal? The symbol is always two-sided: it is a form that is inscribed in a matter, but in a conventional way. It is by convention that such and such a material configuration - for example, the presence of an electric current - refers to such and such symbolic content - for example, the value 1 rather than 0. The symbol is inscribed in a matter, but the matter is indifferent. It could be anything and everything as long as it can function as a medium of inscription. On the contrary, the notion of signal carries another type of relation between matter and signification, since in the case of the signal, the information is not separable from the material configuration, susceptible to find by convention a new inscription: the information is the material configuration and reciprocally.

Cyberneticians do not deny that information can function in a symbolic way. On the contrary, it is the functioning of digital mechanical calculators or of the lines of communication modeled by Shannon. However, as in the declarations of the 7th Macy conference, they will regularly insist on the fact that this symbolic functioning is only a simplification or an abstraction compared to the "real" functioning which, on the physical level, operates in an analogical way.

But the 7th Macy Conference also reveals variations in this materialist or physicalist stance. Three distinct viewpoints can be identified.

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19 Ibid 26.

20 Ibid 27.

21 Ibid 20-21.

22 Ibid 32.

The most radical physicalist reductionism is found in Von Neumann, who repeats several times that "in reality" we are dealing primarily with the continuous: "To conclude, one must say that in almost all parts of physics the underlying reality is analogical, that is, the true physical variables are in almost all cases continuous, or equivalent to continuous descriptions. The digital procedure is usually a human artifact for the sake of description."<sup>23</sup>

On Wiener's side, a more pragmatic position is expressed, which consists in explaining that we can choose the "code" according to the situation: "I say that the whole habit of our thinking is to use the continuous where that is the easiest and to use the discrete where the discrete is the easiest. Both of them represent abstractions that do not completely fit the situation as we see it. One thing that we cannot do is to take the full complexity of the world without simplification of methods."<sup>24</sup>

Lastly, Pitts introduces another variation, emphasizing that the opposition between digital and analog is not strictly binary and that there can exist intermediate systems, and in particular forms of continuous calculation, at the biological level, which do not however correspond to the model of analogical calculators: There is a third between the two, because they are not opposite. The digital and analogical sorts of devices have been defined quite independently and are not logical opposite. [...] There can be devices which are computing machines which are continuous without being analogous in the sense that the engineer assumes."<sup>25</sup>

If we agree that cybernetics defends an original conception of information, we are left with a question: what is the point? What difference does it make? Three theoretical sectors are directly concerned by this discussion on the nature of information, which can be briefly outlined. The first sector is related to the theory of telecommunications. We find traces of it in the dispute over priority between Shannon and Wiener. Wiener reproached Shannon for having pre-empted the theory of communications from a digital conception of the signal, whereas Wiener had developed a model of information based on the physics of the continuous signal<sup>26</sup>.

The second area concerns the analogy between information and entropy. Wiener and Von Neumann, in particular, advocated for a physicalist interpretation of the formal analogy between the measurement of the information quantity and entropy, interpreting information as the inverse of entropy. Information would then be a measure of the amount of order in a physical system, while entropy represents the measure of system disorganization. Maxwell's demon thought experiment is revisited by Wiener, to provide a framework for interpreting information as a physical quantity<sup>27</sup>.

The most significant impact of the conception of information lies in the development of computer science, around the question of the brain-computer relationship, as it appears, in particular, in Von Neumann's work<sup>28</sup>. The discussion in the 7th Macy conference concerns directly the computer-brain analogy. The history of these debates can be summarized as a return to the "original sin" of the First Draft of a Report on the EDVAC. In this document, crucial for the history of computer science, Von Neumann formalized the operations of digital computers. To carry out this formalization of logical-mathematical operations, Von Neumann relied on what he called "E-Elements", binary automata with a threshold, directly inspired by the formal neurons of the 1943 article by McCulloch and Pitts,

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23 Ibid 27.

24 Ibid 50.

25 Ibid 48.

26 David Mindell, *Between Human and Machine, Feedback, Control, and Computing before Cybernetics* (Baltimore: John Hopkins University Press, 2002), 286.

27 Wiener, *supra* n 2, 58.

28 John Von Neumann, *The Computer and the Brain*, 2nd ed., (Yale: Yale University Press, 2000).

to which he directly referred<sup>29</sup>. Nevertheless, Von Neumann never ceased to return to this "shortcut" of the "E-Elements": by considering the processes in a digital way, one masks the complexity of the real processes, which are of a completely different nature. The complexity of the underlying processes reappears in the failure or the error of calculation. This "physics of information" gives rise to two scientific programs: alternative models of basic components at the technological level, motivated by the desire to obtain stable behavior with unstable elements<sup>30</sup>, and a focus on cellular-level processes in the modeling of living beings, pushing a research agenda for artificial life<sup>31</sup>.

As Andrew Pickering has shown, the machines envisioned by the first cybernetics are not so much intended to manipulate representations, but to act on the world, to orient themselves in a changing environment, by adapting their ways of doing things according to a goal<sup>32</sup>. In this sense, the model remains that of the living being rather than that of the mind manipulating symbols. Cybernetics had in view another kind of computer science and calculation machines, which we can hardly imagine today.

In essence, cybernetics presents an original conception of information, rejecting its reduction to a mere set of symbols. This division leads to specific research orientations such as artificial life, neuro-connectionism, and Wiener's interest in prostheses, which subsequently influenced Licklider's paradigm of "man-machine symbiosis."<sup>33</sup>

But what significance can the symbol-signal partition still have today, when the tsunami of Machine Learning has brought neuroconnectionist models back to the fore? Apparently, cybernetics has won: the parallels between the arguments of cyberneticians and the approaches of machine learning are obvious. The demo of Yann Le Cun's team on character recognition in 1993 follows the same problem of recognition of incomplete forms as in Von Neumann's General and Logical Theory of Automata in 1948. But, despite the continuity of the research programs, contemporary Machine Learning relies on two technical conditions that were foreign to cyberneticians. Firstly, the explosion of computing power, particularly with the use of GPUs, plays a crucial role. Secondly, the availability of massive amounts of data, referred to as Big Data, is essential for the effectiveness of Machine Learning, without which it loses its supremacy over other techniques such as classical AI or statistical processing.

One may wonder if we are not dealing with a "revenge of symbols", within the neuroconnectionist paradigms themselves: the models only work on the condition of a prior reduction of the world into data, into symbolic information. These observations about the technical, economic, legal, and political conditions underlying the resurgence of cybernetic approaches point to a fundamental difference in machine design. Contemporary Machine Learning is a technique for processing massive data, whereas cyberneticians envisioned machines where manipulating representations was secondary to their performative abilities. Hence, the resurgence of neuroconnectionism relies on a considerable shift from the physicalist orientation of cyberneticians. This shift remains unexplored and extends beyond the binary choice between machine learning and symbolic artificial intelligence.

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29 John Von Neumann, "First draft of a report on the EDVAC", *IEEE Annals of the History of Computing* 15, no. 4 (1993), 5

30 John Von Neumann, "Probabilistic Logics and the Syntheses of Reliable Organisms from Unreliable Components", in *Automata Studies*, ed. Claude Shannon and John McCarthy (Princeton: Princeton University Press, 1952): 43-98.

31 John Von Neumann, "Letter to Norbert Wiener, November 29<sup>th</sup> 1946", in *John Von Neumann, Selected Papers*, ed. Miklos Rédei (American Mathematical Society, 2005), 280.

32 Pickering, *supra* n 6, 5-7.

33 J.R. Licklider, "Man-Computer Symbiosis", *Transactions on Human Factors in Electronics* 1 (1960): 4-11.

### III

So far, I have been interested in the impact of the cybernetic conception of information on technoscientific programs. However, the influence of this conception extends beyond the scientific domain. The style of science, original to cybernetics, offers us a last remarkable component, in the form of a transfer of arguments about the nature of information to the field of politics, particularly in the case of Wiener.

Here, we must insist on the fact that Wiener's position is singular within the cybernetic group, as demonstrated by Steve Heims<sup>34</sup>. Multiple competing political orientations emerged from the early days of cybernetics, not to mention the subsequent variations that followed. For example, Wiener's program is diametrically opposed to Von Neumann's game-theoretic perspective of calculating optimal decisions. It also differs from Bateson and Mead's intention of employing cybernetic modeling in the social sciences.

Wiener's uniqueness, which is surprising considering the general image of cybernetics, lies in his refusal to simply "apply" engineering sciences to the social world. He argues that such an application is impossible and would amount to a form of fraud. The social and historical world is marked by the singularity of its trajectories and does not present the regularity necessary to be subjected to calculation. There is something very surprising in this refusal to make cybernetics work as a "science of government", departing from the explicit meaning of the term "cybernétique" in Ampère. Wiener states: "in the social sciences we have to deal with short statistical runs, nor can we be sure that a considerable part of what we observe is not a an artifact of our own creation. [...] We cannot afford to neglect [natural sciences] ; neither should we build exaggerated expectations of their possibilities. There is much which we must leave, whether we like it or not, to the un-« scientific », narrative method of the professional historian."<sup>35</sup>

Yet, despite this refusal to make cybernetics a "science of government," we find a cybernetic politics in Wiener. What does it entail? It involves a strategic use of cybernetic concepts to understand political and social issues, rather than a straightforward application. Cybernetics, with its conception of information, provides strategic argumentative resources, without indulging in a scientific reduction of the social world to engineering sciences.

I take three samples of Wiener's political use of the notion of information. The first maxim, the most obvious, is the refusal to consider information as an immaterial term. Considering information as a physical quantity, the opposite of entropy, nurtures in Wiener a form of tragic humanism. The world is inevitably going to waste, as the second law of thermodynamics indicates that entropy necessarily increases in any isolated system. The role of political action, in Wiener's view, is to create and maintain local enclaves of organization and knowledge to resist chaos. He states, "We are shipwrecked passengers on a doomed planet. [...] We shall go down, but let it be in a manner to which we may look forward as worthy of our dignity."<sup>36</sup>

Beyond that, the axiom of the physicality of information, leads Wiener to an ecological style of thinking. In his article "Too Big for Private Enterprise," he defends the role of public power in managing long-term interests that cannot be left in the hands of the "first businessman who comes

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34 Heims, supra n 5.

35 Wiener, supra n 2, 164.

36 Norbert Wiener, *The Human Use of Human Beings, Cybernetics and Society* 2nd ed., (London: Free Association Books, 1989), 40.

along<sup>37</sup>. *The Human use of Human Beings* thus proposes a critique of the "American philosophy of progress". Wiener argues, "We have a good deal of experience as to how the industrialists regard a new industrial potential. [...] They have very few inhibitions when it comes to taking all the profit out of an industry that there is to be taken, and then letting the public pick up the pieces. This is the history of the lumber and mining industries, and is part of what we have called in another chapter the traditional American philosophy of progress."<sup>38</sup>

This first epistemological-political maxim regarding the materiality of information resonates strongly today. It challenges the discourse of dematerialization and digital dualism, urging us to scrutinize the material, technical, and extractive mediations that underpin information systems. If we return to the autonomous car, let us start with rare metals, let us not forget assembly lines, the global division of labor.

The second of Wiener's political maxims is encapsulated in the statement, "Information is not meant to be a commodity." This can be deduced, once again, from the physics of information, as the inverse of entropy: information cannot retain its value, it is always a function of time and inevitably gained by noise. Wiener argues: "What makes a thing a good commodity? Essentially, that it can pass from hand to hand with substantial retention of its value [...] Information cannot be conserved as easily, for as we have already seen the amount of information communicated is related to the non-additive quantity known as entropy. [...] Just as entropy tends to increase spontaneously in a closed system, so information tends to decrease[...]. Information and entropy are not conserved, and are equally unsuited to being commodities."<sup>39</sup>

Wiener mobilizes here an argument that may seem singularly out of step with contemporary arguments that would lead to the same conclusion. Indeed, contemporary arguments against the commodification of information insist rather on the possibility of information being shared without loss of value. But this argument rests precisely on a distinction between material and immaterial goods, which is problematic in the spirit of the first cybernetics. This being so, this second maxim leads to a political perspective of criticism of intellectual property rights, which would not be out of place in contemporary movements in favor of free software or the digital commons, for example.

Lastly, a third maxim, which follows directly from the cybernetic conception of information, can be expressed as a rejection of the "myth of the robot". One of Wiener's major political concerns revolved around automation, particularly the idea of automated factories introduced at the beginning of this article. Wiener engaged with union leaders, professional organizations, and political figures. Notably, his conversation with Indian leader Nehru emphasized the importance of intermediate professional training and technical culture<sup>40</sup>.

Wiener feared that computers would facilitate the automation of production, leading to a "new industrial revolution" and significant job losses. However, his argument goes beyond mere fear of replacement. He posits that the prospect of replacing humans with machines ignores the difference between human and mechanical capabilities. Humans excel at reasoning in undefined contexts, while machines are superior in logical calculation. Thus, the ideal relationship with machines is one of coupling or what Licklider termed "symbiosis" between two different beings.

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37 Norbert Wiener, "Too Big for Private Enterprise", in Norbert Wiener, *Collected works with commentaries*, Volume IV, ed. Pesi Masani (Basel: Birkhäuser Verlag, 1990): 702-703.

38 Wiener, *supra* n 36, 161.

39 Wiener, *supra* n 36, 116.

40 Norbert Wiener, *I am a Mathematician, The Latter Life of a Prodigy* (New York: Doubleday, 1956), 335-356.

The cybernetic reflection on the computer-brain relationship leads to this political position: the objective of replacing man by the machine supposes in reality a considerable reduction of human capabilities. Such replacement is only possible due to the existence of "inhuman uses of human beings". The robot is not dangerous in itself, because pure replacement is a myth. It is dangerous because it is put at the service of social forces, which have an interest in extending the non-human use of human beings. The robot embodies a political and economic domination that drastically reduces the human potential. Wiener states: "Our view of society differs from the ideal of society which is held by many Fascists, Strong Men in Business, and Government. [...] Such people prefer an organization in which all orders come from above, and none return. The human beings under them have been reduced to the level of effectors for a supposedly higher nervous organism. I wish to devote this book to a protest against this inhumane use of human beings."<sup>41</sup>

What to do with the argument today? This is perhaps one of the places where Wiener's position is most endangered, insofar as the cybernetic program reaches a new stage, with the emergence of artificial entities that possess learning capabilities, exhibit a form of intuition, and take a new step forward in the kind of purposeful behavior that machines are capable of producing. In other words, Wiener's old argument that robot replacement is a myth because there is a complexity in humans that resists the machine seems to be threatened by a novel combination of machine learning and Big Data that cybernetics could not see coming. However, this argument prompts us to resist this vertigo and to draw our attention to the human part of AI and the way it can only work by enlisting human labor in the loop. Behind the robot, there is Digital Labor: proletarianized forms of work, which serve to train and monitor AI.

## Conclusion

Returning to cybernetics, the original scene of information technologies, allows us to exhume a set of theoretical resources, which are challenged by contemporary configurations. One of cybernetics' lessons may nevertheless lie in the constitution of a "counter-discipline", that brings together life sciences and engineering in a unique manner.

Wiener used the authority of cybernetics to critically analyze the new modes of production of American science. Cybernetics promoted small democratic collectives, marked by both a high level of individual and collective information. These collectives ensure, in Bernard Stiegler's vocabulary, the formation of "circuits of transindividuation", a requirement for the crisis of the technical milieu to end on other perspectives than "arch-proletarianization".

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41 Norbert Wiener, *The Human Use of Human Beings, Cybernetics and Society* 1st ed. (London: Eyre and Spottiswoode, 1950), 16.

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