

For Eco-Technology Thinking Beyond Techno-Solutionism and Technophobic Ecologism¹

Ludovic Duhem & Jean-Hugues Barthélémy

Résumé

L'article examine la notion d'écotechnologie comme une voie permettant de dépasser l'opposition stérile entre le technosolutionnisme naïf et l'écologisme technophobe, à partir d'un dialogue critique avec la philosophie de Gilbert Simondon. Les auteurs partent du constat que, dans le contexte de la crise écologique globale, la question des « technologies du futur » n'est pas seulement technique ou économique, mais avant tout une question de sens, liée à la possibilité même de croire en un avenir commun. L'écotechnologie est présentée comme un effort de réconciliation entre technologie et écologie, impliquant une redéfinition du progrès. Contre l'idée moderne du progrès comme accroissement illimité de la puissance, est proposé un « principe de moindre puissance », selon lequel la valeur d'avenir d'une technologie doit être évaluée en fonction de ses relations d'échelle, de ses effets entropiques globaux et de son intégration aux milieux naturels et sociaux. Le texte articule trois approches complémentaires de l'écotechnologie : comme étude régulatrice des échelles techniques, chez Vincent Bontems ; comme projet culturel de transformation des formes de vie, chez Ludovic Duhem ; et comme théorie philosophique systématique, intégrée à une « écologie humaine » incluant la question du Droit et des droits des nonhumains, chez Jean-Hugues Barthélémy. Cette perspective élargit l'héritage simondonien en insistant sur la nécessité d'un nouvel éclairage des Lumières, capable d'intégrer technique, culture et nature sans retomber dans le mythe du progrès linéaire. Enfin, l'article examine de manière critique des propositions historiques de technologies alternatives en montrant à la fois leur potentiel et leurs limites face aux exigences énergétiques, sociales et politiques contemporaines. La conclusion soutient que notre société n'est pas « excessivement technique », mais mal orientée tant du point de vue technique qu'écologique.

Mots-clés: Écotechnologie; Philosophie de la technique; Principe de moindre puissance; Crise écologique; Redéfinition du progrès

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Abstract

The article examines the notion of ecotechnology as a way of overcoming the sterile opposition between naïve technosolutionism and technophobic ecologism, through a critical dialogue with the philosophy of Gilbert Simondon. The authors start from the observation that, in the context of the global ecological crisis, the question of “technologies of the future” is not merely technical or economic, but above all a question of meaning, tied to the very possibility of believing in a shared future. Ecotechnology is presented as an effort to reconcile technology and ecology, implying a redefinition of progress. Against the modern idea of progress as an unlimited increase in power, a “principle of lesser power” is proposed, according to which the future value of a technology must be assessed in terms of its scalar relations, its global entropic effects, and its integration into natural and social environments. The text articulates three complementary approaches to ecotechnology: as a regulatory study of technical scales, in the work of Vincent Bontems; as a cultural project aimed at transforming ways of life, in the work of Ludovic Duhem; and as a systematic philosophical theory, integrated into an “human ecology” that includes the question of law and the rights of nonhumans, in the work of JeanHugues Barthélémy. This perspective extends the Simondonian legacy by emphasizing the need for a renewed Enlightenment capable of integrating technology, culture, and nature without falling back into the myth of linear progress. Finally, the article critically examines historical proposals for alternative technologies, highlighting both their potential and their limits in light of contemporary energy, social, and political demands. The conclusion argues that our society is not “excessively technical,” but rather poorly oriented both technically and ecologically.

Keywords: Ecotechnology; Philosophy of technology; Principle of minimal power; Ecological crisis; Redefinition of progress

Ludovic Duhem

The implicit meaning of the conference title

The title of this conference is surprising. The question it poses “Where have the technologies of the future gone?” seems to formulate a paradox. On one hand, it asserts that technologies of the future are, in a sense, untraceable: we no longer know where they are, we may no longer know how to conceive and implement them, or perhaps we can no longer even imagine them. On the other hand, such a question nevertheless suggests that we can already conduct an investigation to rediscover these “technologies of the future” and objectively question what happened to them (thus assuming that they once existed, if not as actual realities, at least as ideas, sketches, prototypes, and that we believed in their concrete and functional future).

But another paradox in such a question should be noted, one that is less explicit and deeper: technologies of the future are probably no longer those that make the future possible as a sense of what is to come and trust in what happens for the collective good, since, after the many catastrophes and disasters of the last two centuries, new technologies are suspected of embodying the threat of eliminating any future by destroying the fundamental conditions for the existence of the human species and the biosphere in general.

The question posed by the conference title is therefore less about knowing “where” the technologies of the future have gone, in the sense of a specific geographical location or historical moment, even though geographical and historical issues are important for such an investigation, nor simply about which technologies have a real chance of developing in the future according to the current state of science and technology, which technologies will be encouraged or hindered by the global capitalist network society, and which ones should be, according to various ethical, economic, or political positions. Rather, it is about what meaning to give to technologies of the future in a time of planetary ecological crisis. Thus, it is a matter of re-asking the question of the meaning of the future of technologies from the ecological perspective: not only questioning the criteria for evaluating the future value of technologies based on their simulatable, measurable, and controllable ecological impact, but also their capacity to carry a promise, a hope, a belief in the future that involves meaning, sensitivity, and direction irreducible to any calculation.

Re-asking the question of the meaning of the future of technologies, especially those that have a future because they are ecological, is therefore also and above all re-asking the question of the meaning to be given today to the promise, to the hope, to the belief that the future is possible, that the future is positive, that technologies can carry such meaning, such momentum, such values, without falling back into the “myth of progress” and without preparing a new “collapse of civilization into barbarism” through a misguided illusion of lucidity regarding the lessons to be learned from the past. This also requires questioning the conditions of compatibility between the sense of the future carried by technology and the sense of the future carried by ecology, which are most often presented as contradictory and irreconcilable.

According to a common schematic representation, the technological future would be essentially short-term, utilitarian, serving particular interests, while the ecological future would be long-term, anti-utilitarian, and serving the general interest beyond even human interests. The technological future would also be fundamentally optimistic, based on the idea that technology, through scientific knowledge and technical efficiency, can solve all human problems, including those posed by the functioning and use of technologies, made possible by a demand for rationality, freedom, and convergent means. The ecological future, on the other hand, would be fundamentally pessimistic, based above all on anticipating the long-term negative effects of any human technology, this anticipation itself relying on scientific knowl-

edge, historical records, and empirical observations of the consequences of industrial development since the 19th century. Moreover, ecologists would immediately denounce the illusion of radical technicians who believe that ecological problems could all be solved by technology without completely transforming our ways of living, thinking, and acting, and technicians would reciprocally denounce the illusion of radical ecologists who think they can live in a utopia of deprivation, discomfort, and vulnerability.

Overcoming these two opposing conceptions of the future, which clash especially in the false debate between technophobic ecologism and technological solutionism, is a major challenge for the eco-technology that Vincent, Jean-Hugues, and I advocate. This “eco-technology” certainly requires a profound cultural reform to emerge as a lasting and fruitful reconciliation of technology and ecology in practices uniting organic life, technical life, and symbolic life through long-term care (attention, prudence, temperance) for their uniqueness and interdependence. To be fulfilled, this requirement certainly calls for restoring the link to the Earth, to places, and to living beings through daily experience and in situ education, but it also requires “new Enlightenment” as Simondon asserted was necessary. However, such a theoretical gesture, which consists in returning to the Enlightenment and renewing them, is not self-evident, as it immediately questions what is considered today as a “bygone” era and an “outdated” way of thinking because of its anthropocentrism, scientism, technicism, and universalism, but above all because of its belief that the future can only be a linear, continuous, and necessarily positive progress if it is rationally defined and conducted. In other words, if new Enlightenment are essential for rethinking the meaning of the future after the modern disaster and in the time of the current planetary ecological crisis, they will undoubtedly have to integrate darkness and regression as much as the limits imposed by the awareness of human finitude: which is a true requirement for reflexivity and invention, decentering, and participation.

Jean-Hugues Barthélémy

In the argument for this conference, Vincent used the notion of eco-technology twice. He also made a reference to the question of progress. Now, the link between this notion and that question began to be explored last year in a book in which Vincent participated: the book *Écologie et technologie. Redéfinir le progrès après Simondon*, which Ludovic and I co-edited for Matériologiques. That is why my way of contributing to the conference will first consist in recalling this link in order to outline, from it, a theoretical framework for the question of new technologies as “technologies of the future.” Then, it will be necessary to more concretely discuss some technologies that could fit into this framework—and for that, I will hand the floor back to Ludovic.

Aspects of the Idea of Eco-Technology

The notion of eco-technology, then, arises quite naturally from the desire to reconcile technology with the ecological emergency, and that is why the book *Écologie et technologie* provided the opportunity for this notion of eco-technology to emerge—independently and without any prior coordination—among Ludovic, Vincent, and myself. Of course, the precise meanings we each gave to this notion may differ somewhat. What is important to emphasize, therefore, is the complementarity between the three conceptions of eco-technology that came to us respectively. Then I will also recall the link between, on the one hand, these three definitions of the notion thus unified, and, on the other hand, the question of progress.

For Vincent, first, eco-technology is defined as a study that updates Simondon's reflection because this study consists in "taking into account the implications of integrating technical reality within the natural environment and analyzing their joint evolutions." The starting point is the positive notion of scalability, which refers to "the capacity of a technology to adapt to changes in scale, whether in terms of operation or production." Vincent relates this to the more negative notion of exo-transcendence, defined by Bernard Stiegler as the emergence of a tendency toward increasing entropy within individuation processes due to the technical amplification of human activities. More precisely, Vincent seeks to develop the hypothesis that scalability, in its positivity, simultaneously constitutes an exo-transcendence in its negativity: "although the machine is organized matter and an organizer at its own scale, the combined effect of all machines' operations is undeniably the main cause of entropy at the scale of the global environment." The eco-technological study of the implications of integrating technical reality within the natural environment and their joint evolutions then leads him to formulate a "principle of least power": "a regulatory principle allowing us to estimate the future value of technologies based on the scale relations between their life cycles, their performance in their associated environment, and their overall entropic consequences." For Vincent, then, eco-technology is a study placed at the service of reducing the exo-transcendence that scalability always entails.

For Ludovic, eco-technology is defined as a problem of building a culture that is both "technological and ecological," because this culture, first, would have fully become aware that, as Simondon argued, technology "belongs as much to cultural reality as to an extension of natural reality." But Ludovic obviously does not stop at this idea, because:

first, this awareness, by culture, of its deep unity with nature as with technology must go further than Simondon himself regarding the link between the latter two: nature and technology, and by also relying for this purpose on an accentuation of the link between nature and culture, Simondon having for his part begun to unify the three by insisting more on the link between culture and technology than on the other two links. Ludovic particularly insists on the fact that within his thinking of the link

between nature and technology, Simondon thought of technical progress more as a process of “concretization” through integration of the techno-geographical environment as a condition for the functioning of the machine, or as a progressive “naturalization” of technical objects whose functioning relies on an increasing number of known and integrated natural laws, than as something that must have “an ecological meaning.”; - second, the awareness mentioned above, that is to say the awareness that technology belongs as much to cultural reality as to an extension of natural reality, will in fact be transformative for culture, since as Simondon already said our Western culture was until now in denial not only of the belonging of technology to the world of cultural meanings, but also of the continuity between nature and culture and of that between nature and technology – which precisely nourishes in an essential way the first continuity.

We can see that Ludovic conceives eco-technology more as a problematic and a cultural goal, whereas Vincent conceives it as a study and a means. But this study also defines for Vincent a “problematic,” and as a means it is indeed at the service of the same goal as in Ludovic: making possible what Ludovic calls “ways of living, thinking, and acting”—that is, a culture—that reconciles the idea of technical progress with the necessity of not destroying our natural environments and thus our own ecological conditions of existence. For Vincent, this redefinition of progress lies in the fact that the “future value” of technologies has as its regulatory principle a “principle of least power,” extending Simondon’s critique of “philosophies of human power through technologies.” The Simondonian nature of the approach is also revealed in the fact that its guiding thread is the passage where Simondon affirmed that «of all the transductive aspects of technology, the one that enables the change of scale, and consequently mobilization, timelessness, potentialization, is undoubtedly the most important. »¹ It should then be added that Vincent, starting from Simondon’s idea that “the machine” “is intended to maintain the homeostasis of the universe in an objective alliance with the living against entropy,” immediately notes a paradox between this idea and Simondon’s definition of technical progress, which indeed “does not integrate respect for ecosystems.” Vincent emphasizes the fact that in Simondon the process of concretization “constitutes an adaptation to nature as physical constraints and not as resources for living beings.” But he then adds, on the one hand, that Simondon’s reflection evolved somewhat after *MEOT*, and on the other hand, that “what explains the contradiction, in *MEOT*, between progress at the level of individuals (within technical lineages) [this refers to machines as ‘technical individuals’ in Simondon] and ecological considerations is above all the break in scale between the local associated milieu and the global environment.” If therefore Simondon’s philosophy “makes it possible to escape the tragic slope without, however, ignoring the danger toward which contemporary technological civilization

¹ Simondon, G., 2014, *Sur la technique (1953–1983)*, présentation de J.-Y. Château, Paris, Presses Universitaires de France. Op. cit. p. 136.

is moving ever faster,” it is because this philosophy “implies the analysis of scale relations” and thus of that exo-transcendence that scalability always is, Simondon having precisely systematized this analysis in the 1970s.

For Ludovic, the emphasis is on the capacity of Simondonian thought for the “subversion of oppositions,” on which I myself had insisted in my exegetical work on Simondon’s oeuvre. Ludovic focuses more particularly on the three oppositions nature/culture, culture/technology, and nature/technology, the critique of this last opposition being, like the critique of the nature/culture opposition, the occasion to go further than Simondon in order to truly make possible an eco-technological culture. This culture must consist in “giving another meaning to becoming, both as the significance of the relation of the human to the world and to itself, as a sensitivity shared symbolically across space and time, and as a direction collectively defined, developed, controlled, corrected.” Ludovic then makes the eco-technological problematics “that in which the main source of alienation is now negligence, as insensitivity to and ignorance of our relation of dependence and responsibility toward living beings, artificial beings, and their environments. Fighting against this negligence is a requirement of culture and reflexivity regarding the meaning of becoming, that is to say, a necessity to cultivate care for organic life, technical life, and symbolic life as an inseparable whole in its evolution. It is in this broadened and renewed sense that all the critiques formulated by Simondon to establish a new Enlightenment are useful.”

My own reflection on eco-technology does not seem to me to be in tension with the perspectives of Vincent and Ludovic. Like them, I proposed the notion of eco-technology driven by the need to reconcile technology with the ecological emergency, and by advocating for overcoming the opposition between naïve technological solutionism and technophobic environmentalism - which our book *Écologie et technologie* aimed to set against each other. Here again, it is our shared Simondonian heritage that inspires a double critique of what Simondon called “intemperate technicism” and its adversary, technophobia, and this in the name of what I have called, in my work on Simondon, a technophilia that is both learned and anti-technicist.

However, I would readily say that while in some respects Ludovic’s very definition of eco-technology was broader than Vincent’s, as it was directed toward the idea of an eco-technological culture, what is broader in my case is first the theoretical context, since this context is my human ecology as a philosophy that is immediately global by virtue of its very method. Without going here into these methodological foundations as they determine a layered philosophical architecture and as they were recalled in 2022 in Chapter 5 of my *Manifeste pour l’écologie humaine*, I would simply like to clarify the role of eco-technology within this philosophical structure defined by the new method that I began to establish in 2018 in the book entitled *La Société de l’invention. Pour une architectonique philosophique de l’âge écologique*. The actual definition, then, that I give of eco-technology makes it the theory of the

reconciliation between technical power, today devastating, and the protection of natural environments, now a priority. Like Vincent—and Ludovic—and in accordance with what Simondon undoubtedly said first, I conceive power as being neither the essence nor the ultimate *telos* of technology, true technical progress leading to informational ensembles whose higher vocations are, on the one hand, the scientific knowledge of nature, the very condition of its “mastery,” and on the other hand, the universal transmission of knowledge for the benefit of the “mastery of mastery,” that is, the mastery of the consequences of our power to act upon nature—this mastery of mastery which Hans Jonas was the first to say we lacked.

Now, there is here a specificity of the theoretical framework that is both very broad (or even “systematic” in the sense of global) and very systemic (in the sense of relational) brought by the philosophy I have called “human ecology.” This specificity is that eco-technology, as a theory of the reconciliation of technical power and ecological priority through the problem of “mastery of mastery,” can no longer be thought of independently of the question of the rights of non-humans, as these rights must today come to limit our freedom in the use of technical power. Political ecology is very concerned with the question “how can we avoid the ultimate catastrophe that is looming?” Now, to build a true “new Enlightenment” is to dare to pose the question of the refoundation of Law, and thus the question of “why?” in the sense of the norms and the goals that these norms define for human action. This is why the two major interlocutors of the system of human ecology and its internal political ecology are Bernard Stiegler and Corine Pelluchon. This is also why I write, for my part, “eco-techno-logy,” with two hyphens and not just one, the association of the two hyphens serving to give “eco” an etymological meaning that concerns not only political ecology but also political economy. And since the latter is not economic science but rather belongs to political philosophy, its fundamental problem is the foundations of Law as a normative framework for economic activity and the satisfaction of needs—which today more than ever must be distinguished from desires and their ecologically destructive spiral.

Relation of the Idea of Eco-Technology to the Question of Progress

To conclude this first part of our presentation, and thus the only but somewhat lengthy section that falls to me within our discussion, I had announced that after outlining the possible unity of our three definitions of eco-technology, I would come to the link between this unified definition and the question of progress. Now, we have already had along the way a first but very brief glimpse of this, when I said that for Ludovic, the purpose of eco-technology is to make possible what he calls “ways of living, thinking, and acting”—that is, a culture—that reconciles the idea of technical progress with the necessity of not destroying our natural environments and thus our own ecological conditions of existence. And I added that for Vincent, this redefi-

inition of progress lies in the fact that the “future value” of technologies has as its regulatory principle a “principle of least power,” extending Simondon’s critique of the “philosophies of human power through technologies.” In light, on the one hand, of our shared Simondonian heritage, and on the other hand, of the general theoretical framework of human ecology that I propose, it seems to me that three additional remarks are possible to prepare future developments on which we could work together as we have all three been doing for years:

First, our shared Simondonian heritage was expressed in the collective work *Ecology and Technology* through a conviction stated in its subtitle: the conviction that we must “redefine progress.” This means that the loss of credibility of the idea of progress that occurred since the Second World War opened a real highway for ideas that are in fact non-philosophical substitutes² for the very idea of progress that one wanted to discard: the ideas of “development” and “growth.” These ideas, non-philosophical but ideological in the pejorative sense of the term, ultimately led to that form of capitalist economy called consumerism, and to its political endorsement, which is the neoliberal ideology. These are substitutes for the old idea of progress insofar as our world, as it is dominated by economic motivations and desires for comfort and consumption, remains subject to a form of over-productive technical rationalization—perhaps less radically inhuman than the scarecrow that the famous “technical rationalization” implemented during the Second World War had become, but more ecologically devastating due to the globalization of over-productive consumerism. This is why we must redefine the idea of progress rather than hope to get rid of it. The substitutes that have occupied the empty space have moreover revealed over the past two decades their intimate and philosophically degrading link to the outdated idea of progress, since the technophile humanism of the Enlightenment has given way to a delirious and naïve technicist transhumanism that is the perfect techno-scientific ally of neoliberalism.

Next, it should be recalled that Simondon, in his learned and anti-technicist technophilia, had precisely prepared the ground for this redefinition of progress, he who at once attacked the “intemperate technicism” of certain cyberneticists of his time and sought to think the unity—still misunderstood—of technology with culture on the one hand, and with nature on the other. His “difficult humanism,” as I have called it in my works on him, was “difficult” both because it integrated technology into culture—against all technophobic humanism—and because it fought anthropocentrism and, more generally, any form of “anthropological divide,” or separation between humans and other species. He aimed in particular to reconcile technical progress both with the preservation of nature and with properly human progress. This is why *On the Mode of Existence of Technical Objects* distinguishes technical evolution from technical progress and rejects lines of technical evolution that are

² In the original french text : “(...) des idées qui sont en réalité des *ersatz*”. (T.N.)

overdetermined by socio-economic factors. The very subtle fundamental and founding paradox of his thought lies at this point: that technical normativity for social progress itself resides in what is least human in technology, that is, in functionings rather than in uses, and this progress of functionings leads to informational ensembles whose highest vocation does not correspond to the lines of technical evolution overdetermined by socio-economic factors arising from uses as defined by the “society of yield”—an expression by which he designated our over-productive and consumerist society, already emerging in his time.

Finally, redefining progress as being both technical and human obviously means raising the question of the “new Enlightenment” and of the refoundation of Law without which they cannot truly be a new Enlightenment. And at this point, it is therefore a matter of extending Simondon’s idea of technical normativity for social progress by showing that the age of informational ensembles is also that of scientific access to the subject-being of the non-human animal, as Simondon had already conceived it as a precursor strongly interested in ethology. This subject-being of the non-human animal is defined by a sensitivo-emotional affectivity, and the non-satisfaction of the needs of the non-human animal then generates suffering—physiological or even psychic. My own work for the refoundation of Law therefore consists in showing that Law, instead of being the system of compatibility of the “free wills” of “moral persons” alone, as it was for Kant and as it remains in our anthropocentric societies, must become the system of the greatest possible compatibility of the suffering needs of all beings, human and non-human, that have such needs. And it is within this future legal framework, to which Corine Pelluchon also aspires, that our uses of technical power will have to be conceived.

Ludovic Duhem

What technologies could fit into such a framework? Do future technologies exist today that we could consider as being fully eco-technological? It is obviously difficult to answer.

First, because future technologies do not necessarily follow from such a broad theoretical framework, unless it takes the form of a planning process that would set out its main guiding principles, define its development priorities, establish its goals, state its strategy, and determine its material, economic, and human resources. The idea of eco-technological planning should therefore be discussed, both in terms of its content and its modalities; but also regarding its necessity, since we all know the technical, economic, social, and political problems that planning has produced since the industrial revolution in Europe, the USA, and Russia.

It is difficult to answer next because the idea of eco-technology, even unified as Jean-Hugues has just mentioned, is still a concept under construction, which therefore requires further theoretical work to become fully understandable, publicly de-

batable, and above all connected to existing technologies or possible technologies for which we have sufficient indications to assess their relevance and potential.

It is difficult to answer finally because it would be necessary to develop a set of objective criteria to select technologies claiming to be technologies of the future. Eco-technology as formulated by Vincent through scalability and exo-transcendence provides at least a first fundamental criterion, that of “least power.” Other factual criteria could also be stated, such as: the amount of resources mobilized, the amount of energy required and its mode of production, land footprint, impact on biodiversity, quantity and quality of pollutant emissions, and more generally the integration into the functioning and evolution of technological lineages of negative effects on natural environments at different scales and throughout the entire life cycle of technologies—that is, their capacity to tend toward complete naturalization or even to contribute to the enrichment of the associated milieu. But it might be necessary to establish a new mechanological science to satisfactorily define all these criteria: an eco-technological mechanology that would be developed within the framework of a general ecological organology, at once multidimensional, relational, processual, and scalar.

In any case, for the moment, future technologies that meet the requirement of a coherent eco-technology lie between two extremes: on one side, integral geo-engineering, which is a totalitarian technicism on a planetary scale, and on the other, technological primitivism, which is a radically techno-critical environmentalism. The former claims to be able to control natural cycles such as the carbon cycle (machines to store CO₂), the water cycle (rain control, desalination, artificial snow), the reproductive cycle of plants and animals (genetic biotechnologies: GMOs, CRISPR-Cas2, etc.), the evolutionary cycle of living beings (paleogenomics, pre-Neolithic rewilding), and even the cycle of the universe (terraforming of terrestrial planets, control of stellar radiation). The latter claims to be able to eliminate all technological dependencies by returning to a pre-industrial state based on an artisanal and ascetic model, or even, in its most mystical form, by returning to a pre-technical or archaic state in the manner of a return to a magical-technical era of the Paleolithic, to the mythical golden age of abundance under the benevolent gaze of the gods, to the Edenic time before the fall, or even to a supposedly purely animal, wild state, uncorrupted by civilization.

Between these two extremes (of which not everything should necessarily be rejected in principle despite their sometimes utopian and fanciful aspects), there is nevertheless a wide spectrum of technologies that could meet the eco-technological requirement. As early as the 1970s, some ecological thinkers proposed future technologies, such as Schumacher with “intermediate technologies,” Illich with “convivial technologies,” Bookchin with “liberatory technologies,” or more recently Bihouix with “low technologies” (or Low Tech). Despite their differences (which should not be overlooked), these proposals had in common: the fundamental critique

of the capitalist industrial system and consumer society, the preservation of nature as an absolute priority without any sanctuarization, the integration of technology into culture and nature, the reappropriation of alienated knowledge, the privilege given to the local scale for production and distribution, the reduction of mobilized energy and generated waste, the limitation of human needs, the recognition of vernacular cultures, and the pursuit of individual autonomy and collective emancipation.

The future technologies corresponding to their proposals were mostly derived from the pre-industrial artisanal model and clever tinkering, renewable energy production technologies (especially wind and solar), and networked informational technologies for the dissemination of knowledge. All modes of industrial production based on large-scale machinery were prohibited, as well as fossil energies such as coal, oil, and nuclear power. In this respect, the idea that nuclear energy could be conceived as an “ecological” energy or “more acceptable” than others was in no way acceptable to these thinkers, nor to the majority of environmental activists. Few, if any, of them would have subscribed at that time to the idea defended by Simondon in his texts of the 1970s: namely, that in the future, nuclear fusion reactors would be operational and could be used to reintegrate and eliminate all previously produced nuclear waste. This eco-technophile optimism of Simondon is still not on the agenda 50 years later, despite the very recent progress of this technology (within the international ITER program); and it is by no means certain, moreover, that it would be technically possible, economically viable, ecologically sustainable, and socially acceptable to use it in parallel with electricity production to eliminate nuclear waste buried underground and sealed.

In the same way, wind, solar, hydraulic, and tidal power technologies, which Simondon studied with enthusiasm, have experienced for some a limited development, such as tidal energy, and for others significant growth, such as solar and wind power. However, these technologies still fail to reach sufficient load and efficiency levels to meet the electricity needs of a society based on continuous industrial production, permanent connectivity, automatic processing of massive data, electric-powered transportation, and widespread air conditioning. Furthermore, as we know, these technologies require, in order to exist and function, a technical environment, technical ensembles, technical networks—that is, a large quantity of machines, metals, and rare earths, and considerable energy, which at every stage of the process and at every level of the system recalls the dependence on what is not eco-technological, particularly the dependence on oil.

Eco-technological coherence is therefore a requirement that should go far beyond the development of this or that eco-technology materialized, for example, in a household appliance, an electric car, a wind turbine, or a solar network (smart grids). The integration of life cycle analysis of the product coupled with the ecological assessment certainly constitutes an interesting normative framework for defining a set of specifications to develop future technologies aiming at eco-technological co-

herence, but this rather demanding framework does not allow for a qualitative leap producing the necessary bifurcation to respond to the ecological emergency. The current enthusiasm around “Low Tech” is in this respect revealing both of a promise of a positive future, an aspiration to autonomy, and above all a capacity for designing and developing credible and sustainable alternatives to digital technologies and industrial machinery, whether for producing energy and food, or for housing, transportation, healthcare, clothing, adornment, and entertainment. But the advent of the “age of Low Tech,” to use Bihouix’s phrase, is also not for tomorrow, as much for technical reasons as for economic, social, and political ones. It is not possible to develop these reasons here, but such a generalization of Low Tech to society as a whole raises numerous problems, particularly for so-called “sensitive” and “strategic” sectors such as research in fundamental and applied science, military defense, human health, telecommunications, and space exploration; but also in its relation to the industrial scale, which seems unavoidable to meet the energy and food needs, housing, and equipment of a global population that is predominantly urban and metropolitan.

I will conclude by saying, following Simondon, that today’s society is not “too technical” but “poorly technical,” not only because it expresses resentment toward technology, and machines in particular, in the name of an easy humanism based on a misunderstanding of its meaning and its intrinsic relations with nature and humanity, but also because it fails to reform itself culturally to integrate technology and ecology by making them compatible at the level of values as well as norms. Today’s society is therefore both poorly technical and poorly ecological, because it still cannot materialize eco-technology according to a mix based on openness that is at once artisanal and industrial, low tech and high tech, in the right place and at the right scale, intense here and light there, dismantled elsewhere. But all this will only make sense for the future if the economy, finance, and law are redefined according to the principles of degrowth and long-term care for the Earth system where organic life, technical life, and symbolic life sustain each other. We are faced here with a political choice.

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