Cybernetics is an Antihumanism: Advanced Technologies and the Rebellion Against the Human Condition

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> There is no science that does not rest on a metaphysics, though typically it remains concealed. It is the responsibility of the philosopher to uncover this metaphysics, and then to subject it to criticism. What I have tried to show is that cybernetics, far from being the apotheosis of Cartesian humanism, as Heidegger supposed, actually represented a crucial moment in its demystification, and indeed in its deconstruction.

Foreword

I chose the topic of my contribution to our workshop after I discovered, first with amazement, then with wonder, N. Katherine Hayles's beautiful book, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics.*[1] Amazement because she and I worked on the same fairly confidential corpus, in particular the proceedings of the Macy conferences, which were the birthplace of cybernetics and, I have claimed, of cognitive science, we celebrate the same heroes, in particular Warren McCulloch, Heinz von Foerster and Francisco Varela, and, in spite of these shared interests and passions, we apparently never heard of each other. She and I live and work worlds and languages apart. The world is still far from being a close-knit village. Wonder at realizing how from the same corpus we could arrive at interpretations that, although compatible or even complementary, are so richly diverse or even divergent.

My book on the Macy conferences and the origins of cybernetics and cognitive science, *Sur l'origine des sciences cognitives*, was first published in French in 1985;[2] a second and completely revised edition followed in 1994;[3] the first English-language edition, an extensively revised and amplified version of the latter, came out in 2000.[4] It is with

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[1] N. Katherine Hayles, *How we became posthuman. Virtual Bodies in Cybernetics, Literature, and Informatics*, Chicago, Chicago University Press, 1999.

[2] Jean-Pierre Dupuy, *L'essor de la première cybernétique (1943-1953)*, Paris, Ecole Polytechnique, Cahiers du CREA, 7, 1985.

[3] Jean-Pierre Dupuy, *Aux origines des sciences cognitives*, Paris, La Découverte, 1994.

[4] Jean-Pierre Dupuy, *The Mechanization of the Mind*, Princeton, Princeton University Press, 2000. A revised paperback edition is about to be published by the MIT Press under the title *On the Origins of Cognitive Science: The Mechanization of the Mind* (2008).

shame that I acknowledge that during all this time, I never came across Ms. Hayles' work, published in book form in 1999. It is with great sadness that I realize that there is no longer any way that I could ask my two great friends, Heinz von Foerster and Francisco Varela, two men of communication, why they never put us in touch. The Chilean neurophilosopher, Francisco Varela, was the cofounder of the theory of autopoietic systems; he chose to come to France and work in my research institution after he was expelled from his country. Heinz von Foerster, a Viennese Jewish immigrant to the United States, after serving as secretary to the Macy Conferences, went on to found what was to be called second-order cybernetics. Francisco and Heinz play important roles in the story that I tell in my book. The former passed away in 2000; the latter in 2002. I miss them both terribly.

My book seeks to disabuse readers of a number of ideas that I consider mistaken. Cybernetics calls to mind a series of familiar images that turn out on closer inspection to be highly doubtful. As the etymology of the word suggests, cybernetics is meant to signify control, mastery, governance — in short, the philosophical project associated with Descartes, who assigned mankind the mission of exercising dominion over the world, and over mankind itself. Within the cybernetics movement, this view was championed by Norbert Wiener — unsurprisingly, perhaps, since it was Wiener who gave it its name. But this gives only a very partial, if not superficial idea of what cybernetics was about, notwithstanding that even a philosopher of such penetrating insight as Heidegger was taken in by it.

In my work, I have relied on the notion, due to Karl Popper, of a *metaphysical research program*, which is to say a set of presuppositions about the structure of the world that are neither testable nor empirically falsifiable, but without which no science would be possible. For there is no science that does not rest on a metaphysics, though typically it remains concealed. It is the responsibility of the philosopher to uncover this metaphysics, and then to subject it to criticism. What I have tried to show is that cybernetics, far from being the apotheosis of Cartesian humanism, as Heidegger supposed, actually represented a crucial moment in its demystification, and indeed in its deconstruction. To borrow a term that has been applied to the structuralist movement in the human sciences, cybernetics constituted a decisive step in the rise of *antihumanism.* Consider, for example, the way in which cybernetics conceived the relationship between man and machine. The philosophers of consciousness were not alone in being caught up in the trap set by a question such as "Will it be possible one day to design a machine that thinks?" The cybernetician's answer, rather in the spirit of Molière, was: "Madame, you pride yourself so on thinking. And yet, you are only a machine!" The aim of cognitive science always was — and still is today — the mechanization of the mind, not the humanization of the machine.

"Continental" political philosophy has yet to acknowledge the notion of posthumanism. On the other hand, the notion of antihumanism has been debated for at least four decades. My contribution will bear on the latter only. My hope is that our workshop will enable us to explore the possible connections between the two notions and, beyond, perhaps, bridge the gap between two cultural worlds so far apart.

1   Heidegger's Error

I will start with a classic question: can the idea that we have of the human person, which is to say of ourselves, survive the forward march of scientific discovery? It is a commonplace that from Copernicus to molecular biology, and from Marx to Freud along the way, we have had steadily to abandon our proud view of ourselves as occupying a special place in the universe, and to admit that we are at the mercy of determinisms that leave little room for what we have been accustomed to consider our freedom and our reason. Is not cognitive science now in the process of completing this process of disillusionment and demystification by showing us that just where we believe we sense the workings of a mind, there is only the firing of neural networks, no different in principle than an ordinary electric circuit? The task in which I have joined with many others, faced with reductive interpretations of scientific advance of this sort, has been to defend the values proper to the human person, or, to put it more bluntly, to defend humanism against the excesses of science and technology.

Heidegger completely inverted this way of posing the problem. For him it was no longer a question of defending humanism but rather of indicting it. As for science and technology, or rather "technoscience" (an expression meant to signify that science is subordinated to the practical ambition of achieving mastery over the world through technology), far from threatening human values, they are on Heidegger's view the most striking manifestation of them. This dual reversal is so remarkable that it deserves to be considered in some detail, even — or above all — in a reflection on the place of cybernetics in the history of ideas, for it is precisely cybernetics that found itself to be the principal object of Heidegger's attack. In those places where Heideggerian thought has been influential, it became impossible to defend human values against the claims of science. This was particularly true in France, where structuralism — and then poststructuralism — reigned supreme over the intellectual landscape for several decades before taking refuge in the literature departments of American universities. Anchored in the thought of the three great Germanic "masters of suspicion" — Marx, Nietzsche, and Freud — against a common background of Heideggerianism, the human sciences *à la française* made antihumanism their watchword,[5] loudly celebrating exactly what humanists dread: the death of man. This unfortunate creature, or rather a certain image that man created of himself, was reproached for being "metaphysical." With Heidegger, "metaphysics" acquired a new and quite special sense, opposite to its usual meaning. For positivists ever since Comte, the progress of science had been seen as forcing the retreat of metaphysics; for Heidegger, by contrast, technoscience represented the culmination of metaphysics. And the height of metaphysics was nothing other than cybernetics.

Let us try to unravel this tangled skein. For Heidegger, metaphysics is the search for an ultimate foundation for all reality, for a "primary being" in relation to which all other beings find their place and purpose. Where traditional metaphysics ("onto-theology")

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[5]   This point is clearly established by Luc Ferry and Alain Renaut, *French Philosophy of the Sixties: An Essay on Antihumanism*, trans. Mary H. S. Cattani, Amherst, University of Massachusetts Press, 1990.

had placed God, modern metaphysics substituted man. This is why modern metaphysics is fundamentally humanist, and humanism fundamentally metaphysical. Man is a subject endowed with consciousness and will: his features were described at the dawn of modernity in the philosophy of Descartes and Leibniz. As a conscious being, he is present and transparent to himself; as a willing being, he causes things to happen as he intends. Subjectivity, both as theoretical presence to oneself and as practical mastery over the world, occupies center stage in this scheme — whence the Cartesian promise to make man "master and possessor of nature." In the metaphysical conception of the world, Heidegger holds, everything that exists is a slave to the purposes of man; everything becomes an object of his will, fashionable as a function of his ends and desires. The value of things depends solely on their capacity to help man realize his essence, which is to achieve mastery over being. It thus becomes clear why technoscience, and cybernetics in particular, may be said to represent the completion of metaphysics. To contemplative thought — thought that poses the question of meaning and of Being, understood as the sudden appearance of things, which escapes all attempts at grasping it — Heidegger opposes "calculating" thought. This latter type is characteristic of all forms of planning that seek to attain ends by taking circumstances into account. Technoscience, insofar as it constructs mathematical models to better establish its mastery over the causal organization of the world, knows only calculating thought. Cybernetics is precisely that which calculates — computes — in order to govern, in the nautical sense (Wiener coined the term from the Greek κυβερνητης, meaning "steersman"): it is indeed the height of metaphysics.

Heidegger anticipated the objection that would be brought against him: "Because we are speaking against humanism people fear a defense of the inhuman and a glorification of barbaric brutality. For what is more *logical* than that for somebody who negates humanism nothing remains but the affirmation of inhumanity?"[6] Heidegger defended himself by attacking. Barbarism is not to be found where one usually looks for it. The true barbarians are the ones who are supposed to be humanists, who, in the name of the dignity that man accords himself, leave behind them a world devastated by technology, a desert in which no one can truly be said to dwell.

Let us for the sake of argument grant the justice of Heidegger's position. At once an additional enigma presents itself. If for him cybernetics really represented the apotheosis of metaphysical humanism, how are we to explain the fact that the human sciences in France, whose postwar development I have just said can be understood only against the background of Heidegger's philosophy, availed themselves of the conceptual toolkit of cybernetics in order to deconstruct the metaphysics of subjectivity? How is it that these sciences, in their utter determination to put man as subject to death, each seeking to outdo the other's radicalism, should have found in cybernetics the weapons for their assaults?

From the beginning of the 1950s — which is to say, from the end of the first cybernetics — through the 1960s and 1970s, when the second cybernetics was investigating

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6   Martin Heidegger, "Letter on Humanism" in *Basic Writings*, ed. David Farrell Krell, New York, Harper and Row, 1977, p. 225.

theories of self-organization and cognitivism was on the rise, the enterprise of mechanizing the human world underwent a parallel development on each side of the Atlantic. This common destiny was rarely noticed, perhaps because the thought of any similarity seemed almost absurd: whereas cognitive science claimed to be the avant-garde of modern science, structuralism — followed by poststructuralism — covered itself in a pretentious and often incomprehensible philosophical jargon. What is more, it was too tempting to accuse French deconstructionists of a fascination with mathematical concepts and models that they hardly understood. But even if this way of looking at the matter is not entirely unjustified, it only scratches the surface. There were very good reasons, in fact, why the deconstruction of metaphysical humanism found in cybernetics an ally of the first order.

At the beginning of the 1940s, a philosopher of consciousness such as Sartre could write: "The inhuman is merely … the mechanical."[7] Structuralists hastened to adopt this definition as their own, while reversing the value assigned to its terms. Doing Heidegger one better, they made a great show of championing the inhuman — which is to say the mechanical.[8] Cybernetics, as it happened, was ready to hand, having come along at just the right moment to demystify the voluntary and conscious subject. The will? All its manifestations could apparently be simulated, and therefore duplicated, by a simple negative feedback mechanism. Consciousness? The "Cybernetics Group"[9] had examined the Freudian unconscious, whose existence was defended by one of its members, Lawrence Kubie, and found it chimerical. If Kubie often found himself the butt of his colleagues' jokes, it was not because he was thought to be an enemy of human dignity. It was rather because the postulation of a hidden entity, located in the substructure of a purportedly conscious subject, manifesting itself only through symptoms while yet being endowed with the essential attributes of the subject (intentionality, desires, beliefs, presence to oneself, and so on), seemed to the cyberneticians nothing more than a poor conjuring trick aimed at keeping the structure of subjectivity intact.

It is remarkable that a few years later the French psychoanalyst Jacques Lacan, along with the anthropologist Claude Lévi-Strauss and the Marxist philosopher Louis Althusser (one of the founders of structuralism), should have adopted the same critical attitude toward Freud as cybernetics. The father of psychoanalysis had been led to postulate an improbable "death wish" — "beyond the pleasure principle," as he put it — as if the subject actually desired the very thing that made him suffer, by voluntarily and repeatedly placing himself in situations from which he could only emerge battered and hurt. This compulsion (*Zwang*) to repeat failure Freud called *Wiederholungszwang*, an

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[7]   This phrase is found in the review Sartre wrote in 1943 of Albert Camus's *The Stranger*, "Explications de *l'Etranger*," reprinted in Critiques littéraires (*Situations I*), Paris, Gallimard, 1947; available in English in *Literary and Philosophical Essays*, trans. Annette Michelson, New York, Criterion Books, 1955.

[8]   "To render philosophy inhuman" — thus the task Jean-François Lyotard set himself in 1984.

[9]   This expression is borrowed from Steve Heims's indispensable book, *The Cybernetics Group*, Cambridge, Mass., MIT Press, 1991.

expression translated by Lacan as "automatisme de répétition," which is to say the *automatism* of repetition. In so doing he replaced the supposed unconscious death wish with the senseless functioning of a machine, the unconscious henceforth being identified with a cybernetic automaton. The alliance of psychoanalysis and cybernetics was neither anecdotal nor fortuitous: it corresponded to a radicalization of the critique of metaphysical humanism.

There was a deeper reason for the encounter between the French *sciences de l'homme* and cybernetics, however. What structuralism sought to conceive — in the anthropology of Lévi-Strauss, for example, and particularly in his study of systems of exchange in traditional societies — was a subjectless cognition, indeed cognition without mental content. Whence the project of making "symbolic thought" a mechanism peculiar not to individual brains but to "unconscious" linguistic structures that automatically operate behind the back, as it were, of unfortunate human "subjects," who are no more than a sort of afterthought. "It thinks" was destined to take the place once and for all of the Cartesian *cogito*. Now cognition without a subject was exactly the unlikely configuration that cybernetics seemed to have succeeded in conceiving. Here again, the encounter between cybernetics and structuralism was in no way accidental. It grew out of a new intellectual necessity whose sudden emergence appears in retrospect as an exceptional moment in the history of ideas.

2 The Self-Mechanized Mind

It is time to come back to our enigma, which now may be formulated as a paradox. Was cybernetics the height of metaphysical humanism, as Heidegger maintained, or was it the height of its deconstruction, as certain of Heidegger's followers believe? To this question I believe it is necessary to reply that cybernetics was both things at once, and that this is what made it not only the root of cognitive science, which finds itself faced with the same paradox, but also a turning point in the history of human conceptions of humanity. The title I have given to this section — the self-mechanized mind — appears to have the form of a self-referential statement, not unlike those strange loops the cyberneticians were so crazy about, especially the cyberneticians of the second phase. But this is only an appearance: the mind that carries out the mechanization and the one that is the object of it are two distinct (albeit closely related) entities, like the two ends of a seesaw, the one rising ever higher in the heavens of metaphysical humanism as the other descends further into the depths of its deconstruction. In mechanizing the mind, in treating it as an artifact, the mind presumes to exercise power over this artifact to a degree that no psychology claiming to be scientific has ever dreamed of attaining. The mind can now hope not only to manipulate this mechanized version of itself at will, but even to reproduce and manufacture it in accordance with its own wishes and intentions. Accordingly, the technologies of the mind, present and future, open up a vast continent upon which man now has to impose norms if he wishes to give them meaning and purpose. The human subject will therefore need to have recourse to a supplementary endowment of will and conscience in order to determine, not what he can do, but what he ought to do — or, rather, what he ought not to do. These new technologies will require a whole ethics to be elaborated, an ethics not less

demanding than the one that is slowly being devised today in order to control the rapid development and unforeseen consequences of new biotechnologies. But to speak of ethics, conscience, the will — is this not to speak of the triumph of the subject?

The connection between the mechanization of life and the mechanization of the mind is plain. Even if the Cybernetics Group snubbed biology, to the great displeasure of John von Neumann, it was of course a cybernetic metaphor that enabled molecular biology to formulate its central dogma: the genome operates like a computer program. This metaphor is surely not less false than the analogous metaphor that structures the cognitivist paradigm. The theory of biological self-organization, first opposed to the cybernetic paradigm during the Macy Conferences before later being adopted by the second cybernetics as its principal model, furnished then — and still furnishes today — decisive arguments against the legitimacy of identifying DNA with a "genetic program." Nonetheless — and this is the crucial point — even though this identification is profoundly illegitimate from both a scientific and a philosophical point of view, its technological consequences have been considerable. Today, as a result, man may be inclined to believe that he is the master of his own genome. Never, one is tempted to say, has he been so near to realizing the Cartesian promise: he has become — or is close to becoming — the master and possessor of all of nature, up to and including himself.

Must we then salute this as yet another masterpiece of metaphysical humanism? It seems at first altogether astonishing, though after a moment's reflection perfectly comprehensible, that a German philosopher following in the tradition of Nietzsche and Heidegger, Peter Sloterdijk, should have recently come forward, determined to take issue with the liberal humanism of his country's philosophical establishment, and boldly affirmed that the new biotechnologies sound the death knell for the era of humanism. Unleashing a debate the like of which is hardly imaginable in any other country, this philosopher ventured to assert: "The domestication of man by man is the great unimagined prospect in the face of which humanism has looked the other way from antiquity until the present day." And to prophesy:

> It suffices to clearly understand that the next long periods of history will be periods of choice as far as the [human] species is concerned. Then it will be seen if humanity, or at least its cultural elites, will succeed in establishing effective procedures for self-domestication. It will be necessary, in the future, to forthrightly address the issue and formulate a code governing anthropological technologies. Such a code would modify, a posteriori, the meaning of classical humanism, for it would show that *humanitas* consists not only in the friendship of man with man, but that it also implies…, in increasingly obvious ways, that man represents the supreme power for man.[10]

But why should this "superhuman" power of man over himself be seen, in Nietzschean fashion, as representing the death of humanism rather than its apotheosis? For man to be able, as subject, to exercise a power of this sort over himself, it is first necessary that he be reduced to the rank of an object, able to be reshaped to suit any purpose. No

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[10]   Peter Sloterdijk, "On the Rules of the Human Fleet," a paper delivered at a conference on Heidegger at Elmau Castle, Upper Bavaria, on July 17, 1999, and presented as a reply to Heidegger's "Letter on Humanism."

raising up can occur without a concomitant lowering, and vice versa.

Let us come back to cybernetics and, beyond that, to cognitive science. We need to consider more closely the paradox that an enterprise that sets itself the task of naturalizing the mind should have as its spearhead a discipline that calls itself artificial intelligence. To be sure, the desired naturalization proceeds via mechanization. Nothing about this is inconsistent with a conception of the world that treats nature as an immense computational machine. Within this world man is just another machine — no surprise there. But in the name of what, or of whom, will man, thus artificialized, exercise his increased power over himself? In the name of this very blind mechanism with which he is identified? In the name of a meaning that he claims is mere appearance or phenomenon? His will and capacity for choice are now left dangling over the abyss. The attempt to restore mind to the natural world that gave birth to it ends up exiling the mind from the world and from nature. This paradox is typical of what the French sociologist Louis Dumont, in his magisterial study of the genesis of modern individualism, called

> the model of modern artificialism in general, the systematic application of an extrinsic, imposed value to the things of the world. Not a value drawn from our belonging to the world, from its harmony and our harmony with it, but a value rooted in our heterogeneity in relation to it: the identification of our will with the will of God (Descartes: man makes himself master and possessor of nature). The will thus applied to the world, the end sought, the motive and the profound impulse of the will are [all] foreign. In other words, they are extra-worldly. Extra-worldliness is now concentrated in the individual will.[11]

The paradox of the naturalization of the mind attempted by cybernetics, and today by cognitive science, then, is that the mind has been raised up as a demigod in relation to itself.

Many of the criticisms brought against the materialism of cognitive science from the point of view either of a philosophy of consciousness or a defense of humanism miss this paradox. Concentrating their (often justified) attacks on the weaknesses and naiveté of such a mechanist materialism, they fail to see that it invalidates itself by placing the human subject outside of the very world to which he is said to belong. The recent interest shown by cognitive science in what it regards as the "mystery" of consciousness seems bound to accentuate this blindness.

3   The Nanotechnological Dream

I want now to broach not so much the intellectual evolution of cognitive science itself as its embodiment by new technologies, or, as one should rather say, its instantiation by ideas for new technologies. For the moment at least these technologies exist only as projects, indeed in some cases only as dreams. But no matter that many such dreams will acquire physical reality sooner or later, the simple fact that they already exist in people's minds affects how we see the world and how we see ourselves.

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[11]   Louis Dumont, *Essays on Individualism: Modern Ideology in Anthropological Perspective*, Chicago, University of Chicago Press, 1986.

Since my book was first published, I have thought a great deal about the philosophical foundations of what is called the NBIC Convergence — the convergence of nanotechnology, biotechnology, information technology, and cognitive science — and about the ethical implications of this development.[12] Here I have found many of the same tensions, contradictions, paradoxes, and confusions that I discerned first within cybernetics, and then within cognitive science. But now the potential consequences are far more serious, because we are not dealing with a theoretical matter, a certain view of the world, but with an entire program for acting upon nature and mankind.

In searching for the underlying metaphysics of this program, I did not have far to look. One of the first reports of the National Science Foundation devoted to the subject, entitled "Converging Technologies for Improving Human Performance," summarizes the credo of the movement in a sort of haiku:

> If the Cognitive Scientists can think it,
> The Nano people can build it,
> The Bio people can implement it, and
> The IT people can monitor and control
> it.[13]

Note that cognitive science plays the leading role in this division of labor, that of thinker — not an insignificant detail, for it shows that the metaphysics of NBIC Convergence is embedded in the work of cognitive scientists. It comes as no surprise, then, that the contradictions inherent in cognitive science should be found at the heart of the metaphysics itself. One of the main themes of my book is the confrontation between Norbert Wiener and John von Neumann, Wiener embodying the ideas of control, mastery, and design, von Neumann the ideas of complexity and self-organization. Cybernetics never succeeded in resolving the tension, indeed the contradiction, between these two perspectives; more specifically, it never managed to give a satisfactory answer to the problems involved in realizing its ambition of *designing* an autonomous, self-organizing machine. Nanotechnology — whose wildest dream is to reconstruct the natural world that has been given to us, atom by atom — is caught up in the same contradiction.

The most obvious element of the nanotechnological dream is to substitute for what François Jacob called *bricolage,* or the tinkering of biological evolution, a paradigm of

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12 See Jean-Pierre Dupuy, "Some Pitfalls in the Philosophical Foundations of Nanoethics," *Journal of Medicine and Philosophy* 32, no. 3 (2007): 237-261; Jean-Pierre Dupuy, "Complexity and Uncertainty: A Prudential Approach to Nanotechnology," in John Weckert et al., eds., *Nanoethics: Examining the Social Impact of Nanotechnology* (Hoboken, N.J.: John Wiley and Sons, 2007), 119-131; Jean-Pierre Dupuy, "The double language of science, and why it is so difficult to have a proper public debate about the nanotechnology program," Foreword to Fritz Allhoff and Patrick Lin, eds., *Nanoethics: Emerging Debates* (Dordrecht: Springer, 2008); and Jean-Pierre Dupuy and Alexei Grinbaum, "Living with Uncertainty: Toward a Normative Assessment of Nanotechnology," *Techné* (joint issue with *Hyle)* 8, no. 2 (2004): 4-25.

13 Mihail C. Roco and William Sims Bainbridge, *Converging Technologies for Improving Human Performance: Nanotechnology, Biotechnology, Information Technology, and Cognitive Science* (Washington, D.C.: National Science Foundation, 2002), 13.

design. Damien Broderick, the Australian cultural theorist and popular science writer, barely manages to conceal his contempt for the world that human beings have inherited when he talks about the likelihood that "nanosystems, designed by human minds, will bypass all this Darwinian wandering, and leap straight to *design success.*"[14] One can hardly fail to note the irony that science, which in America has had to engage in an epic struggle to root out every trace of creationism (including its most recent avatar, "intelligent design") from public education, should now revert to a logic of design in the form of the nanotechnology program — the only difference being that now it is mankind that assumes the role of the demiurge.

Philosophers, faced with the ambition of emerging technologies to supersede nature and life as the engineers of evolution, the designers of biological and natural processes, may suppose that they are dealing with an old idea: Descartes' vision of science as the means by which man may become the master and possessor of nature. Again, however, this is only part of a larger and more complicated picture. As another influential visionary, the American applied physicist Kevin Kelly, revealingly remarked, "It took us a long time to realize that the power of a technology is proportional to its inherent *out-of-controlness*, its inherent ability to surprise and be generative. In fact, unless we can worry about a technology, it is not revolutionary enough."[15] With NanoBioConvergence, a novel conception of engineering has indeed been introduced. The engineer, far from seeking mastery over nature, is now meant to feel that his enterprise will be crowned by success only to the extent that the system component he has created is capable of surprising him. For whoever wishes ultimately to create a self-organizing system — another word for life — is bound to attempt to reproduce its essential property, namely, the ability to make something that is radically new.

In her masterful study of the perils facing mankind, *The Human Condition* (1958), of which we are celebrating the fiftieth anniversary, Hannah Arendt brought out the fundamental paradox of our age: whereas the power of mankind to alter its environment goes on increasing under the stimulus of technological progress, less and less do we find ourselves in a position to control the consequences of our actions. I take the liberty of giving a long quotation here whose pertinence to the subject at hand cannot be exaggerated — keeping in mind, too, that these lines were written fifty years ago:

> To what extent we have begun to *act into nature*, in the literal sense of the word, is perhaps best illustrated by a recent casual remark of a scientist [Wernher von Braun, December 1957] who quite seriously suggested that "*basic research is when I am doing what I don't know what I am doing.*"
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> This started harmlessly enough with the experiment in which men were no longer content to observe, to register, and contemplate whatever nature was willing to yield in her own appearance, but began to prescribe conditions and to provoke natural

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[14] Damien Broderick, *The Spike: How Our Lives Are Being Transformed by Rapidly Advancing Technologies* (New York: Forge, 2001), 118.

[15] See Kevin Kelly, "Will Spiritual Robots Replace Humanity by 2100?," in *The Technium,* a work in progress, http://www.kk.org./thetechnium/.

processes. What then developed into an ever-increasing skill in *unchaining elemental processes,* which, without the interference of men, would have lain dormant and perhaps never have come to pass, has finally ended in a veritable art of *"making" nature,* that is, of creating "natural" processes which without men would never exist and which earthly nature by herself seems incapable of accomplishing....

[N]atural sciences have become exclusively sciences of process and, in their last stage, *sciences of potentially irreversible, irremediable "processes of no return"....*[16]

The sorcerer's apprentice myth must therefore be updated: it is neither by error nor terror that mankind will be dispossessed of its own creations, but by *design* — which henceforth is understood to signify not mastery, but non-mastery and out-of-controlness.

4 The Rebellion Against the Human Condition

Arendt began the same, decidedly prescient book with the following words:

The human artifice of the world separates human existence from all mere animal environment, but life itself is outside this artificial world, and through life man remains related to all other living organisms. For some time now, a great many scientific endeavors have been directed toward making life also "artificial," toward cutting the last tie through which even man belongs among the children of nature....

This future man, whom the scientists tell us they will produce in no more than a hundred years, seems to be possessed by *a rebellion against human existence as it has been given,* a free gift from nowhere (secularly speaking), which he wishes to exchange, as it were, for something he has made himself.[17]

The nanotechnological dream that began to take shape only a few decades after the utterance of Arendt's prophesy amounts to exactly this revolt against the finiteness, the mortality of the human condition. Human life has an end, for it is promised to death. But not only do the champions of NBIC Convergence oppose themselves to fate, by promising immortality; they quarrel with the very fact that we are born. Their revolt against the given is therefore something subtler and less visible, something still more fundamental, than the revolt against human mortality, for it rejects the notion that we should be brought into the world for no reason. "Human beings are ashamed to have been born instead of made." Thus the German philosopher Günther Anders (Arendt's first husband and himself a student of Heidegger) characterized the essence of the revolt against the given in his great book, published in 1956, *Die Antiquiertheit des Menschen* — The Obsolescence of the Human Being.[18] One cannot help recalling here another philosophical emotion: the nausea described by Jean-Paul Sartre, that sense of forlornness that takes hold of human beings when they realize that they are not the foundation of their own being. The human condition is ultimately one of freedom; but freedom, being absolute, runs up against the obstacle of its own contingency, for we

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[16] Hannah Arendt, *The Human Condition* (Chicago: University of Chicago Press, 1958), 231.

[17] Ibid., 2-3.

[18] Günther Anders, *Die Antiquiertheit des Menschen: über die Seele im Zeitalter der zweiten industriellen Revolution*, vol. 1 (Munich: Beck, 1980), 21-97.

are free to choose anything except the condition of being *un*free. Discovering that we have been *thrown* into the world without any reason, we feel abandoned. Sartre acknowledged his debt to Günther Anders in expressing this idea by means of a phrase that was to become famous: man is "to freedom condemned."[19]

Freedom, Sartre held, never ceases trying to "nihilate" that which resists it. Mankind will therefore do everything it can to become its own maker; to owe its freedom to no one but itself. But only things are what they are; only things coincide with themselves. Freedom, on the other hand, is a mode of being that never coincides with itself since it ceaselessly projects itself into the future, desiring to be what it is not. Self-coincidence is what freedom aspires to and cannot attain, just as a moth is irresistibly attracted to the flame that will consume it. A *metaphysical self-made man,* were such a being possible, would paradoxically have lost his freedom, and indeed would no longer be a man at all, since freedom necessarily entails the impossibility of transforming itself into a thing. Thus Anders' notion of "Promethean shame" leads inexorably to the obsolescence of man.

Had they lived to see the dawn of the twenty-first century, Sartre and Anders would have found this argument resoundingly confirmed in the shape of the NBIC Convergence — a Promethean project if ever there was one. For the aim of this distinctively metaphysical program is to place mankind in the position of being the divine maker of the world, the demiurge, while at the same time condemning human beings to see themselves as out of date.

At the heart of the nanotechnological dream we therefore encounter a paradox that has been with us since the cybernetic chapter in the philosophical history of cognitive science — an extraordinary paradox arising from the convergence of opposites, whereby the overweening ambition and pride of a certain scientific humanism leads directly to the obsolescence of mankind. It is in the light, or perhaps I should say the shadow, of this paradox that all "ethical" questions touching on the engineering of mankind by mankind must be considered.

5 "Playing God" versus the Blurring of Fundamental Distinctions

In 1964, Norbert Wiener published an odd book with the curious title *God and Golem, Inc.: A Comment on Certain Points where Cybernetics Impinges on Religion.* In it one finds this:

> God is supposed to have made man in His own image, and the propagation of the race may also be interpreted as a function in which one living being makes another in its own image. In our desire to glorify God with respect to man and Man with respect to matter, it is thus natural to assume that machines cannot make other machines in their own image; that this is something associated with a sharp dichotomy of systems into living and non-living; and that it is moreover associated with the other dichotomy between creator and creature. Is this, however, so?[20]

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[19]   Jean-Paul Sartre, *L'Existentialisme est un humanisme*, Paris, Nagel, 1946.

[20]   Norbert Wiener, *God and Golem, Inc.: A Comment on Certain Points where Cybernetics Impinges on Religion* (Cambridge, Mass.: The MIT Press, 1964), 12.

The rest of the book is devoted to mobilizing the resources of cybernetics to show that these are false dichotomies and that, in truth, "machines are very well able to make other machines in their own image."[21]

In recent years, the enterprise of "making life from scratch" has been organized as a formal scientific discipline under the seemingly innocuous name of synthetic biology. In June 2007, on the occasion of the first Kavli Futures Symposium at the University of Greenland in Ilulissat, leading researchers from around the world gathered to announce the convergence of work in synthetic biology and nanotechnology and to take stock of the most recent advances in the manufacture of artificial cells. Their call for a global effort to promote "the construction or redesign of biological systems components that do not naturally exist" evoked memories of the statement that was issued in Asilomar, California more than thirty years earlier, in 1975, by the pioneers of biotechnology. Like their predecessors, the founders of synthetic biology insisted not only on the splendid things they were poised to achieve, but also on the dangers that might flow from them. Accordingly, they invited society to prepare itself for the consequences, while laying down rules of ethical conduct for themselves.[22] We know what became of the charter drawn up at Asilomar. A few years later, this attempt by scientists to regulate their own research had fallen to pieces. The dynamics of technological advance and the greed of the marketplace refused to suffer any limitation.

Only a week before the symposium in Ilulissat, a spokesman for the ETC Group, an environmental lobby based in Ottawa that has expanded its campaign against genetically modified foods to include emerging nanotechnologies, greeted the announcement of a feat of genetic engineering by the J. Craig Venter Institute in Rockville, Maryland with the memorable words, "For the first time, God has competition." In the event, ETC had misinterpreted the nature of the achievement.[23] But if the Ilulissat Statement is to be believed, the actual synthesis of an organism equipped with an artificial genome ("a free-living organism that can grow and replicate") will become a reality in the next few years. Whatever the actual timetable may turn out to be, the process of fabricating DNA is now better understood with every passing day, and the moment when it will be possible to create an artificial cell using artificial DNA is surely not far off. The question arises, however, whether such an achievement will really amount to *creating life.* In order to assert this much, one must suppose that between life and non-life there is an absolute distinction, a critical threshold, so that whoever crosses it will have shattered a taboo, like the prophet Jeremiah and like Rabbi Löw of Prague in the Jewish tradition, who dared to create an

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[21] Ibid., 13.

[22] The Ilulissat Statement, Kavli Futures Symposium, "The merging of bio and nano: towards cyborg cells," 11-15 June 2007, Ilulissat, Greenland.

[23] Carole Lartigue's JCVI team had succeeded in "simply" transferring the genome of one bacterium, *Mycoplasma mycoides,* to another, *Mycoplasma capricolum,* and showing that the cells of the recipient organism could function with the new genome. In effect, one species had been converted into another.

artificial man, a *golem.* In the view of its promoters and some of its admirers, notably the English physicist and science writer Philip Ball,[24] synthetic biology has succeeded in demonstrating that no threshold of this type exists: between the dust of the earth and the creature that God formed from it, there is no break in continuity that permits us to say (quoting *Genesis* 2:7) that He breathed into man's nostrils the breath of life. And even in the event that synthetic biology should turn out to be incapable of fabricating an artificial cell, these researchers contend, it would still have had the virtue of depriving the prescientific notion of life of all consistency.

It is here, in the very particular logic that is characteristic of dreams, that nanotechnology plays an important symbolic role. It is typically defined by the scale of the phenomena over which it promises to exert control — a scale that is described in very vague terms, since it extends from a tenth of a nanometer[25] to a tenth of a micron. Nevertheless, over this entire gamut, the essential distinction between life and non-life loses all meaning. It is meaningless to say, for example, that a DNA molecule is a living thing. At the symbolic level, a lack of precision in defining nanotechnology does not matter; what matters is the deliberate and surreptitious attempt to blur a fundamental distinction that until now has enabled human beings to steer a course through the world that was given to them. In the darkness of dreams, there is no difference between a living cat and a dead cat.

Once again, we find that science oscillates between two opposed attitudes: on the one hand, vainglory, an excessive and often indecent pride; and on the other, when it becomes necessary to silence critics, a false humility that consists in denying that one has done anything out of the ordinary, anything that departs from the usual business of normal science. As a philosopher, I am more troubled by the false humility, for in truth it is this, and not the vainglory, that constitutes the height of pride. I am less disturbed by a science that claims to be the equal of God than by a science that drains one of the most essential distinctions known to humanity since the moment it first came into existence of all meaning: the distinction between that which lives and that which does not; or, to speak more bluntly, between life and death.

Let me propose an analogy that is more profound, I believe, than one may at first be inclined to suspect. With the rise of terrorism in recent years, specifically in the form of suicide attacks, violence on a global scale has taken a radically new turn. The first edition of this book belongs to a bygone era, which ended on 11 September 2001. In that world, even the most brutal persecutor expressed his attachment to life, because he killed in order to affirm and assert the primacy of his own way of living. But when the persecutor assumes the role of victim, killing herself in order to maximize the number of people killed around him, all distinctions are blurred, all possibility of reasoned dissuasion is lost, all control of violence is doomed to impotence. If science is allowed, in its turn, to continue along this same path in denying the crucial difference

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[24] See Philip Ball, "Meanings of 'life'," Editorial, *Nature* 447 (28 June 2007): 1031-1032. The subtitle is "Synthetic biology provides a welcome antidote to chronic vitalism."

[25] A nanometer is one-billionth of a meter.

that life introduces in the world, it will, I predict, prove itself to be capable of a violence that is no less horrifying.

Among the most extreme promises of nanotechnology, as we have seen, is immortality (or "indefinite life extension," as it is called). But if there is thought to be no essential difference between the living and the nonliving, then there is nothing at all extraordinary about this promise. Yet again, Hannah Arendt very profoundly intuited what such a pact with the devil would involve:

> The greatest and most appalling danger for human thought is that what we once believed could be wiped out by the discovery of some fact that had hitherto remained unknown; for example, it could be that one day we succeed in making men immortal, and everything we had ever thought concerning death and its profundity would then become simply laughable. Some may think that this is too high a price to pay for the suppression of death.[26]

The ETC Group's premonitory observation — "For the first time, God has competition" — can only strengthen the advocates of the NBIC Convergence in their belief that those who criticize them do so for religious reasons. The same phrases are always used to sum up what is imagined to be the heart of this objection: human beings do not have the right to usurp powers reserved to God alone; *playing God* is forbidden. Often it is added that this taboo is specifically "Judeo-Christian."

Let us put to one side the fact that this allegation wholly misconstrues the teaching of the Talmud as well as that of Christian theology. In conflating them with the ancient Greek conception of the sacred — the gods, jealous of men who have committed the sin of pride, *hubris,* send after them the goddess of vengeance, Nemesis — it forgets that the Bible depicts man as co-creator of the world with God. As the French biophysicist and Talmudic scholar Henri Atlan notes with regard to the literature about the Golem:

> One does not find [in it], at least to begin with, the kind of negative judgment one finds in the Faust legend concerning the knowledge and creative activity of men "in God's image." Quite to the contrary, it is in creative activity that man attains his full humanity, in a perspective of *imitatio Dei* that allows him to be associated with God, in a process of ongoing and perfectible creation.[27]

Within the Christian tradition, authors such as G. K. Chesterton, René Girard, and Ivan Illich see Christianity as the womb of Western modernity, while arguing that modernity has betrayed and corrupted its message. This analysis links up with the idea, due to Max Weber, of the desacralization of the world — its famous "disenchantment" — in regarding Christianity, or at least what modernity made of it, as the main factor in the progressive elimination of all taboos, sacred prohibitions, and other forms of religious limitation.

It fell to science itself to extend and deepen this desacralization, inaugurated by the religions of the Bible, by stripping nature of any prescriptive or normative value. It is

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[26] Hannah Arendt, *Journal de pensée (1950-1973),* 2 vols., translated by Sylvie Courtine-Denamy (Paris: Seuil, 2005), 1.

[27] Henri Atlan, *Les étincelles du hasard,* vol. 1: *Connaissance spermatique* (Paris: Seuil, 1999), 45.

utterly futile, then, to accuse science of being at odds with the Judeo-Christian tradition on this point.

Kantianism, for its part, conferred philosophical legitimacy on the devaluation of nature by regarding it as devoid of intentions and reasons, inhabited only by causes, and by severing the world of nature from the world of freedom, where the reasons for human action fall under the jurisdiction of moral law.

Where, then, is the ethical problem located, if in fact there is one here? It clearly does not lie in the transgression of this or that taboo sanctioned by nature or the sacred, since the joint evolution of religion and science has done away with any such foundation for the very concept of a moral limitation, and hence of a transgression. But that is precisely the problem. For there is no free and autonomous human society that does not rest on some principle of self-limitation. We will not find the limits we desperately need in the religions of the Book, as though such limits are imposed on us by some transcendental authority, for these religions do nothing more than confront us with our own freedom and responsibility.

The ethical problem weighs more heavily than any specific question dealing, for instance, with the enhancement of a particular cognitive ability by one or another novel technology. But what makes it all the more intractable is that, whereas our capacity to act into the world is increasing without limit, with the consequence that we now find ourselves faced with new and unprecedented responsibilities, the ethical resources at our disposal are diminishing at the same pace. Why should this be? Because the same technological ambition that gives mankind such power to act upon the world also reduces mankind to the status of an object that can be fashioned and shaped at will; the conception of the mind as a machine — the very conception that allows us to imagine the possibility of (re)fabricating ourselves — prevents us from fulfilling these new responsibilities. Hence my profound pessimism.

6 Alcmena's Paradox

To pay Heinz von Foerster a final homage, I would like to conclude by recounting a very lovely and moving story he told me, one that has a direct bearing on the arguments developed here.

The story takes place in Vienna toward the end of 1945, and it concerns another Viennese Jew, the psychiatrist Viktor Frankl, whose celebrated book *Man's Search for Meaning* was to be published the following year. Frankl had just returned to Vienna, having miraculously survived the Auschwitz-Birkenau camp; in the meantime he had learned that his wife, his parents, his brother, and other members of his family had all been exterminated. He decided to resume his practice. Here, then, is the story as my friend Heinz told it:

> Concentration camps were the setting for many horrific stories. Imagine then the incredulous delight of a couple who returned to Vienna from two different camps to find each other alive. They were together for about six months, and then the wife died of an illness she had contracted in the camp. At this her husband lost heart completely, and fell into the deepest despair, from which none of his friends could rouse him, not even

with the appeal "Imagine if she had died earlier and you had not been reunited!" Finally he was convinced to seek the help of Viktor Frankl, known for his ability to help the victims of the catastrophe.

They met several times, conversed for many hours, and eventually one day Frankl said: "Let us assume God granted me the power to create a woman just like your wife: she would remember all your conversations, she would remember the jokes, she would remember every detail: you could not distinguish this woman from the wife you lost. Would you like me to do it?" The man kept silent for a while, then stood up and said, "No thank you, doctor!" They shook hands; the man left and started a new life.

When I asked him about this astonishing and simple change, Frankl explained, "You see, Heinz, we see ourselves through the eyes of the other. When she died, he became blind. But when he saw that he was blind, he could see!"[28]

This, at least, is the lesson that von Foerster drew from this story — in typical cybernetic fashion. But I think that another lesson can be drawn from it, one that extends the first. What was it that this man suddenly saw, which he did not see before? The thought experiment that Frankl invited his patient to perform echoes one of the most famous Greek myths, that of Amphitryon. In order to seduce Amphitryon's wife, Alcmena, and to pass a night of love with her, Zeus assumes the form of Amphitryon.

All through the night, Alcmena loves a man whose qualities are in every particular identical to those of her husband. The self-same description would apply equally to both. All the reasons that Alcmena has for loving Amphitryon are equally reasons for loving Zeus, who has the appearance of Amphitryon, for Zeus and Amphitryon can only be distinguished numerically: they are two rather than one. Yet it is Amphitryon whom Alcmena loves and not the god who has taken on his form. If one wishes to account for the emotion of love by appeal to arguments meant to justify it or to the qualities that lovers attribute to the objects of their love, what rational explanation can be given for that "something" which Amphitryon possesses, but that Zeus does not, and which explains why Alcmena loves only Amphitryon, and not Zeus?[29]

When we love somebody, we do not love a list of characteristics, even one that is sufficiently exhaustive to distinguish the person in question from anyone else. The most perfect *simulation* still fails to capture something, and it is this something that is the essence of love — this poor word that says everything and explains nothing. I very much fear that the spontaneous ontology of those who wish to set themselves up as the makers or re-creators of the world know nothing of the beings who inhabit it, only lists of characteristics. If the nanobiotechnological dream were ever to come true, what still today we call love would become incomprehensible.

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[28] Translated from the German ("Wir sehen uns mit den Augen des anderen.... Als er aber erkannte, daß er blind war, da konnte er sehen!"). See Heinz von Foerster, "Mit den Augen des anderen," in *Wissen und Gewissen. Versuch einer Brücke*, S. J. Schmidt, ed., Frankfurt, 1993; 350-363.

[29] Monique Canto-Sperber, "Amour," in Monique Canto-Sperber, ed., *Dictionnaire d'éthique et de philosophie morale,* 4th edition (Paris: Presses Universitaires de France, 2004), 41.

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