LOCAL ANTHROPOGENIES - PHYLOGENESIS

PRIORITY OF TECHNIQUE

(*Le nouvel âge 1962*)

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Originally, this study was entitled *Le Nouvel Age*, Technique, Science, Art, Ethics, 1962. The current title aims at better marking the omnipresent and preliminary role of Technique in the human phylogenesis. The English translation also bears a new title: *Priority of Technique (The New Age, 1962)*.

The technical object strongly fashions culture. Men, women, and children see it, touch it, and manipulate it. It penetrates the human body with its rhythms and configures it as much as it is configured by it. It unceasingly intervenes between man and nature, between man and man, and it would not be an easy task to demonstrate how so many sublime theories are only ever its reflection. It plays a role in every civilization, not just in a few, such as science. It concerns every class of a society, not only the elite, as art does. It is thereby logical that we should start with it.

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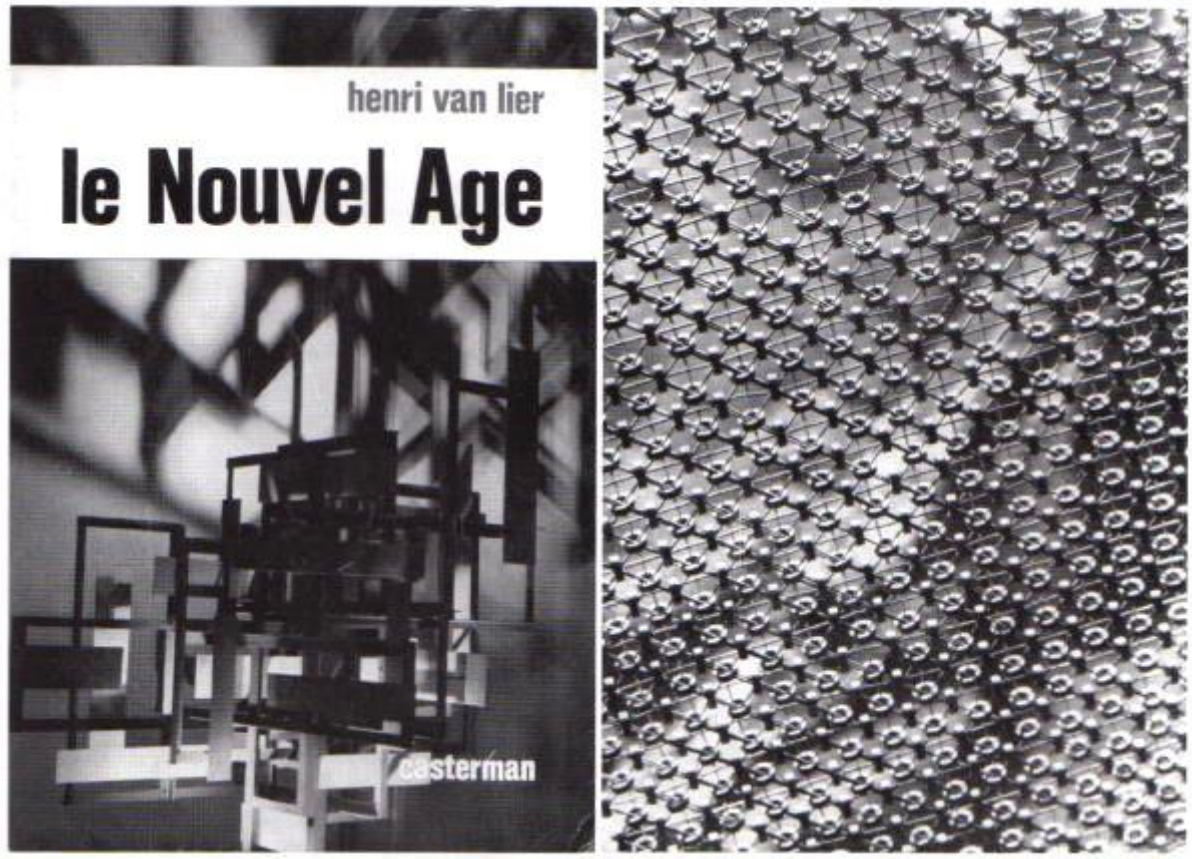

The main concern of this paper is to attempt an assessment of one of the most brilliant and comprehensive syntheses, that advanced by Henri Van Lier in his book entitled "The New Age", 1962. It is a significant essay presenting an intellectually inspiring and invigorating integration of technology, science, art and ethics, viewed in the perspective of an all-embracing, philosophical vision of culture. It is one of the most symptomatic expressions of the quest for ideological and philosophical orientation to be found in contemporary Western thought. Further, it is a synthesis of a special kind, for it is worked out as if the march is simultaneously "in progress" and at the crossroads. Janusz Kuczynski. C. 1990

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INTRODUCTION

A. Omnipresence of technique

Indeed, we cannot doubt that Homo – standing apart from all other beings through his angular and angularising articulations and by his flat hands in bilateral symmetry – should be a technician from instant to instant. In the phylogenesis, Homo erectus developed techniques one million years before he practiced somewhat detailed languages. In its ontogenesis, each hominoid specimen swims in a technician environment from its cradle or the arms of his genitors. Our languages only have significance insofar as they are the phonic or written thematisations of a preliminary technical milieu. Although they have forgotten it, 'classic' linguistics from Saussure to Chomsky very well described the formal properties of languages, but were unable to understand that it matters. For Homo, even 'Nature' is made technical. Paths cross his forests. He ritually hunts or rears his animals.

We have noted that angularising techniques prolong Homo's angular body hence increasing its powers, sometimes disproportionately. Yet, there is something more essential. Techniques introduce and support the own spaces and times of each people, hence its topology, cybernetic, logico-semiotic, its presentivity, what we call its culture or its civilization. The absence of the wheel comforted the constrictive and future-less cultures of Amerindians. At the oppostive, their constrictive and future-less grasping dictated that they should not invent the wheel.

The technique is so much the first and the last for Homo that he usually conceives the entire Universe as a technical object to which he elects a master Technician: the Gods, a unique demiurge, general fluxes, or still, a great Axiom. To such an extent that we may ask ourselves whether the origin of many of Homo's metaphysic problems does not lie in that he is incapable of conceiving anything but a technical object, whereas the Universe, which produced him as a technician, is not a *technical object*, but precisely a *natural object.* Creare, make grow, is the active tense of crescere, growing. Technician Homo was quicker to understand *creare* than *crescere*.

B. Absence of theories of the technique

Since technique is so important to Homo, we could have expected that it should trigger multiple and rich philosophies. Such is not the case. Not Plato, not Plotinus, not Saint Thomas Aquinas, not Descartes, not Kant, not Hegel, not even Marx elaborated philosophies of the technique. There is nothing in Confucius or Lao-tze in China, or in Çankara or Ramanuya in India. In the end, Aristotle is the only one who, because he enjoyed seeing things from the bottom up, stopped before 'technical objects' at the same time as he stopped before 'animal parts' (*De partibus animalium*). And the result was the famous theory of the four causes: to technically produce an object – for instance a Greek vase – we need an aim *(final cause)*, a matter *(material cause)*, a form *(formal cause)*, and a producing agent *(efficient cause)*. To these causes, the Medieval added the instrumental cause (a potters' wheel, a chisel, and a hammer). In their vision, we see that the final cause – which is the first and the last – is the 'most noble', the one that justifies all others. It is that cause that means that, for the Greek and the Romans, the Mediterranean Universe was a Cosmos-Mundis (non-vile), of which Homo is the Microcosm.

With the planetary success of western physics and techniques, the Aristotelian theory of the four causes became the model for all causalities, human or divine. Jehovah himself shares this model with the bartender, the surgeon, and the theologian. This Efficient Cause created Adam by sculpting, in the matter (alluvium), a form whose final cause was 'to his image and resemblance'.

C. First awakenings

In summary, we had to wait until the 1930's and Mumford's 'Technique and civilization' before it was stated that every civilization and culture were above and foremost a question of technique. Hence, the invention of the '*chase*' of the clockmaking wheels in the late Middle Ages inaugurated relatively exact and constant timetables that allowed the West to move from maritime coastal navigation to the crossing of oceans, then from the Workshop to the Manufacture, to the Arsenal, the Factory, the Industry, triggering simultaneously Convents and Nation States. Until the day Homo discovered a 'being-of-the-temporal world', Heidegger's 1927 *Dasein* of *Sein und Zeit*.

It was only in 1957 that Gilbert Simondon, a young French doctoral candidate, dared a decidedly philosophical title: *Du mode d'existence des objets techniques*. Yes, indeed, technical objects had a 'practical' but also an 'existential' scope. Until then, there had been 'Histories of the technique' and 'Museums of the technique', but they went no further than juxtaposing descriptions and dating machines and processes. Simondon's revolutionary work went largely unnoticed. Was it deemed too technical for philosophers, and too philosophical for technicians? Or was it simply too unsettling… Just think! Technical objects, the slaves of our daily lives, would concern, condition, and carry the secret perception that we have of our existences!

Whereas existentialism had only just suggested that *existing* (*sistere*, *ex*, being projected towards) is the ultimate framework of human destiny and freedom.

Yet, in 1959, the author of the present *Anthropogénie* found the *Du Mode d'existence des objets techniques*. He had only just published *Les Arts de l'Espace*, where painting, sculpture, architecture, and the fine arts were understood as being the produce of particular technical gestures; gestures capable of constructing and maintaining the space-times of groups or individuals like ordinary technical gestures, but also to thematize these space-times, and even to grant them a statute of absolute (solvere, ab, untying from any local and transitory operativity) by boosting or neutralizing them. Since the work focused on the arts of space, the thematized and absolutised space-times were called 'pictorial subject', 'sculptural subject', or still, 'architectural subject', so many 'work subjects' that had a sense per se, independently from the descriptive or narrative themes that they conveyed. Among the work subjects, da Vinci's *Mona Lisa*, Michelangelo's *David*, Borromini's *Chiesa* were a 'Vinci', a 'Michelangelo', a 'Borromini' before being a Mona Lisa, a David or a Roman Chiesa. In Africa, the statue of a king, an antelope or a monkey were, through the work subject, 'Kuba', or 'Luba', and 'Bambara' or 'Dogon' before being a king, an antelope or a monkey… even though they were that too, politically and ritually.

During the sixties, Homo was decidedly moving from what the *Anthropogénie* calls WORLD 2 – the world of the 'distant continuous' of Greece and the West – to WORLD 3, the world of contemporary 'discontinuous'. This violent turn was obviously caused by new Sciences, new Arts, and new Ethics, but also and more initially by the mutation of the Technique. Indeed, the latter was moving from 'energy machines' that had ruled since the origins of Homo to 'information machines' whose theory had begun being explained with the Theory of information and the 1948 Cybernetic. This abrupt turn was dramatized by two world wars, inchoatively (inchoativement) in 1914-18 and decisively in 1940-45.

Thereby, *Le Nouvel Age* is the sum of the *Les Arts de l'espace* and *Du mode d'existence des objets techniques*. The three chapters of the present work on science, art, and ethics were preceded by a chapter on technique that was as considerable as the three former put together. In October 1963, Gilbert Simondon, who was putting the finishing touches to *L'individu et sa genèse physico-biologique*, published in 1964, wrote the following lines to the author (who chose the italics), which are enlightening as to the three works: 'I admire the strength of the ideas, the richness of the documentation, and this unity, this *power of integration* that makes your book the testimony of a way of thinking that has its *own logic*, its *own axiomatic* capable of accounting for the *modes of realities that are just appearing* through the *process of technical inventions*. Furthermore, this work possesses a true *aesthetic strength* that is capable of creating a link, of instituting a communication under a sort of *activity of the imaginative oversimplicity'*. In this context, the term 'aesthetic' assuredly meant a grasping of things that, in the space-times of human productions – hence in their topology, cybernetic, logico-semiotic and presentivity – perceives their existential implications and instaurations, whether relating to daily objects, scientific theories, works of art, political or religious protocols, traditions, etc.

Perhaps because of this 'generalised aesthetic' (the work of another author bore the same title at the time) 1962's *Nouvel Age* had much more scope than the two works – albeit remarkable – of Gilbert Simondon. Poland's Academy of sciences, which was then trying to open soviet Marxism to modernity (and in particular to phenomenology) hurriedly translated it into polish, *Nowy Wiek*, adding a preface that had socio-political undertones, which the original

did not have. In Canada, in 1962, the same year as the *Nouvel Age*, Mc Luhan strongly brought focus on the Technique through his genius shortcut: 'The medium is the message'. In the latter, he thrusts forward, in just five words, that the technical structures of a media (radio, television, etc) were in itself a message (existential) more fundamental than the particular messages that it conveyed. Hence, he felt that he could make a distinction between 'hot' media (radio) from 'cold' media (television). Prime Minister Trudeau heard of the *Nouvel Age* from Jean Lemoyne, his adviser. He decided to give the author all the necessary means, including television teams, to organize an international seminar on the theme 'Technique and its cultural implications'.

What interests us here is not that the author jumped at the opportunity. Perhaps his penchant for a 'generalized aesthetic' already led him towards 1965's *L'Intention sexuelle'*, and to his 1970 reflections on *Industrial design*. What is remarkable is that no one cared to take over a project for an international seminar on Technique, which was ready. When in 1990, the Société internationale de Métaphysique – regrouping forty or so countries – dedicated, in its first volume *Person and Nature*, a long chapter to Technique under the signature of Janusz Kuczynski, it almost exclusively used the *Nouvel Age* as reference.

D. A few reasons behind this negligence

What is behind this repression and even this foreclusion of technique in human ontologies and epistemologies? The theme alone would deserve multiple doctorates. We shall make do with a few ideas.

(a) When Homo, this living bio-techno-semiotic, creates the first systems of his Cosmos-World, he goes immediately to the signs, even to the most elevated signs: **stars**. He does this using a mixture of astrology and astronomy that we encounter in Egypt and in Sumer, but also on the other side of the world, with the Australian aboriginals. Then, he becomes more rational during the 'axial period' (Jaspers), in the era around – 500, when he turns to **more or less mathematical abstractions**, such as Pythagorean figures, Platonist figures, organic topologies of Aristotle's eternal species, mutual conversions (Yi) of the Yin and the Yang, Quick (thick universal blood) of the Amerindian, Good and Evil of Manichaeism. As if the **sublime** alone was capable of justifying Homo. As though remarking on some of the techniques, too contingent or too heavily material (*guè-ôdès*, said Plato), would have compromised its justification as a culminating species.

(b) Homo has always attributed properties of revelation, lucidity, and almost divine demonstration to his languages. However, we humiliate this illusion if we recognize that language relations ('in languages there are only differences' Saussure) are only the specifications and thematisations of the technical relations that they are satisfied with suspending (putting in between parentheses) the operating dimension.

(c) Technique is not only a **means,** it is also a **milieu**. A milieu is largely independent from what it encompasses; there are unforeseeable developments, it dominates more than it serves. Recognizing the status of Technique's 'milieu' in human reality means recognizing its modesty. We could think that, in order for this humility to be bearable, we had to wait for the sixties when Homo started realizing that the Evolution is in no way orthogenetic, but luxurious.

That it is not a constant growth towards him, as Spencer and Bergson thought around 1900 and Teilhardt de Chardin in 1950; and that – to use the words of Stephen Jay Gould – he was only a 'punctuated balance' amongst others.

(e) We shall not forget simply **epistemological** reasons. Indeed, what Homo calls his ideas, his concepts and his axioms chiefly depend on the *cortical areas* of his brain, characterised by their speed and determination. Hence, nothing is easier to do than speculate and build abstract systems. At the opposite, objects and technical processes largely depend from the *deep brain*, for instance the basic glands and the cerebral trunk, which have extremely performing autonomous memory as they allow a hairdresser or an airline pilot to remember the thousands of nuances in the handling of a pair of scissors or a joystick. Yet, these solid teachings are very slow to acquire and modify. Hence, abstract ideas are passed down from the master to his disciple, sometimes in a mere moment, where many years are necessary for a technical aptitude to be passed down from a master to his apprentice.

(f) Still **epistemologically**, the order of exhibition and the order of invention are not the same in technique and philosophy. Descartes is so convinced of playing with 'clear and distinct' ideas and Spinoza with 'adequate ideas', that they both believe they can describe an order of exhibition equivalent to their order of invention. And they write 'discourses on the method', 'rules for the direction of the mind', the 'ethic demonstrated in a geometric manner'. Their rational pretension can be found in some English empiricism. Yet, such an illusion is not possible for a technician. Simondon insists that, in Watt's invention of the steam machine, the crossroads between theory and empery are so numerous, so inextricable, particularly between preliminary analogical invention and posterior digital rectification, that a discourse of the technical method is not probable. The Eiffel Tower is a popular example of the part played by day-to-day working operations in the construction-invention of technical objects.

(g) Finally, Homo's trust and defiance towards the Technique has an **ontological** source. We must recall that the primordial articulation in the Universe is the distinction: *functioning / presence (s). (Anth. Gén*. Chapter 8), and that everywhere we find in Homo his favour for experiments of presence that put the functioning in between parenthesis: music, spatial arts, religious rites, orgasm, all the banal forms of daily drunkenness, nirvana, dikr, voodoo… (Maslow noted all these *peak experiences* among students from one same University that had all been deemed 'normal' by their peers). They are all different forms of functioning being put in between parenthesis, sometimes by neutralizing, other times by boosting their perceptive-motor and logico-semiotic field effects in the comptabilisation of uncoordinables that is **rhythm** with its eight resources (*ibidem*).

However, technique stands on the side of functioning, and the word 'rhythm' only designates the regularity of cadences. Hence, Homo admires technique, he develops it, and in turn, each morning it gives him his immediate goals. But it is always a bit as though it was a preliminary or a fundament in view of something else that would solely be truly essential, the 'final cause', when for example working *for* leisure. Buddha leaves the 'technical' management of a kingdom to seek the silence of the without breadth (nir-vana) where functioning are abolished. A Japanese general director suddenly leaves the huge factory that he has spent his entire life building to go and watch cherry trees in blossom. It is as though technique, as respectable as it may be, was never the last word, but always ended up as a means, a game of *ends and means*. This happens even when it questions the infinite spaces around the big bang

to attempt touching, sensing the Last Word, the Ultimate Question, which are supposed to be of another nature.

Thereby philosophers – who are convinced in advance that technique is not final – would have ended up forgetting just how foremost it is, how constantly primary. The Anthropogénie is not a philosophy. It deals with origins, genesis, 'genius', and takes into consideration the ultimate goals, but starting with their preliminaries. Especially when these preliminaries, such as Technique, can be more or less neutralized, boosted by 'presentive' behaviours favouring pure presence, but that are never outdated or forgotten.

(h) We still need to specify that the Technique has not always had the same importance in **Homo's phylogenesis**. Despite its powerful ascent from the Palaeolithic to the Neolithic, the primary empires, and the Greek and Roman rational crafts, it did not shake up Nature much; and this, since the day circa 1000, when Western Homo did not see Christ return and decided not only to obey Nature, but also to exploit it by becoming an engineer, a co-creator alongside the Creator Engineer. *Energy machines* created local perturbations while the incommensurably more powerful forces of nature soon re-established the compromised ecological balance. Economic and political systems held on to the illusion that they governed the world. In 1948 still, in the Human Rights Declaration, States proclaimed that they were 'sovereign'.

This changed with the reign of *information machines* that begun soon after the Second World War. The expertise of energy machines was slow to pass down, but the know-how of information machines is rapidly decipherable and understandable. In the same time, it is globally transmitted through the development of the communications it generates. In fifty years, the couple energy-information modified the ecological balance of the entire Planet, meaning its climates and living species. Today, technician Homo has many of the properties of the omnipresent Engineer that he used to think as being the Demiurge of his Universe. In 2007, he hopes that, in 2008, he will be able to recreate several conditions of the big bang at the CERN. These urgencies further take him away from any philosophy of the Technique, or the opportunity to daydream in increasingly rarer moments of pure respite.

Chapter 1 - THE THREE FACES OF THE MACHINE

By approaching the history of the technique, the sociologist has the satisfaction of finding the same steps, whatever the envisaged viewpoint may be. Whether he is interested in the machine for its great types of functioning, its political or artistic incidence, or for the optimism or pessimism it triggered, the sociologist must always consider these three eras: what comes before the industrial revolution, the industrial revolution itself, and finally, our era. We will obviously discuss precise dates and we will ask what facts rather than others decided of the beginning and of the scope of the great eras. However, the global articulations remain. Mumford gave us a classic expression by making the distinction between an *ecotechnical* era right until the mid 18th century, a *paleotechnical* era covering the 19th and early 20th centuries, and a *neotechnical* era, which we inaugurate. [1].

We shall not escape a similar division. Perhaps the most substantial progress of this reflection is to stop talking of *the* machine in general and to distinguish three stages, three violently contrasted faces, which triggered very different cultural reactions. We cannot go straight to the last, ours, because its predecessors still inspire our optimist or pessimistic philosophies as they do our daily options, which may be irritated or fascinated by it. Furthermore, the most advanced stages of a technique still include the first as elements: the rooftop is still held in place by the floors.

Hence, we must turn to the past in the aim of genetically grasping the articulations, the stratifications of today's machines, and our emotional reactions to them. In pretentious terms, our research aims to be not historical but phenomenological and structural, as befits a coming of a reflected culture.

1A. THE STATIC MACHINE

Paleontology dates the arrival of man and his tools. Needles and combs made from bones, hatchets and arrows made of flint prove more, in man's eyes, than the shape and volume of a skull. Indeed, the means of transformation – whose internal and external relations show very well that their functions were grasped as such, as a 'secondary' universe; the technique – is capable in turn of being transformed and developed. Koehler's monkey, when deciding to grasp a stick to reach a banana, invents a transitory tool, which in this case is not one. The true tool stabilizes itself, detaches itself, and refers to other complementary artifices and to its own development. It supposes a power of symbolization, of objectivation, of distance that is typical to man. The way in which its idea implies the notion of system invites to put its development in relation with that of the system per se: language [2].

What were the first machine-related principles put to use? From the Palaeolithic, rupestre representations of traps demonstrate how the animal, when touching the bottom, would cause the fall of bevelled tree trunks. The principle of the lever was working. Yet, the true beginning of the machine starts with the wheel during the Neolithic era. In the interlocking of the disk and the axis, the wheel brought a richer application of the conjugated functions and supplied the first Antiquity for its peak. Lever and wheel, with their derivatives, the pulley, the hoist, the gear and the turning machine, – all engines for the reduction of forces – would suffice to carry, in war time and in peace, the agrarian cultivations of the Nile, the Euphrates, the Ganges and the Yellow River.

The classic Antiquity and the first middle Ages did not require much more. For social and religious reasons [3], the Ancients were not so much engineers as they were astronomers and physicists, and the mechanical poverty of their hourglasses and their clepsydras contrasts with the mathematical refinement of their sundials. Even their vocabulary is disappointing: the Greek *Mèchanè* and Latin *Machina* refer to the aspect of cleverness, surprise, and abrupt efficiency of the engines rather than to their mechanical characteristics of independence and automacity [4]. If Ctesibius invents a force pump and if Hero of Alexandria uses the pressure of heated air and water, it is essentially to combine automatons for playful or cultural means. There is only one area where antique technicians considered their talent with some seriousness: war machinery and in particular torsion catapults where they transformed the teachings of Philo of Byzantium, of Vitruvius and of Hero of Alexandria into empiric recipes. For the rest, the Romans used Archimedes' bucket drains for the evacuation of water in their mines. They developed the norias and, on the eve of Christianity, watermills. Yet, these remarkable inventions do not bring about the technical revolution that they could have. Even in the area of architecture where they had the merit of perfecting the grouting process, we see that the citizens of the empire continue using the costly solution of inclined plane aqueducts, whereas in Pergamon, the principles of communicating vessels were in place as soon as the second century of our era. It is true that technical knowledge is not solely cumulative; it supposes a mind that decides to exploit it or to let it go to waste. Schuhl speaks of the 'premecanician mentality', or the 'antimecanician mentality' of the Antiquity [5].

Around the fatidic year 1000, Western civilisation will deeply change this attitude. If, until then, the technique aimed at ends without much considering the means, it is because it had its slaves, a weak motor force that was expensive to feed, albeit mobile. The fall of the Empire and the progressive reflection on the implications of Christianity will soon put an end to this resource. Henceforth, the first aim of the technique will be – even before the pursuit of the result – to lighten the burden of man and the effect was that it greatly favoured the results and the West then launches into a prodigious research and exploitation of exterior forces. The strength of the animal in the hardware and the harness; physical forces in the endless development of hydraulic wheels, the windmills of Islam, the sails of ships. The forces of regulation in the fixed steer and the pedal loom, chemical forces in gunpowder and particularly in the distillation of sulphuric and nitric acids, the aggregates of metalwork, all this leading to the use of light, iodine supports: colourless glass, the milieu of chemical reactions, and paper, soon conjoined to mobile characters and the printers' press [6].

Yet, these conquests, which take place between the 10^{th} and the 13^{th} centuries, almost fade before another contemporary conquest [7], the mechanical clock. The event is one of history's most considerable, where Spengler sees the symbol of a new culture, as the regular chiming and the hand on the dial demonstrate an obsession for the exact and efficient length

that was unknown to the Chinese, the Indians and the Greek and that penetrates all our creations. Munford dates the 'geotechnical' era from this invention and underlines the fact that the clock, engendered by the monasteries' need for regularity, were about to provide the western man with this abstract, rigid framework that was independent from the seasons and that would lead him to conceive the past as such (let us recall the historical resurrections of the Renaissance, Classicism and Romanticism), to place himself rigorously into space (let us look at the compass, the sailing compass, cartography, territorial explorations) and to be interested in pure greatnesses and powers (the elements of capitalism), and finally, to engender these concentrates of precision, regularity, synchronisation, and acceleration: our machines.

From a machine-related viewpoint, escapement is not a simple progress, but it is a mutation. Nothing in the triggering of the bow or the catapult or in the rhythmic swaying of the noria can forecast the idea of this oscillation, which alternatively holds and frees the movement [8]. Henceforth, the new mechanic mind is born. From now on, it will be possible to envisage the indefinite repetition of an identical action using a winding system. It will be possible to combine a succession of different actions in advance: in its germ, the clock contains not only the perpetual Strasbourg calendar, but all the automatons that will characterise the Swiss clock making of the 17th and 18th centuries. And if all this gratuitous virtuosity was looked down upon, let us recall that the process, in the form of the jumper, feeds Pascal's arithmetic machine and that the cam, which belongs to the same mind, is at the source of all our modelling engines.

Such was in substance the technique from its origins to the 1750's. Indeed, the great scientific discoveries of the Renaissance and the Baroque only produced some industrial applications much later. We can see its culmination in 18th century navigation. Seeing the position of their colonies, the Portuguese and the Spanish would sail along the coasts to reach the latitude of the targeted country, and would then follow the parallel calculated by the angular height of the Polar star using a process that was already known by the Greek. Because of their rivalry, and because their colonies were in high latitudes where the parallel makes a noticeable detour, the French and the English launched into a severe competition to achieve a navigation in straight line that demanded the delicate calculation of longitudes. They needed either chronometers or optical instruments whose refinement used turning and dividing machines, the ancestors of every tooling. Armed with these precious clocking precisions, redoubtable artillery and prodigious sailing force, a vessel of the admiralty of Louis XVI summarises the ancient technique [9].

Had the machine remained at that mechanical stage where it only transmitted movements either directly or indirectly [10], it would not have caused a problem, and we do not see how the philosophers of the time would have felt it to be much of a concern. They had only conceived it as it was, as every other tool or utensil, an artificial object that was by essence the opposite of living or mineral beings, an object that had a somewhat particular causality, one that Aristotle called instrumental. They did not give it much consideration, as they did not much consider anything that was related to practical realisation or manual work, which were not worth a free man. It was nothing for them to be concerned with [11]. What was a pulley, a hoist, a catapult, a ram, or even a clock or a pump, if not the prolonged gesture of a limb similar to our limbs, similar to an arm that coils, empties, balances, turns, to the hand that buckles, grasps, lets go in rhythm? And it is indeed the image of the accrued body that is most often alleged by theoreticians. In fact, the almost exclusively used material was wood. It is the most docile and the closest material to the human body (whilst steel with the violence of the miner and the blacksmith) [12] was still the exception. As for the windmills and sailing boats, if they did

anything else than prolong a gesture, they also captured the most familiar elements very visibly. Orators, poets, decorators and liturgists had there, during thousands of years, an endless arsenal of images that were reassuring and understood by all. The natural character is so particular to these forms of energy that it explains both its quality and its flaw: a very high turnover contrasting with the wastefulness of steam engines and the irregularities linked to the whims of the seasons.

The teaching mode reinforced cosmic sympathy: the latter, which was intuitive, consisted in the acquisition of dexterity. Things were supposed to conceal mysterious powers that the artisan would free in an intimate contact that resembled a taming. The modeller tested the clay with the palm of his hand and the peasant knew the earth and the rain in a touch that spread to his entire body.

The interposition of the tool and the machine did not change much. These instruments of contacts participated to the proximity of the worker's gesture. Hence the initiatory character of the teaching both with the primitives and in our corporations, which conclude the testimony of the ancient machine by binding man to society and nature. Dexterity supposed the direct and daily commerce of the master, from whom the 'mastery' was passed down in a kind of filiation. Similar work relations engendered generally stable and warm social structures despite inequalities. We only note one revolution since the Antiquity, which was quite content to submit to the order of the world until the Renaissance, impatient to exploit it. For Francis Bacon, the technique was 'mankind added to nature', and does not include the merest idea of violence, at the opposite of Descartes' perception. In their opinion, we act upon it – more in desire than in actions – by acting like it, according to a formula used by Marsile Ficin.

This image will seem idyllic for the end of that period. New industries – mining, glass, and printing – owe much to capitalism, which was quick to subtract them from the social rules of the corporation. On the other hand, it is in musketry that appeared, for the very first time, the advantages of mass production that engendered collusion between technique and militarism that meant that campaigning armies and an industry ready for wartime became the ideal of many technicians. Finally, the beneficial growth of the demand depended of (through the bourgeois luxury) the great courtesans [13]. Yet, these doubtful alliances concern more the atmosphere favourable to the eotechnical object than itself and do not compromise the reassuring picture that we have painted. Capitalism, militarism and luxury of the court all introduced flaw while they maintained a considerable cultural meaning, as the urbanistic realisations of the 17th century testify.

When the great encyclopaedia is published around 1700, it is both the conclusion and the apotheosis of this era [14]. We shall not waste a minute in saying that it already announced – in more than one aspect – the new age. It inaugurated the scientific comprehension of the machine by enlightening the laws of mechanic set up by Galilee, Descartes, Leibniz, Newton, and therefore went beyond the fortuitous and non-communicable skills of earlier technicians. But it is one of these exceptional moments when humanity slides from one phase to another by conjugating benefits and by neutralising the drawbacks one by one. The machine is scientific. Yet, it remains intuitive. It does not abolish dexterity. Rather, it explains it and makes it transparent, joining body and reason. This wonderful, precarious balance culminates in the fifteen volumes of plates that all speak to the mind, the eye, and to the gesture while conjoining the virtues of the number, which will be the world to come – unbeknownst to Da Vinci – with the simultaneous grasping of the outlook that Da Vinci – the perfect Renascent – had exhaled

as the supreme fruition. All this remains at the level of man, right to the appearance: the machine looks like a piece of furniture in the house, unless that, windmill for the miller, it is the house itself… Furthermore, in its illustrative aspect, what is the Encyclopaedia if not the ideal workshop where all the machines would have gathered in a closed order, at hand's reach, in the semi-mental form of printing?

However, we must repeat that it is a transition. By penetrating the science machine, it exposed it to become the instrument of an abstract production that would escape man's measure. Simultaneously, it took away the initiatory character from the teaching and put it at the reach of anyone capable of providing an effort. It shook up every corporative privilege and the entire ancient regime. Therefore, the Encyclopaedia is a direct prelude to the Industrial Revolution and to the French Revolution. It concludes the first age of the machine as it opens the second.

1B. THE DYNAMIC MACHINE

No one agrees as to the beginnings of the Industrial Revolution. At one time, it was fashionable to see it as one of the consequences of the Napoleonic wars that stimulated discovery and – through the national armies and their complex logics – placed Western Europe in a state of industrialisation. Uneasy with this unflattering thesis for humanity, pacifist historians such as John U. Nef underlined to the contrary that the dices had been thrown as soon as 1785 and that it was more appropriate to invoke the exceptional era of peace of the 18th century, first attempt of a united Europe [15]. Indeed, the Industrial Revolution has distant ancestors in both war and peace. Its most characteristic engines – the steam machine, the coal high furnace, the automatic loom – are the result of hundreds of individual inventions whose path can be traced back to the 17th century, the Renaissance, and even before. And we know that capitalism –the luxuries of the court and the militarist regime –, which would favour the industrial mentality, had former credentials. For we must understand that this Revolution was as much a general climate as a machine-related effervescence. If the need for a good turnover steam machine is increasingly pressing in 18th century England, it is because important commercial problems increasingly faced the spinners who were overwhelmed by the demand of the weavers, or affected the weavers that could not follow the orders of the spinners. This alternative was exasperated by a strange law that suppressed – for some time – all the taxes on Indian cottons and silks in an aim to deliberately whip up English textile. Therefore, the Industrial Revolution appears like a confluent where the technique (steel puddling in 1783), the economy (suppression of the last privileges of the corporations and extension of the markets under the influence of Smith's liberalism), external (the Indian colonies) and internal policies (exodus of English peasants towards the cities under the pressure of gentlemen-farmers), all of which were animated by what we really ought to call the new mentality [16], où and in which Calvinist fervour played a great part [17].

Regardless of its era and causes, the machine shows a new face circa 1800. It ceases to be an innocent means to somewhat lighten human tasks and ensure – against all odds – a day-to-day subsistence, and it starts appearing like an indefinite power instrument aimed at satisfying equally indefinite needs. We can pinpoint this mutation with the passage from the Newcomen machine to Watt's machine. With the Newcomen, the effect of steam was to push

back the piston, then pushed by the atmospheric pressure. The work depended of a – naturally limited – natural force, the weight of air. We were still in the world of wind and water mills. Watt turns the problem around. Henceforth, the steam will push, assuming engine time, and, as its power can indefinitely be increased, it is also indefinitely multipliable [18]. Consequently, the commands are passed from nature to man. Energetism – which will soon be developed by thermodynamic and electro dynamism – is born. It will find a powerful ally in an old principle that takes a new departure at its contact: organisation. And the machine that – since its origins – had not alerted men of culture, started to inspire a moral, almost a religion: the religion of efficiency, quality, result, and progress, through the brutal force of the steam machine, and through the organised force of the loom or the telephone. Having conjugated these two grandeurs, the railway became the masterpiece of the era.

There were the optimists who promised a universal statute to steam, and soon to electricity and petrol. Marx could well see that these new engines alienated the proletariat, that they favoured the 'degrading division of work'. However, in his eyes, it was a transitory inconvenient that was essentially linked to the power of capitalism. To see better days, it would be enough to knock capitalism over and to give the worker possession of his work tools. Someone like Berthelot was more confident still when he considered that the new instruments applicable to the chemical synthesis that he promoted would not only fill the material needs of the human being but would inevitably engender (through overabundance) a political regime that would ensure happiness and virtue. He was constructing the economy of a revolution where Marx saw a stepping-stone that was everywhere necessary.

Yet, the vast majority of men of culture were sombre as they felt that the disadvantages of what they were beginning to call the modern world were tied to its very being. There was the long complaint of the poets, from Vigny to Rilke, going through the furore of Nietzsche. Flaubert attempted to grasp the century and proved that it was possible to raise to the style the ancient Carthage or Alexandria, or even the more traditional province of Madame Bovary, but not what there was – both in intuitions and things – that was purely 19th century. Indeed, the failure of the *Education Sentimentale* preludes that of naturalism. Painters, who were more radical, decided to silence a world that they did not understand; the workshops of the Renaissance stepped in Dürer's paintings, and the windmills of the 17th century in Rembrandt's. The locomotive, despite Turner's first enthusiasm, only became pictorial through the fog of impressionism [19]. However, architects and engineers had great confidence in steel and concrete, although they usually used them to simply render characterless and ancient architecture bigger. This general state of helplessness is well expressed in the contradictions of the aestheticians of the era who float between the bare truth of true functionalism, indigent seeing the elementarily of the machine of the era, and the untruth of the ornament that will result in the *Modern Style*. Yokes are supported by Corinthian columns or hidden behind tapestries [20]. Ruskin is probably logical when he preaches the fleeing of a world he sees as degraded and a return to nature, the source of life. His opinion is shared by less aesthetic moralists. In the myth of *Erewhon*, in 1872, Butler, who supposes that the machines obey to Darwin's natural selection and that they have arrived to hound man, offers the lone salvaging measure: their destruction.

Assuredly, we find many prejudices and ignorance in these viewpoints. But then again, a condemnation that is so unanimous and that persists for such a long time undoubtedly aims further than the political flaws denounced by Marx. It had to be linked to the deep character of these new objects. To express the uneasiness, was it enough to say that Pittsburgh's environment

of smoke, dust and sludge would place the rich boss in a situation that was almost as gloomy as his starved workers? That, for the very first time in history, an entire civilisation rested on the mine, the most inhumane and backward of industries. That the cult of production demanded that everyone show a contention that would engender the down to earth small mindedness of Victorian morals and a barbarian conception of school, ensuring training but also the depersonalising discipline required by the new jobs [21] ?

The explanation is all too simple. In this regard, countries are very different, and Germany never knew the monstrous excesses of England [22]. Furthermore, hideousness characterises the dynamic machine in the couple coal-steel of its beginnings, but fades away in the couple electricity-aluminium in 1850 and in the couple petrol-special metals from 1880. Electrical apparel invites cleanliness, finesse, and geometry. Electricity, which is easily transportable in every corner of the workshop or the region, suggests industrial decentralisation by freeing the machines from the propeller shaft of the steam machine [23]. Petrol has the same effect and, as it allows the automobile, it frees the town centres, saturated by the fatal convergence of railway lines. Does all this not plead in favour of a frank, clean life? Munford was so convinced of this that, after Lenin, he saw the possibility of a new era in electrification, petrol and the telephone, a 'neotechnical era' that would relay the 'paleotechnical' era of coal and steel under the condition that men should draw the economic and political consequences of these new powers. Under the angle of ugliness, dirt and fatigue, the flaws of the dynamic machine would seem to be correctible and not linked to its very being. However, the critics were not satisfied with so little. They did not lean their essential argumentation on the ugliness and brutalities or the social injustices. Contrary to the opinion of Munford, they deemed that a complete passage to electricity – if it were at all possible – would not solve the problem. What is the problem, if we try to go back to before these clumsy, passionate formulations?

1B1. The dynamic energy machine

The 19th century energetic machine is in complete break with man and nature. The mechanical machine that preceded it prolonged the human body and natural forces: mills, sailing boats, and even pumps and presses captured wind and water according to their own output, putting them to work without disguise, using them on site [24]. At the opposite, the locomotive, the high furnace, the electrical turbine and the internal combustion engine not only isolate the worker but also, instead of blending in with natural forces, stir them in every possible way. They transmute them from a form into another, whether it is mechanical, thermal, electrical, or chemical. In this context, the concept of energy and the principle of its consecration will be discovered, transporting them everywhere without any reminder of their origin. Hence the feeling – that some witnesses expressed – of finding oneself before a new being that, even when it was not as frightening as the first high furnaces or guilty of rape as the factory and the railway that violated the landscape, remained inassimilable through the culture and value systems, because we only knew of man, of nature and of the few objects binding the two. After the semi-artificial engines of the past, the energetic machine is a consumed artifice that forms a strange reign, away from everything.

Furthermore, a means only seems natural to us when it is visibly linked to a concrete end: grinding wheat, lifting a stone at the top of a wall, or dyeing a garment. This was the case of the mechanical machine whose energy was polyvalent by right (it could be used for a thousand things) but was in fact limited to a task to which it was no longer 'dedicated'. The

energetic machine severs this link. Its end is no longer the accomplishment of a concrete action but to produce energy in general. It is a means to a means. It inaugurates the reign of the pure means, which is as distant from man as it is from nature, as strange – some will say monstrous – as the reign of the pure artifice.

On top of its strangeness, it also has something that is aggressive for the living. Whilst it changes its mind, adapts ever-renewed operations and works through synthesis and continuity, it goes straight ahead, endlessly repeating the same action, analysing its processes thoroughly. This was tolerated in the slow ticking of the clock and the mill, reminiscent of vital rhythms, but in the hundredfold speed of concentrations of energy, it shows a scary face, the face of raw matter. The linear thrust, the numeric multiplication, the analytical fragmentation are the very characters of materiality. Under the effect of acceleration, they take a relief, a purity that comes from the to-and-fro of the piston, of the rod and the wheel, the vertiginous antipode of life. The deep shame is that such blindness is often more efficient than its flexibility. The living felt dispossessed.

The only thing the living could do was to force himself to adopt the invader's way of being. We shall not dwell on chain work that gives the gesture a stereospecificity where man models himself on the machine, where man 'serves' the machine in countdown instrumentation. It is a consequence that is inscribed in the logic of the energy but it is one that perhaps does not belong to its essence. By right, it also tends to reduce the tasks of the labourer. The influence on the intelligence of the user, the worker, and even the inventor was much more fundamental. Indeed, the energy machine does not belong to the lived experience of the ancient dexterity, nor does it belong to a true scientific knowledge. There is nothing scandalous there, we shall say, because, between the *non criticised function* of empiric and the *critical fact* of science, there is room for a third order: that of the *criticised function*, which belongs to modern technique [25]. But precisely, in the dynamist world, the function reduced to itself (the means of a means) is so poor, so material, that it was never able to define its own territory in the kingdom of knowledge. We observe that most of the technicians of the era hesitated between the status of empirical finders, and that – less glorious – of the simple appliers of scholarly theories. To this, we must attribute (more than to a pretend modesty or incapability of expression) that 19th century technicians found themselves in trade-related problems and hated going into any general idea of the technique, except to affirm a thoughtless faith in quantitative progress or, more often, to situate themselves outside of culture, (in their eyes) the territory of the philosopher, the literary, the artist, and recently, the man of science [26].

In turn, this state of things affected social relations. Assuredly, it is difficult to set apart the abuse of capitalism as criticised by Marx and the crimes of the energy machine. Yet, the classes engendered by economic structures were soon joined by three other classes, which were equally 'alienating'. The businessman uses it to economic or political ends, in a manner that is particularly arbitrary that it does not have any intrinsic finality. It is therefore questioned by this arbitrary itself and by his ignorance towards the instruments on which he leans and that he must content with exploiting. The technician, engineer or foreman understands his instruments – although he feels that he is a scholarly bastard – but in return he is excluded from the decision of the ends, extrinsic to the machine and under the responsibility of the businessman or the politician. Finally, the worker, simple working livestock, is excluded from the true comprehension of the machine apart from that of the pursued objective. The proof that these characters are linked to the energetic mechanic statute is that we find them in Stalinian Russia, where the arbitrary of the businessman – the planner – is illustrated by what the Russian critics

have since baptized 'economic subjectivism', the uneasiness of the technician through the drama of the intelligentsia, the functioning livestock of the work camps [27]. The social disarray is best found in the era's architectural dispersion. Apart from a few policing-inspired urban attempts like Haussmann's in Paris, never has the space of the house, the city, or the road been more incoherent than in the 19th century.

Finally, the adversaries of the dynamist machine deemed it harmful right down to its cultural advantages. One by one, they rejected the three arguments brought forth by its rare defenders, in particularly American technocrats of the 1920's [28]. You say that the machine increases leisure? But speaking of the sort means accepting a dichotomy where true life is nowhere, not in the work, not preparatory to leisure, nor in the leisure, which, deprived of articulations around work, empties of substance. It frees work from sordid constraints and, with the developments of electricity and special metals, goes as far as to dress it with an aesthetic order and functionality. To humanize a work, it is not enough to lighten it, but it must be made significant. Yet, the aesthetic of the *styling*, if reduced to the finish of the matter, to the round of the form and to a certain reminiscence of living being as invoked by Mumford, does not promise anything more than a vain rest for the eyes. There is little to expect from the functionality if the function of the means-to-means is devoid of spiritual content. The energy machine comprises the suppression of rarity [29] hence privileges and social classes. To the contrary, we have just seen that it implicates a new division in classes – the class of the businessman, the technician, and the executer – that is even more alienating than its predecessor. Whichever way we look at it, we are at the wheel…

1B2. The dynamic order machine

The technical world does not only have energy machines. It needs machine that produce forms, arrangements that are more spatial than in modelling machines [30], that are more temporal in the information machines. The 19th century was wealthy in both genres. It perfected the loom, mechanised printing, the sower and the reaper. It was revolutionary by creating the telegraph, the telephone, the cinema, and the radio.

Still, in its information machines, the technical world only saw a new means to activate its modelling machines from a distance. In these machines, it only saw an indirect way to favour his production of energy even more. It did not perceive the technical originality of information, which is that it can speculate over time and manage actions in return. It did not grasp the originality of order as a universal, physical and technical principle that is distinct from energy. In every way, it remains energetic. It is hardly surprising that here too it was open to reproaches. In its technical use of machines of order, we find everywhere the acceleration of linear movements that are recurrent, analytic, the means-of-means, the dependency of man to his tool.

Yet, what can be said of the manner in which the late 19th century and the early 20th century used the press, the phonograph, the cinema, the radio – and very soon, television – to multiply directly cultural realities, the text, the voice, the music, and the gesture? Was it not bringing to the life of the mind – apart from a democratic broadcast – the intense and varied exchanges that sociologists have always considered as its main engine? Even here the critics did not give in. Culture is an artifice, they say. Its end is to put us in contact with the real. Yet, the proliferating information screens both mind and things, and in this sense, it is passive. Not that it would provoke somnolence, but the activity that it triggers mainly targets the substitutes

of reality, images, sounds, words, and phantasms that all too soon become ghosts [31]. Let us not prejudge anything. Perhaps that one day soon we will have to admit that, transported in another context, broadcasting takes on an unexpected character of truth. But then, it will no longer be simply quantitative multiplications.

In fact, the common trait of dynamic engines – whether of order or of energy – was clearly expressed by the Bergsonian philosophy that concludes the period: they are abstract [32]. The metamorphosed energy is an abstraction; it is torn away from its natural milieu and has become means-of-means. It is an abstraction that the repetition and the stereotyped succession made purely numerical through the effect of acceleration. Training, which is neither truly intuitive nor truly scientific, in the same way as the attached economic-social and urban relationships, is an abstraction. Information, which turns on itself, screening the world instead of revealing it, is an abstraction. Bergson does not explicitly draft the theory of the dynamic machines, but we can sense that these machines shape his environment when he opposes quantity to quality, the 'all done' to the 'doing', determinism to freedom, inert time to lived length. If he wants to reign, man needs these servants that will reduce him to slavery [33], Hence, it is essential that he should promote and control them, seeking in their gathering a 'supplement of soul'.

These analysis and those of the innumerable pessimistic essayists that follow [34], are still very much alive because the dynamic machine – like the static machine before – is a constant of the technician world, and its ideal of purely quantitative efficiency will exert its fascination over some minds for a very long time still. Bergson's sole mistake (and particularly his successors') is that he extended his criticism of one state of the machine to the machine in general. Not only did he and his followers lose sight that it could be subject to a metamorphosis, but they also forgot that it had known, in its origins, a much less redoubtable status. Yet, how could they think about that as they were submerged under new machines?

If we are more careful and if we look more closely, we shall see that, before the Industrial Revolution, technical objects had a very different status. We will understand that we must distinguish these two ages because we are inaugurating a third age, one that directly controls our future.

1C. THE DIALECTIC MACHINE

We are witnessing what is commonly accepted as a second Industrial Revolution. Yet, we still need to determine what it lies in. We are generally content with stressing that nuclear forces have given our energy machines a prodigious leap and that our information machines have gone from the still elementary stage of the telephone to that of calculators and cybernetic engines. And we can effortlessly demonstrate a huge increase of both power and precision: support before the oil and coal layers ran out (something that haunted the consciousness of the 19th century), mobility allowing for the improvement of deserted regions and decentralisation of the others [35]; perfection of the settings that increase the qualities of the finish and the proportion that Mumford saw in electrical apparels. But if things were to stay still from our cultural viewpoint, would we be much better off? In such a perspective, technique remains

accountable for every accusation of anti-humanism accumulated against the dynamic machine, which remains suspect even in its advantages.

Thankfully, it is the place for a deeper mutation. Gilbert Simondon remarked that every technical object is engaged in a concretisation process, meaning that in the start, it is articulated in isolated functions and organs that are analytically distinct and that it tends to conjoin them, establishing concomitances, interrelations, and synergies between them [36]. But then, it is plausible that some objects present such a rate of abstraction that they appear and are known as abstract despite their concreteness whilst others present such a rate of concreteness that they appear and are said to be concrete in spite of their abstraction. We should like to characterise the present machine-related change using a similar mutation of rates. Whilst the 19th century machine (which was still analytical, linear and juxtaposed) seemed globally abstract and deserved every reproach that have since stuck to abstraction, our machine, in an ever-increasing number of cases, discovers enough synergies for concreteness to move to the forefront, taking with it a deep change of its cultural sense. We even feel that with this new face, it explains – or in any event reinforces – most of the essential characters of the contemporary world; that it suggests a value system susceptible of promoting a new humanism.

Hence defined, dating the second Industrial Revolution is no easier task than defining a date for the first. An energetic scheme as concrete as the Diesel goes back to 1893-97; a concrete cybernetic scheme like feedback also begins with Watt in the 18th century. However, let us not forget that far from the first trace of a technical discovery is its cultural glow. It has to become a daily object. Using other words, it must be industrialised. It is increasingly important that is should no longer offer a simple fact but a principle with its own fecundities. Therefore, as soon as 1780, Watt equipped his steam engine with a ball-type governor. When the machine turned without gripping, the balls were lifted by the centrifuge force and acted on a lever that would partly interrupt the entry of steam. Assuredly, such a device offers an example of retroactive action where an effect (the movement of the piston) acts on its cause (the entry of steam) to regulate it. There we have the feedback that we are so proud of! But it is completely different to invent a device enforcing a principle than laying down the principle itself. So Watt does not invent the feedback, he invents a mechanism that includes a feedback. We shall have to wait until 1868 for Maxwell to analyse this rigorously. Then, we will have to wait many more years before physiologists clearly recognise a structure of our nervous assembling. Then, we wait for some more until finally, with our contemporary cyberneticists, the feedback takes on the dignity of a universal scheme of functioning. Still, before truly being part of humanism, the man of culture must see the invention, and he will transform it into common categories. We can see that the road is long. It is even longer when some steps are skipped. Diesel, when he creates the spark-ignition engine, immediately made a reasoned invention by taking away its principle [37]. Some rare humanists have now understood that it concerns them.

When we consider these precisions, we can affirm that the concrete thought was rearing its head in the early 20th century when the First World War triggered a gigantic comeback of the most dynamist mentality. This comeback proved to be destructive during the conflict and constructive after it, and incurred the sad consequences that we know in the great crisis of 1930, which demonstrated the impasses of pure dynamism and would have perhaps been enough to promote the synergic preoccupations that were put aside, as we see in the American technocracy. In any event, the latter were brought to the front of the scene by a new worldwide conflict with its brutal clearings and need for instantaneous riposte demanding the dazzling progress of the radar, anti-air cannons, and operational research. The world took a new face that

it held onto during peacetime. In short, the concrete mentality definitely joins the definition of cybernetic with the team of Norbert Wiener in 1948 [38], for information machines, and in the aforementioned thoughts of Simondon in 1958 for energy machines.

1C1. The dialectic energy machine

The concreteness or synergies of our engines are applicable to them all and demonstrate their unity. However, since some are more obvious in energy machines and others in information machines, we shall classify them between these two types for an easier comprehension.

1C1a. Synergy of functions

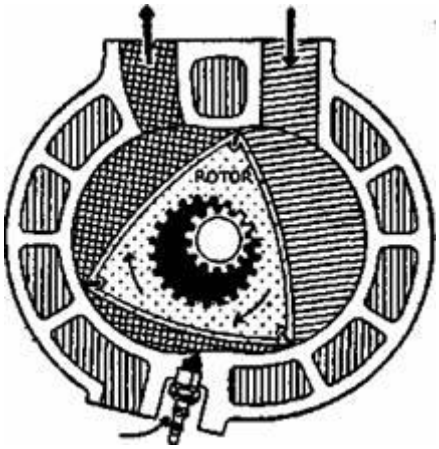
The body of an airplane must respond to at least three requirements: it must be rigid, offer a decent surface of sustentation, and break the air effortlessly. The early apparels dating back to the early 20th century had a carcass conferring them rigidity and a coating granting them the surface of sustentation. Yet, this distinction between the coating and the carcass imposed a weight and an angular form that were not compatible with breaking the air. In today's airplanes, the coating is streamlined in such a way that it is self-carrying, as the pressures that exert in one plan reel at the average curve, so much so that it can decrease the work of the carcass, sometimes even suppress it. Simultaneously, it improves its surface of sustentation and makes the breaking of air easier, since self-carrying, aerodynamic forms are ideal in this regard. Hence, we are here in the presence of three functions, once of which, the coating, accomplishes a good part of the two others, i.e. sustentation and breaking. We should even note that, by accomplishing them almost on its own – hence largely suppressing the antagonism that systematically occurs between two distinct organs – it perfects them. This is a case of simple versatility, which we will call a first-degree synergy.

Yet, some are more complex. The cylinder and the yoke of an internal combustion or combustion engine must provide a rigid volume that resists to the internal pressures. On the other hand, they must evacuate the heat provoked by these pressures. In the old engines, both functions were designed separately. The thickening of the cylinder and the yoke ensured rigidity, and a current of cold water dragging the heat ensured the cooling. Air-cooling is synergic. Along the cylinder – and particularly in the region of the valves – the cooling blades intervene, ensuring the thermal dissipation. Yet, when they are properly spread out, they also guarantee the rigidity of the volume, which used to be obtained by the thickening of the walls. These blades also work as support ribs. In return, their rib work allows making the wall of the cylinder thinner and also contributes to the thermal dissipation, which is already ensured by their blade role [39]. In the same way as with the coating of the airplane, these blade-ribs show us a function that accomplishes another by accomplishing itself: it is their simple versatility, or first-degree synergy. By accomplishing this second function, they perfect the first. We then speak of circular versatility or of second-degree synergy.

The physiology of our machines presents the same outline as their anatomy. In last century's internal combustion engine, the various operations are articulated in clearly distinct places and moments. First, the fuel is blended to the combustive air in the carburettor. Then,

the hence carburetted mixture is introduced into the combustion chamber. Then, the spark plug lights under the action of an organ that is again distinct, the battery. Finally, the lighting of the spark plug provokes the deflagration of the carburetted mixture that activates the piston. In Diesel's internal combustion engine that opens the 20th century, these moments and places conjugate. It is indeed the injection of the combustible into the compressed air by the return of the piston that mixes it to the air (the role of the carburettor), lights it (role of the spark plug), and pushes back the piston (motor role of the deflagration). These are first-degree synergies. But we could find some second-degree synergies too. Whereas in the internal combustion engine there is a marked antagonism between the compression and the deflagration, since the latter – under the effect of the pressure – risks transforming itself into a detonation, in the Diesel, since the compression is the source of the deflagration, it reduces the antagonism between the deflagration and its effects that in turn provokes it. Thereby, it can increase itself by increasing it.

ÉCHAPPEMENT ADMISSION



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Let us note that the progress of concreteness is not always rectilinear. In the recent Wankel engine, some synergies of the Diesel were abandoned. We go back to the spark plug ignition and to pre-carburation. There was still an antagonism between the properties of piston engines and turbines. The first run economically using petrol, and the easy transportation of the latter is well suited to the automobile, although they experience every loss of energy inherent to the brutal to-and-fro of the piston with its dual break. Turbines do not present these drawbacks, but only economically run using water or steam in reduced units, which, for the time being at least, makes them ill-suited for the automobile. Wankel [40] imagined a triangular rotor locked in a flattened cylinder. The three chambers created between the rotor and the cylinder serve the first to the admission and the initial compression of the carburetted mixture, the second for the maximal compression and its explosion, the third to its expansion and its evacuation. The revolution of the rotor that is provoked by the deflagration takes the carburetted mixture, compresses it, and accelerates its exhaust after its power stroke. Furthermore, it directly moves the axle, which is the soul of the fixed gear on which the rotor moves. Hence,

Wankel designed a configuration of the piston that makes simultaneous and reconciles the formerly antagonistic functions of motor compression and expansion, and conjoins them both with a third function that used to be incompatible, the direct rotation of an axle.

The Wankel engine is a very good demonstration that it is artificial to consider separately the anatomy and the physiology of our engines since they are often in synergy among themselves. The classic airplane engine propels the aircraft as it spins the propeller. However, its body needed to conquer the air resistance in pure loss. The two functions of propulsion (physiological) and breaking (anatomical) were antagonist. The ramjet reconciles them: the air pressure at the entry of the divergent ensures, by compression, the combustion of the kerosene, whose gases lead to the propulsive effect by escaping the convergent.

It would be possible to lengthen the list of all these examples, particularly in electrical machine where, initially, enough precautions could not be taken to isolate the different organs from each other for fear that their fields should perturb each other. Rather than isolating the fields, the contemporary electrical or electronic machine attempts to conjugate them into one unique action. Simondon demonstrated all sorts of synergies that the passage of Crookes' tube into Coolidge's tube proposes in the production of x-rays, or in engines of amplification, that of Fleming's diode to Lee de Forest's triode, then to the tetrode and the pentode [41].

For the time being, we shall stick to a simple description, as this is not the place for underlining the cultural scope of all of this. Yet, if we remember the great distress that the machine caused in the dynamic era because of its opposition to life, we can easily imagine the scope of a transformation that, by reconciling what had previously been separated under the form of a context, gives it some characteristics of the human being, filled with first and second degree synergies. This kinship through the functioning goes way beyond the simple assimilation by appearances that is 'reminiscent' of life where Mumford already perceived a sensitive progress in 1934. Henceforth, on both sides, there is an organic idea, a prevalence of the whole over the part where the part is no longer simply a part but becomes an organ.

1C1b. Synergy of the machine and nature

In the same way as it isolated its functions to realise them with more purity, the 19th century machine worked on the exterior ambient nature: it transformed it as it avoided a transformation in return. The ancient locomotive rushed ahead, enduring resistance to air in pure loss, unwillingly. To propel the aircraft, airplane propellers would determine an acceleration of the air upstream that was wasted in turbulence.

Our fast cars improve the use of air resistance to improve their road holding. In a recent model of airplane, the Bréguet 941, a light coating of the synchronous propellers allow to uniformly steer, on the wings, the debit of the air accelerated to increase the lift. In both these cases, the first function of the machine (the propelling) provokes a reaction of milieu that, far from being damaging or vain as it used to be, favours another function in return (adherence or sustentation). The positive synergy no longer plays mechanical functions between the organs or the functions, but between the machine and its milieu.

Furthermore, we see in this order some synergies that we could define as being negative. Thanks to its versatility [42], the Guimbal generator can entirely be immersed with its turbine

into the pressure pipeline of the barrage wall. Yet, if the liquid flux accelerates, it will also accelerate the propellers of the turbine, the effect of which is to heat up the latter, but also to increase its own turbulence, facilitating the evacuation of heat. The stream flow is taken in a mechanism where it is both a principle of heat and cold. It is no longer an action that increases another in order to grow itself. The problem is less linked to the increase than to the settings. The machine and the milieu are in circular causality of regulation.

We are a long way away from the dynamist rape, but are not back to the simple prolongation of natural forces characterising the static machine. Reconciliation occurs: it is an active reconciliation based on reciprocal causalities that gives birth to what Simondon calls an 'associated milieu' [43]. The water around the Guimbal turbine, the air around the fast car or between the propeller and the wing of the Bréguet 941 are not machines; nor are they simple nature; they form a *median reality* with the machine. This type of reality will only need to grow to become more spectacular – and we shall soon see some examples – for its cultural incidence, the fading away of the ancient, unmovable Nature, to become blatantly obvious.

1C1c. Synergy of the matter and the form

When Aristotle distinguished a 'matter' and a 'form' in every finished being, he took his inspiration from the technical objects lying around him. Any object or machine from yesteryear resulted from a configuration *imprinted into* a material. Whether it was an antique pulley or a 19th century steam engine, we could find everywhere a structure and a receptacle, and between the two lay the separation characterising abstract technique [44].

In front of our thermometers or our germanium transistors, it has become impossible to consider the germanium as *in* what the form of the instrument incarnates. It is itself what is most original in the form through the intimacy of its electronic structure. Similarly, the tungsten in the anticathode of a Coolidge tube is not simply *placed* in such a way as to allow x-rays; its high atomic number and its high resistance to fusion constitutes the fabric of the device and its idea. In our electronic engines, and in those that enforce nuclear energy [45], the 'material' and the 'formal' are conjugated and sometimes even go as far as exchanging their roles.

Let us apply the same observation to this other matter of a machine: the combustible. The form of yesterday's locomotive made do with using heat, whatever its origin, according to the exteriority of the abstraction. Hence, it burned just about anything and only chose coal by commodity. At the opposite, our rapid engines burn their combustible by introducing what is most particular into the most particular of their structure. They have become most exclusive in their choice, according to the demands of concreteness [46].

Can we say that matter and form are in synergy in all of these examples? Assuredly, and we were perhaps too quick in stating that they incorporated and merged. In reality, they figure distinct poles of tension insofar as the matter ceases to be pure passivity to take a machine-related originality in its fabric. They fecund one another: the function of the form accomplishes itself even better that it gives the matter an almost formal task and reciprocally; we find our second-degree positive synergies. As these interactions – in a nuclear reactor for instance – are regulating and stimulating, our negative synergies rear their heads here again.

Here again it is not a case of switching to humanist consequences. Yet, seeing the influence that the distinction between matter and form has had in philosophy and ancient rhetoric, seeing its role in the conception of nature as a permanent substrate and as man as simple modeller of things, we glimpse, once again at the cultural transformation implicated in the new motor schemes.

This too brief overview of energetic synergies shows where their interest lies rather well. They do not necessarily promise a decrease of the organs. The latter, in a Diesel engine or a triode, are more plentiful than in the most abstract and corresponding machines. Nor do they promise us that machines will be easier to understand or easier to repair, or even more polyvalent. The abstract machine, insofar as it separated the functions, was appropriate to the explanation. It was easily repairable and was apt to a wide variety of roles. But the concrete machine introduces a new world that, in its whole, is more powerful and flexible than the former.

From the viewpoint that concerns us, it particularly brings about a new mentality. There will probably always be a vast number – if not a majority – of static (there is no technical world without a hammer or a hoist) or dynamic (we will continue to juxtapose functions for economic, convenience or prestige reasons, as we can see in automobile accessories) tools and machines. There is probably no rupture between the most abstract machines of the 19th century and our more concrete machines, and the technical intention always encompassed a tendency to concretisation. Still, probably in the same way today as yesterday, every machine-related series must go through the most abstract, analytical stages, as we can see with the present nuclear related researches. But *globally* speaking, the technical world offers a new face. An increasing number of objects show a concreteness that is so stunning that the technician can perceive it as such, so that he may pursue it in an explicit manner, that from the point where he has to go back to abstract stages – like for his new series – he knows that this it what he tends to: this is the reason why he reaches it so quickly.

As we have just seen, synergy, taken in all its extension, is synonymous with organic relations between machine-related parts. It suggests dialectic relationships between machine and nature, matter and form. Hence, we shall not be surprised that the recent machine should introduce a new technical [47] and cultural *view* of things, or that it should favour it anyway. This is something that we shall verify in our information machines.

1C2. The dialectic machine of information

Let us not linger over transmission machines such as the telephone, the radio, or television. All of these, in what concerns their informational aspect, only aim at multiplying or broadcasting messages. Their dynamist signification depends on the type of network in which they fall. There is even less to be said for some calculators, these arithmetic electrified machines that only add new commands to mechanisms whose principle goes back to Pascal.

Yet, among our calculating machines, some, more original, not only allow calculating but also allow resolving problems. Analogical machines are devices that mime the data via relations between physical forces. For instance, the tensions and resistances of a circuit are adapted in such a way that they represent an equation whose intensity of the current – when read on an ampere meter – provides the result. We can see that the process, instead of being

simply linear as in arithmetic machines, exploits a complete structure. More remarkable still are computers, which are capable of reaching their complex solutions numerically, meaning through a succession of discreet quantities that are exactly determinable. These logic machines [48] adapt to the situation, confronting partial results obtained using their instructions. They test a path, abandon it if it is not fruitful, or chose another on the basis of anterior results that they either extrapolated or interpolated in a sort of induction. Indeed, they can contain machines that statistically induce averages, establish correlations, define laws of series that they then interpolate and extrapolate. Where analogical machines exploited a global structure more massively still – static or dynamist, as we wish – the logical machine, with its permanent and transitory memories, also interconnects every part of its system in a truly circular and already dialectical manner from which a rectifying return to the past is never excluded.

Our behavioural machines go all the way down that road. Not satisfied with elaborating information that they passively receive and return, they conjoin with their logic organs that elaborate the information to deduct an appropriate directive, energetic organs or execution and exploration, allowing them to complete tasks and harvest data in a circuit of actions and reactions where we find three of the synergic forms of insertion of a living in its milieu. Indeed, the living must ensure its internal balance, whatever the information (more or less disturbing) that he receives from the outside. He must explore his environment for new information. He must be capable of learning (meaning sorting) amongst the information he receives, which piece of information will be significant to him: the Pavlovian conditioning is this complex operation through which an animal distinguishes, amongst innumerable neutral stimuli, what announces a specific stimuli (such as the prey or sexual partner) and has a signalling value.

Yet, the Ashby haemostat that Grey Walter pictorially called the *Machina sopora*, is a machine made up of four moving magnet galvanometers interconnected in such a way [49] that, should the experimenter perturb one of the elements (for instance by blocking the needle), the others would find their balance back because their main feedback is – according to necessities – liberated or contradicted by secondary feedbacks that are inter-composed in turn if one of them should be faulty. The device is therefore homeostatic in relation to its milieu, which is represented by a malevolent experimenter. *Machina speculatrix*, equipped with a photoelectric cell coupled with a positive tropism and an electric contact coupled to a negative tropism combines the data it hence receives so well that it launches into an in-depth exploration of its vital space, avoiding some obstacle while moving others, seeking the optimal (average) 'living conditions', recharges if need be, adopts a differentiated behaviour in relation to its congeners, as with its own image in a mirror. The *Machina docilis*, through its exploration mechanisms (scanning), has thresholds of memory and perception that only grasp and retain neutral stimuli that are effectively linked to specific stimuli. It is capable of extracting 'significations' from its entourage, and to modify itself and modify it in consequence. The behavioural machine is capable of extending to its milieu the circularities that the logical machines conducted within itself.

We do not have to decide whether we should apply the epithet of cybernetic to all these machines without distinction, cybernetic identifier or information theory, or if we should solely keep the term for behavioural machines. Nor do we do not have to decide if, amongst the latter, the faraway future belongs to servo-mechanisms rather than to their taping, predisposing them to tasks of control – as Wiener [50], envisages – or if, at the opposite of these inventive behaviours machines that stimulated Grey Walter's [51] reflection. Finally, we do not have to decide if the properties of these engines wear out what is concrete in the behaviour of the living,

not even if every learning process (as Grey Walter requires after Pavlov) is of an associative [52] nature. All these precisions are delicate and important in themselves and go way beyond our intention.

Such as we have just described them, and should they represent a more speculative than practical interest, our information machines testify of the same synergies between organs and functions, between machine and nature, between matter and form than our energetic machines. *Machina docilis* alone demonstrates some that are positive and negative and first and second degrees. This is why they stand out less through the number of their elements than by the richness of their interconnection [53]. They are the place of blockages by informational conflicts, of releasing through respite or reorganising jerks. Their action presents 'degrees of liberty' in the sense that they can accomplish a behaviour that is foreseen as they follow different paths, and sometimes even to manifest *types* of behaviours that are unforeseen or ignored even by their manufacturer. One single nuance separates energetic machines from the information machines For the synergies that we have recognised until now: the former illustrate best the intimacy of the functioning, whilst the second illustrates the homeostasis and the creativity of the behaviour. The conjunction of the two aspects is what differentiates – for the time being – the living from the machine [54].

We can say that, in the same way as the 19th century invented energy, the 20th century invented information, which is as old as our world. It has been there since an animal shook another using a sign, since some sort of mechanism 'commanded' another by a transmission. Furthermore, thanks to the telegraph and the telephone, it took on such a considerable importance in the 19th century that time increasingly became the fourth dimension of the machine-related world. But never before the era when cybernetic was defined – and despite the use of the regulator by Watt and its analysis by Maxwell – had we so clearly perceived the originality of temporary models: the possibility of the feedback where the effect acts on the cause either to moderate it in homeostasis or to significantly confront a present with a past in the creativity of learning. In effect, with the 'feedback' (the Germans translate *feedback* par *Rückmeldung*) mechanisation joined synergy in time to synergy in space.

And, as always, the extreme case made us conscious of a category that was still unclear. The explicit discovery of the feedback led to the discovery of information in general. Around the Second World War, engineers, physiologists, psychologists and sociologists realised that with or without feedback information was a universal truth whose common laws linked the machine, the living, the culture and the milieu [55]. At the same time as this discovery, information in general engendered the discovery of order as a reality that was complementary yet distinct from energy [56]. Once again, we glimpse at the humanist consequences. The machine no longer belongs to the area of raw force to manifest a reality that is already spiritual and cultural: synergy not only in space but in time too.

However, we had promised ourselves more than the application of the above-envisaged synergies, even more than their extension in time. We had announced that our information machines would offer us new synergies that, without being limited to these synergies, would be illustrated more clearly.

1C2a. Synergy of the machine and the machine

At first sight, the concrete machine enhances the characteristic of independence that already frightened Butler in its abstract ancestors. The intimacy of the exchanges of energy joined with the capacities of self-regulation and initiative allows it to increasingly suffice to itself. A submarine rocket, with its long-term nuclear reserve, its automatic search control and the rich versatility of its internal and external structure, is the best example summarising this autarky characterised by the magical word automation. The future of the machine would then be the robot, the outcome of the 18th century automaton. It is particularly fascinating and worrying, even sacred, that it clams up even more…

But this reminder of the 18th century warns us of our error. The Swiss clockmakers' mechanical harpsichord players and the eating, digesting, excreting duck created by Vaucanson all showed a need for a game and fair exhibition (we will never stress enough the playfulness of ancient mechanic, whose peak is in the work of Da Vinci) when they did not unconsciously target promethean and demiurgic aims (let us recall the Faustian aspect of the same Leonardo) [57]. It took a minister of finances to appoint Vaucanson as inspector for silk manufactures for the man to invent, in 1741, the looming machine that Jacquard will later perfect. Today's concrete technique is very different. It does not look for game or performance, and it does not aim to illustrate its machines through their independence, quite to the contrary.

Indeed, by definition concreteness tends to encompass ever-vaster wholes. It only finds its energetic accomplishment by overlapping the internal organs of a machine, even its associated milieu, to associate them to others prolonging them in a machine-related associated milieu. From the informational viewpoint, it is even more synergic that it opens onto evermore numerous and varied circuit. This is why the significant models of current automation are not the fair's robots, these isolated workers, but the electric plants in Russia and America where the most diverse engines tie in infinite relations of energy and information, right to the furthermost unities so vast that they encompass both the landscape and the road system. More than autarky, the ideal of our machines is versatility, the possibility of inclusion in every varied machine-related situations.

This is not without raising a delicate problem. Synergies of inclusion suppose that the machine should remain a non-saturated, opened system. Yet, these internal synergies tend to render it independent, making it a saturated system. Therefore, the current machine cannot be versatile in the sense of the old tool, by simple lack of differentiation [58]. Its opening must be linked to its distinction itself, in the same way as these highly specified numeric machine that, according to their coding, carry out extractions of cubic root or language translations. In a word, we cannot absolutely say that our engines open or close. Insofar as they accomplish themselves, they clam up to be pluggable, and the aim of their synergies of independence is to enrich their synergies of inclusion. Even the ultimate goal of the artificial satellite is not to float alone as long and as far as possible, but to remain in contact with its base despite the distance, and in the end, to be retrievable, as the recuperation closes the complete circuit opposing it to the abstract linearity of dynamism. In a nutshell, the fundamental technical concept is no longer the machine but the network [59], synergic whole of synergic machines.

The hence-understood network offers a completely different physiognomy than that of former technical establishment, particularly in what concerns the distribution of information.

During the era of the static machine, the equipment drew, transformed, and gave back information on-site, or just about. Management roles (for instance the political power of Rome during the Empire) were content with ensuring the whole with some general conditions (money, road, safety) allowing specific establishments to work. There was little to preoccupy oneself with coordination. To the contrary, coordination became indispensable to the dynamist machine because of its necessary concentrations of energy, and it obtained it through the centralisation of resources and information. From one viewpoint, we could say that it requires to be centralised. Everything depends so much on everything that higher decisions suppose the confrontation of the most information in one single point [60]. Yet, at the same time, secondary centres have such originality that it is crucial to let them define the partial constellations in every order amongst themselves. In such a way that the central power – if we can call it that way – rather than being a centre for the broadcast and the collection of information (and decision), plays a new role, that of a facilitator (and activator) of interconnections [61]. We fall back upon analogies with life. But we particularly feel the cultural, social and political transformations that this passage from a pyramidal scheme (dynamist) to a plurinodal (reticular) scheme will require [62].

1C2b. Synergy of the machine and of man

Yet, the question surfaces again. If the concrete machine opens to the network, does the latter not clam up, evacuating man? To the contrary, the dialectic network comprises one last synergy, and precisely with the human being.

We think of *human engineering*, a discipline that both concerns the engineer and the psychologists, and whose aim it is, starting from an in-depth study of our organism and of the technical object, to determine what structures the machine must present and what training man must undertake for their coupling to be as profitable as possible. This study goes all the way back to prehistory. Indeed, every tool has two sides: one is turned towards nature while the other faces the worker. Taylor made this study progress in the way that we know, attracting the interest of the wide public. Yet, it did not have its current, decisive importance until the Second World War during which ultra-rapid control devices (radars and cockpits) required the most refined adaptations [63]. However, *human engineering* does not prove that the machine humanises itself. It is probable that its theoreticians were led to give an increasingly large share of the human factor in technical return, and as we saw, Taylor, starting off from coercition, went to the gymnastic refinement of the gesture to finally discover that the most stereotyped work presupposes satisfactions of ambiance, contemplation, consideration, opening up, and joy [64]. Yet, these researches concern the human according to something else. If things were to stay still, he would alienate himself.

Hence, to grasp the true coupling of man with the technical object, we should compare them and see how the concrete machine, insofar as it comes closer to man, determines and helps him cultivate his difference [65]. The machine records more, quicker and more faithfully (it even has a tendency to record too much, and this is well-known by communication engineers who are endlessly fighting background noise). Yet, however lacking in intelligence the listener of a conference may be, he will retrieve get more out of a seminar than listening to a Dictaphone (a logical machine), sometimes even more than from a behavioural machine. The latter, although equipped with degrees of freedom and sometimes with types of associations unforeseen by its manufacturer, proves to be much less inventive than the brain, which is

capable (according to Grey Walter) of establishing significant relations 'between just about anything and anything', particularly capable – in virtue of the cellular intimacy of its processes – to gain the realization where its activity is no longer simply 'framed' like that of a machine, but 'framing' [66]. In a word, if the cybernetic machine that explores a sector of the real with superhuman speed and precision (the electronic tube works a thousand times quicker than a neurone) is master in the order of answers to expected-type questions, the brain maintains its control in the order of the interrogation, the project, and the response to unexpected-type questions [67].

This is what causes its productivity in small tasks. Control cybernetic machines will render immense services for the manipulation of large volumes, such as car assembly lines or electricity plants, but they will never replace the duster, the greengrocer, the garage mechanic, or all the workers in charge of very restraint jobs that are very differentiated and occasional. The orange picking machine, which could be built, would not be profitable. We can confess, along with Wiener, that the navvy following the bulldozer to scrape the corners is the gleaner of the machine. But gleaning requires a more difficult machine than reaping. The human brain is alone – along perhaps with the animal brain [68] – that is sufficiently plastic to accomplish these tiny adaptations economically.

As for the most demanding (that the new techniques precisely postulate and where the animal and animalised man are out of the game), the human brain – in what is most distinct about it – is required. Indeed, the network towards which we tend, from the very fact that it presents itself as a tissue of spatial temporal interrelations that are prodigiously complex and fecund but fragile too, and where the tiniest flaw entails long-term deviancies, supposes, just to maintain itself, the continuous vigilance of the mind. But above all, like Simondon remarked, its concreteness takes it into an endless process of concretisation that, because of synergy, can only occur through global reorganisations of every single one of its elements, meaning in a veritable invention. The more concrete the object, the least it can evolve through the improvement of the detail. It supposes that, with each major progress, a complete revision of the entire system [69]. Ainsi, le réseau concret, tant dans son existence que dans sa genè. Hence, the concrete network, both in its existence and in its genesis, forms – with the human brain – a couple where it is concerned by what defines it: its interrogative and initiating capacity. Evidently, this couple draws synergies that are not only of the first but also of the second degree, where each term perfects itself as it perfects the other.

* * *

Throughout this entire chapter, apart from a few rare exceptions, we limited ourselves to machines. Was this justified if our ambition was to embrace every aspect of the technique in general? Mumford used to remark that machines are a modest part of the technical world that still encompasses tools (gripper), machine-tools (potters wheel), utensils (jars), devices (oven), vehicles (cart, ships, aircrafts), utilities (roads, rivers, canal locks, aqueducts), and even, beyond these objects that extent into space, the processes that develop in time, such as cookery, tanning, milling, weaving, dyeing, stock farming, domestication, right to the synthesis of plastics or amino acids, without even considering today's electronic and nuclear reactions. All this, to which we can also add the transformation of the landscape introduced by agriculture and

communication, along with monetary manipulation, political or educational organisation, belongs to the technique. All this exerts an undeniable cultural influence. However, Marx was not wrong in thinking that here, machines are the most striking and the most symptomatic element, at least since the 19th century. Mumford himself seems to admit this when he adopts the convention of speaking of *the* machines in its own sense, and to designate the technical world in general as *the* machine.

And, indeed, the tripartite division suggested by the fully machine-related domain can be so easily and clearly found in all other forms of technique that it would be fastidious to insist. Let us use the evolution of productivity as single proof. In every order, the static era – in continuity with nature – aimed at producing energies that were reduced but that were also waste-less. The artisan excels at using every wood shaving, and nothing is neater or more economically charming than the hydraulic and aeolian enforcement of the Dutch landscape in the 17th century. At the opposite, the dynamic era, obsessed with the quantities it produced, only granted a mediocre attention to wasted quantities. Sometimes, symbolising power, it even boasted about it. Noise, smokes and mine dumps are as flattering for a paleothechnical mining site than its extraction wells. The concrete era, preoccupied with productivity, strives just about everywhere – and particularly in its combustibles – to replace the diagram *raw matter = product + waste* with the diagram *raw matter = sub-product + sub-product* [70]. In the case of atomic energy, where waste is particularly toxic, it is even forced to do this. The recuperation, the synergy of simultaneous and successive actions, is as sensitive is our chemical processes than it is in the machines in the strictest sense.

This is also the case for political economy, an area where we move away from yesterday's simple activism. To us, the industrialisation of a region is something completely different from a gathering of capitals, a standardisation of processes, the transporting of cheap raw material and the dispatching of excellent technicians. Here again, the concrete network not only comprises the natural resources of a country, its road network and raw human potential, but also its social organisation, the psychological well-being of its workforce with its needs for stability and evasion, all in circular causality, in such a way that the economic invention, just like the machine-related invention, no longer consists in a local, quantitative improvement, but in the creation of global forms where all the factors are reorganised by transforming their reciprocal causalities [71]. This is why contemporary economy goes beyond the dynamist-type centralisation and the artisan-type decentralisation. Its founding concepts are no longer concentration or dispersion, but inter-dependence [72], integration, complementarily, internal regulation, and reorganising mobility. Hence, the corporatism of the static era and the paleotechnical alternative of liberalism and dirigisme are all disqualified. Through their underlying concrete structures, and insofar as they are more developed, our capitalist societies seem stuck to a liberalism that is increasingly planned – in the same way as our socialist societies – to an increasingly opened dirigisme. Here, our goal is not to decide of the future of these two systems, but, insofar as they are viable, they will not just be a simple compromise, a good balance between centralisation and decentralisation, but they will be an original reality responding to a new concept of synergic economy that does not privilege the centre or the extremes but includes them in its interactions.

And as the same scheme of thoughts can be found in our medical planning, even in our opinion surveys – which are all impregnated with abstract energetic – it is indeed technique as a whole that has crossed three states: static, dynamic, and dialectic.

Chapter 2 - THE HUMANIST SUGGESTIONS OF THE DIALECTIC MACHINE

The dynamic machine will have taught us that we cannot be content with easy arguments to culturally justify a technique. It is not enough to argue one's power to broadcast ideas, to facilitate work, to increase leisure, or to suppress rarity. All this has a price and makes it a means of culture. The latter is of creative essence and is always compromised at least as much as any sort of means assists it. Simple broadcasting and facilitating means can contribute to keep a moribund past going.

Now we need to see whether current technique is not itself (apart from being a means) a cultural reality charged with values susceptible of a new departure in its structure and in its modes of being and appearing. What requirements must it fill to this effect apart from the three conditions of any principle of humanism: unveiling a fundamental aspect of *nature*; engaging a new and essential conception of the *mind*; and implicating a motor restructuring of society?

2A. ARTIFICIAL NATURE

The ancient humanists were supported from all parts by the idea of nature, the natural, and the nature of things. It is all too clear for post-renaissance Greece and Europe, but the same applies to all other epochs and under every latitude. If the Medieval, the Byzantine, the Egyptian, the Chinese, the Indian, the African do not share the preoccupations of the Greeks and the men of the Renaissance with reproducing exterior forms and studying quantitative relations, it is not because they despised nature in any way, but because they conceive it differently. The Byzantine icons manifest Transcendence because the latter is the true naturality for the orthodox. Hence, by agreeing on words, yesteryear's humanisms were all realistic. In their eyes, truth, goodness and beauty all stand before man, who only needs to recognise them. They can be conceived very differently by Aristotelian empiricism that pursues them in sensitive facts, or still, by the platonic or Cartesian rationalism that sees them in a world of spiritual ideas. They can be immanent or transcendent. It does not matter. The common factor between the idea and the fact is that they are data, that they must be recognised. Hence the security of the traditional man: failing to act like Parmenides or acting like Heraclites, he can be spotted from a distance and is in a pre-established order [73].

The idealist mentality that sees the light of day in the 18th century marks the first imperfection of this beautiful, age-old construction. In every area, it insists on the initiative of the subject, who knows, feels, and acts. For Rousseau, moral action is not the accomplishment of a previous law, but it is measured by the lived intimacy of the intention. For Hugo, beauty, instead of accomplishing the order, bursts in the originality and the vitality of the creator. For

Kant and Hegel, the truth should not be abstracted or intuitive, but it proceeds from the mind that makes up (if not create) the real. We should not dare say that idealism completely breaks with the idea of nature: feeling for Rousseau, genius for Hugo, mind for Kant and Hegel are realities that deploy an internal law and that possess many of the characteristics of the already-there. However, a crack appears, a defiance in relation to the given. It fuses with Kierkegaard, explodes in a storm with Nietzsche, and will experience numerous echoes until today, echoes that are mumbled or thundering in the thousands of varieties of subjectivism. For example, and despite the paradox of terms, the end-of-century naturalism will be one of the neatest questioning of objective reality. It is no longer acribic in the detail, does not impatiently accumulate the tiny notations, because for it, there are only fragments left, shards of nature, meaning no more Nature at all [74].

Unanimously, the current orientations inaugurate a third moment, offering to go simultaneously beyond realism and idealism. As we shall see later, art learned with the masters no longer believes in the ready-made objectivity of a nature that would only need to be expressed. With the same strength, it refuses the simple cry of vain or lame subjectivity, attempting to build a reality where man and nature would conjugate. Science no longer confounds itself with a realistic acknowledgement or an idealistic diktat to discover a system halfway between mind and nature. Ethic no longer dares present itself as a code of prescriptions nor as the romantic legitimation of anarchising fantasy: in its Marxist form, it ties a living experience where mind and nature never cease to dialogue and weave a reality that crosses fact and reality.

These three milestones of civilisations vis-à-vis nature are evidently parallel to the three steps that we already recognised in the history of technique. The static machine in continuity with the human body and its milieu harmonised itself with a conception of things where man could ask the real whether he was sensitive, intelligent, fluent, stable, immanent, transcendent, but where he only thought of conforming to it in a realistic attitude. The dynamic machine, breaking away from the environment and appearing, or so we thought, of a calculation of the mind, fitted in well with the sovereign affirmation of constructive intelligence, which found its representatives in Hamelin, Whitehead or Brunschvicg until the eve of the second world war. As for the concrete machine, adorned with synergies between it and its milieu, between its matter and its form, it is in full agreement with a representation of the world where forces of nature and initiatives of the mind conjugate into an intermediary reality.

Indeed, what image of things does it offer? The network tends to cover up the universe, closely interconnecting the various machines, urban centres, road systems, railways, rivers, air routes, Hertzian waves, and even industrialised agriculture. The network invades the desert and the poles set up by a semi-artificial agriculture, industrialised by solar ovens or by the easily transportable atomic energy, used as the platforms for every sort of flight, included in diverse radar and transmission relays. The network joins the oceans, about which yesterday's speculations on tides, the resources of plankton and the redistribution of maritime currents through a recasting of straights and isthmus are constantly renewed. Finally, thanks to artificial satellites, the cosmic space in turn enters the circuit, so much though the setting up of spatial routes than by the anticipated changes of the high atmosphere, improving the cycle of seasons and the resonance ceiling of our telecommunication systems. We can see that the net is universal. It is tightly knitted, particularly as it does not result from a simple accumulation of engines and processes (as with the 19th century machine) but forms a real fabric where each

element continuously sends back to all the others, stopping the glance on the endless relations of their interactions, and stopping them from going beyond: virgin land.

Yet, we must note that this screen is not satisfied with covering just the surface but operates an in-depth coverage. It is the garment that annexes what it covers. Already, the associated milieu had seemed to us to be so intimately united to the regime of some energy and information machines that we could not decide if it was nature or the machine itself. Simondon calls it techno-geographical. But the fusion of the technique and the landscape is particularly sensitive in the great projects of climatic transformation. Defying purely artificial processes of a linear and abstract type, such as the emission of silver iodine at high altitude, we envisage global adjustments where the introduction of a culture would change the rain rate, hence favouring a new culture which would in turn reform the rain rate in a cycle where nature would not be sovereign nor isolated but inserted in a functional scheme in the manner of an organ or a moment [75]. Similarly, in food production, we no longer have the submission of the ancient man who waited for his provender from the good will of the elements, nor Berthelot's dynamist inflexibility that saw us eating pills combined by chemical synthesis. We know that nature will always work more economically for food production than we ever will [76]. If we do not envisage making a very nourishing alga, the Chlorella, we have learned to cultivate it in transparent tube where it enjoys solar light and optimal quantities of nitrogen and carbon in a semi-artificial semi-natural mechanism where nature is, once again, annexed as an organ and as a moment.

Finally, it is not solely a question of annexation, but of true incorporation. Let us recall the synergy of the matter and the form in the dialectic machine. Let us particularly put forth the vastest example and the most startling of agricultural conceptions. The soil, for the static mentality, was indeed a matter to which the human being gave a certain imprint of his initiative, a form, but whose virtue he had to respect. By reaction, the dynamist artificialism meditated to do completely without it (Berthelot waited for the cultivated fields to stop disfiguring the countryside), or to make it into a pure receptacle, a neutral place where the vegetal would be put in contact with the products that we would have placed for its industrial growth. The dialectic mentality envisages an almost absolute co-penetration of the human and natural poles. It begins by recognising the originality of the soil, whose texture, far from being neutral, stimulates the chemical exchanges between the plant and the fertilizer, but uses it as it wishes, penetrating this texture with such substances as the Kryllium that put its very materiality in form. And we would dig deep into our synthetic products – fabrics, materials, and food – for one thousand similar cases of incorporations. It does not matter that a certain number of the examples put forth are less results than projects: they outline a future that is so near that they are already part of the world that we see and feel. And indeed, what matters here – let us underline it for every analysis that will follow – is less the face that nature has taken physically than the face it receives, in our minds, of the new mentality. It matters little that more than one invoked technique should be outdated: everything in the synergic world is so changing that the Kryllium and the Chlorella will probably not dominate tomorrow's agriculture. But they will make place to processes where the universe and the human initiative will be even more closely confounded.

In a word, the technical world, as it naturalises itself, henceforth makes nature technical by covering it with its extension, by annexing it as an organ and as a moment, by transmuting its very matter in its substance. It is no longer a third reign between man and nature, a metacosm according to Dessauer [77] because it does not join the two others by letting them intact. It is

more of a new unique reign that includes, that crosses the two others, substituting them by putting them into relations that reinterpret them, what we have called an improper name, improper because it does not express this unity, a *median* reality [78]. At the border of concreteness, there is no nature; there is no artifice, but an original, moving synthesis that we can also call an artificial nature or a natural artifice. If the urbanism of the future has 'silence areas' in store for us, and 'green bands', it will be, there again, in a view to network nature: there, it will function.

We see how superficial it would be to justify or criticise our technique by envisaging it as a means. When a reality takes on such invading dimensions, when it fills the sensitive world so well, in most cases it veils and even replaces every other truth, is it still a means? A landscape is not a means; it is the milieu [79], the world-around-us, the *Umwelt*. The concrete technique does not represent an intermediary, a medium that would stand between us and our goals beyond. Most of the time, it is the goal of our actions itself, and our actions end there. Every technical object taken alone evidently offers the means of an action of another object, but the network is the very world in which we are agitated or where we rest. And as it extends indefinitely into space through its synergies, and, using the process of concreteness, into time, the concrete technique not only forms our landscape, our *Umwelt*, but our horizon itself.

This affirmation is of an incalculable cultural consequence. Nature – Earth, Mother Earth, Demeter, Cybil, Isis, Physis, Thalassa, Desert, River, and Mountain – with its thousand other faces, has been the fundament of man's values since his very origins. The source of life, the maternal breast, blazing fire or fecund heat, flood and rise in water level, drought and beneficial rain, silt or loess, it had been even more fascinating and redoubtable, more sacred, that despotically it gave seven years of meagre cows for seven years of fat cows, as it sowed epidemics with one hand and healing with the other. It conveyed all the poetry, the visual arts, the rhetoric, the philosophies, and the liturgies, in a word, every humanism. When, after millennium of realisms, some forms of idealisms wished to underline the primacy of the mind, it remained present as either root or regret. The dynamic era of the machine could do nothing about it. By refusing it, it only served to exasperate the sentiment of every man of culture: Péguy could be left to his dreams of 'dying for the four corners of earth', for a 'carnal earth'.

As we have already said, our aim is not to sketch tomorrow's humanism. However, we must foresee that its poetry, plastic, rhetoric, philosophy and liturgy [80] will no longer play wallflower on old nature. In their images, they will no longer be able to invoke it as a horizon, if it is true that concrete technique is our horizon. But in no case will they be able to hide in the haughty interiority where they have found refuge during the idealistic transition: seeing the expansion that it supposes, a humanism never build itself on subjectivity, no matter how refined or moving.

Indeed, whatever we may do, the fecund cultural themes will be within the plan of this median reality where the new technical mentality imprisons us. Is this a wide enough field, one that is sufficiently deep in view of the former nature, to feed the untiring need for the renewal, for the creation of humanism? It seems so, because this reality is coextensive with the old mentality, even brining it new dimensions. If the technique did not go beyond its status of means, offering it as a horizon would obviously condemn us to the nonsense of a world where everything would only be the means-of-means. However, by merging with nature to create a median reality, landscape and horizon, concrete technique ceases to be a servant to become a cultural becoming in its being. Involving nature in its synergic totalities, it does not only present

utilities but *forms*, in the Goethe sense of what does not exhaust oneself in being sent back to something else, but offers a sense by itself, in its completeness.

2B. THE INSTITUTOR MIND

The idea of nature was so strong in ancient cultures that the mind was conceived on its model. When Descartes saw the soul as being a thinking thing faced to the extent, he was only speaking good sense, the good sense of every literate or illiterate man of his era. Seeing the visible and exterior nature, the mind was invisible and interior, consistent and sufficient. Its relations with the world had the ease of the rider on a horse, to use Plato's popular image.

We could think that ancient technique did not legitimise such views. The coarseness of casting processes and the fact that human, animal, hydraulic, an wind energies were passed through coupling systems where every distance and bifurcation causes considerable losses obliged the artisan to realise miracles of manual dexterity and plastic invention that, far from rendering him pure, would force him to seek ideas following very humble steps, through trial and error. 'Taking some off here, adding some there', says Philo of Byzantium about his catapults. This is how training was passed down from the master to his apprentice in those days. Thereby, we should expect that the philosophies of the era saw man as a whole of gestures through which a thought would search itself without ever managing to possess itself completely. This was not the case. Did the division of social classes mean that the philosopher could not be an artisan? In real fact, the ancient machine suggested a superior conception to all. Its use, manufacture and invention supposed very physical manipulations. However, once its technical form was completed, it seemed so elementary and so obvious that the mind could be under the illusion of having conceived it using the sole resources of his intuition (whether intellectual or sensitive, it is irrelevant) and his reasoning, independently from the gesture. The matter seemed a stubborn receptacle for the form and the gesture a declining execution of the idea [81]. The free man was careful not to get his hands dirty. The wise man looked for shelter in his mind, before or above things, because he was himself a sufficient, thinking thing.

The coming of dynamism only reinforced this distance. Breaking from empiricism, dynamism penetrated the technique of science, again humiliating manipulation. In Watts' machine we find the confluents of the researches of such researchers as Savery and Newcomen, but also of theoreticians such a Galilei, Torricelli, Guericke. When, in 1794, the Convention founds the first polytechnic school, the great Carnot and Monge call upon the inheritors of the *saeculum matheematicum*, Lagrange, Laplace, Legendre, and Fourrier. Thermodynamic, inaugurated by Sadi Carnot in 1824, will bring the idea that every thermal machine is reduced to the projection of a general theory. And this feeling will find confirmation in the increasingly numerous applications of chemistry and electricity (particularly since 1850) where it is difficult to differentiate what results from the physician from the technician. It is true that a plethora of German technicians reacted against this assimilation, triggering a general consciousness that led to – in 1875 – the foundation of the Munich Laboratory of experimental Technology. However, for the public at large and for most authors, technique continued to play its role of *applied science*. And it could have been any different. These still-abstract engines where each function was made on its own were presented as a stack of successively incarnated physical

laws. More than ever, the mind felt independent from the exterior manipulations of the conception of technical structures. Were the latter not the simple applications of truths that had been discovered through reasoning and intuition, sensible for empirics, intelligible for idealism, and whose systems pave the entire period? From the gesture, the exploring manipulation, technique considered as vulgar, the only residue was problems of execution to which science had not yet brought all its theoretical limpidity.

Concrete technique modified this state of things in-depth. In the presence of our engines and processes, the mind cannot have the illusion that manipulation and execution are indifferent and that the only things that matter are acts of intuition and reasoning, for it is obvious that synergy only occurs through pure reasoning. A ramjet, a Guimbal turbine, a pentode, a calculator or behaviour machine, a recent economic or climatic plan present a global structure, a total structure whose efficiency does not result from the successive action of elements, but of their interaction. The understanding of the object can then require, in certain cases – if not by right, at least by fact – that it should be completely finished. During the 1958 Brussels World Fair, the cover cladding the French pavilion pulled at the facades instead of leaning on it. This was only noted when the pavilion was completed. Grey Walter only noticed that the *Machina speculatrix* had unforeseen types of behaviour once the machine was at work. When we are not made to wait for a finalised object, we must at least have models. The architect equipped with formulas on the resistance of materials has never calculated as much as today. Still, he never worked so much on a scale model either. Indeed, the model alone allows him to define synergic structures such as parabolic hyperbolic in the material construction or the free plan in the spiritual conception of the building. This is even more the case when the architect or the inventor of a turbine work without a scale model, only with their drawing board. What happens then is that their work – insofar as it is synergic – presents itself not as a simple inscription of physical laws, but as a living, testing, manipulating research of a spatial, plastic configuration. And should they be required to leave for an instant the rulers and tracing to continue their meditation in an armchair, it is still a manipulation. The dialogue between the project and the object can become as mental as we want; the mind that defines a concrete technique is not conceived as a ruling reality that is solely intuitive and analytical. It is a labouring principle that finds its way through gestures that are sometimes imagined, often testing or winning, until the whole of the data achieves – either at once or in different steps – a new form, a new balance, one that is more comprehensible than the old one.

Clever minds seem to lodge a challenge against this theory. The current age would be characterised by the absorption of technique into science, and nothing is more stupid that the policy of patents protecting the inventors of engines, hence neglecting the inventors of ideas that are usually more fecund. The reign of the plastician and the manipulator, linked to the deficiencies of the ancient machine, would be over. And, if we need to establish a circuit, 'it is better to make a skilful application of static principles and of the calculus of variations to find the best possible circuit, than to work by trial and error [82]. Yet, talking in this way first implies that we leave the best part to the information machines; these nerves of a network that will continue to count its muscles, the energy machines, where the effort of configuration is obvious [83]. On the other hand, the act of configuration is primary, even for information machines. A circuit is neither a machine nor a machine-related system; it is an aspect, a cut on the object whose complete idea is the implementation of a situation where the spatial-temporal test (as pure as it can possibly be) leads the game. Consequently, if it is true that the technique is increasingly penetrated by science, if its leaps forwards are tightly conditioned by the progresses of fundamental research, if the policy of patents and subsidies should be led towards

long-term researches, science and technique are still very distinct from one another. Indeed, where one discovers laws, the other configures *objects in situation* that enforce these laws without being reduced to them. Therefore, nothing is more false than believing that the idea of creative manipulation belongs to the imperfections of primitive technique. To the contrary, since it is no longer mixed up with sweat, it appears to be linked to the institutor exercise of the mind, searching for its projects and ideas through more or less vague gestures. Finally, as we shall explore in the second part, we should not forget that science (which is close to concrete technique) is no longer 19th century science where it worked through intuition and reasoning and envisaged the mind independently from corporal steps, but it is a science that has – in turn – become dialectic, realising that it also implied manipulation.

And, once again, a character put in relief on a concluded case is universal. Having found ourselves to be labourers in the edification of the concrete machine related schemes, we realised that this had always been our role in the eotechnical and the paleotechnical, even if the ease of the era could have fooled us. Every technical instrument (as simple as it may be) is the fruit of an act of configuration [84] – more or less stereotyped or creator, or still, institutor depending on the situation [85] – that differs from the discovery and the application of a law, and supposes a spatial-temporal manipulation (that is direct then indirect) of the elements in situation. We saw more clearly than the artist (the other disinterested [86] institutor who had also started off from the gesture, from the chisel of the sculptor to the first word of the poet) and we realised that what we call an idea is only a vague project filling and determining an execution that Delacroix referred to as creative. Finally, psychologists and sociologists demonstrated that we proceeded in the same operative – we do not use the word empiric – manner when we build our laws and morals. Of course, it is not a question of insisting that concrete technique alone discovered the status of the mind labourer – we shall see that science, ethic, and art reached the same result, each in their own field – but it is possibly the most striking illustration, hence the most efficient culturally. In any case, this illustration is no stranger to the fact that every current philosophy and psychology repeats that we grasp within and on things, in and on our steps towards them. Thought is not a sufficient and initial phenomenon, it is a reprise that is constantly renewed and threatened, of a within on an outside.

Here again, we have nothing to recommend, but it seems obvious that in the future, it will be very difficult to conceive humanism – as all ancient cultures had done – in the manner of a retirement into the isolation of the creative mind. The only way that the thought can grasp itself does indeed seem to be if it turns itself towards these things to which it is now tributary in such a way that its contemplation will not consist so much in an autarkic silence than in the attentive deciphering of appearances and the operating engagement. This even seems to be its unique chance for true interiority. But is it not its death and that of all humanism?

In the vast area of culture (as we are solely focusing on the techniques), we must not forget that the new things towards which the thought moves are not dead objects or the means-of-means. They are a median reality where it finds its own realised structures, prolonging it and coming back to it to stimulate itself. Is a concrete technical form – through the intimacy of it is interrelation and the global reorganisations of its development, its crossing between nature and intention – anything else than the thought appearing in front of itself and receiving the most profound lessons? We had never clearly conceived that our psychological structure was not additive, analytic, but that it was global. The Psychology of the form is formed around 1912. We had never felt that our freedom was not limited to a possibility of choices between ready-made realities, but that it had the powers to remodel the real, to recast it, form and matter, in

truly novel structures. All the existential theories on the introducer power of freedom begin between the two great wars. Never before – before grasping itself as though forced to recuperate itself on the object that it introduces – had the mind guessed that it was not itself nature, but that it was a flaw, an emptiness-in-the-full through which movement and history enter. Just before the Second World War, Sartre offered to envision conscience as 'nothingness'. Here again, we cannot say that concrete technique on its own provoked these statements: pure science, art and ethics all have their original part. But technique gave them a face and showed them with a force that implodes them popularly, transforming them into a cultural blossoming.

In a word, everything happened as though the mind had discovered that it was dependent on its works as they had enough spirituality to reflect and stimulate these cerebral assembling, these complex behaviours, and to simultaneously encourage its behaviours to perceive its irreducible character of conscience, of distance on all the data, its mean to promote them. Hence, it is not unthinkable that it should contemplate at the very moment when it turns to the outside, by grasping the outside like a within [87].

2C. CLASSLESS SOCIETY

Ancient technique favoured the division of society in hostile classes. The static machine did not conquer poverty as much as it underlined it by allowing access to luxury by a lucky few. The dynamic machine put an end to rarity, triggering opposition between businessmen, technicians and working livestock. This fracture was more severe still because, if the old cleavage between the rich and the poor had something natural about it that made it bearable, the new cleavage resulting of artifice and the management of man by man seemed to be such a voluntary state that it locked away the worker in tasks so inhuman amidst a general scheme of humanisation that it was about to reinforce the fight of the classes everywhere that the great industry was to take control.

To believe some theoreticians, today's machine worsens this situation. It leads to the network, and what characterises the network is that it is suspended to its control centre. By destroying a power plant, a telephone or a television exchange, a region is paralysed. By ruling over a radio or television emitter, an entire country is broken up or galvanised. Russell [88] felt that the greatest danger of the future was if a handful of left or right-winged adventurers were to take control of the levers and, using an intermediary class of policemen that had been bought with privileges, would exploit a servile humanity. He detected such dangers in Hitlerism and Stalinist Communism.

Still, Russell understood the network in a dynamist perspective. He saw it as a suite of initiatives going off from a centre and of productions going back to a centre according to a strictly linear process. Yet, the concrete network has many centres. Because of synergy, elements are themselves secondary knots, and the secondary knots are main knots. In such a way that the top – insofar as there is one – has a relation of reciprocity with the base. By this, we do not wish to invoke the commonplace that, in a society, everything is tributary from everything, in the sense of Sully Prudhomme (where he would wonder about the mutual dependence between the butcher and the prince, since this dependence is compatible with the greatest of servitudes). We do not mean that this state of the machine supposes a generalised

qualification of the workforce, because in the linear systems of dynamism we can also foresee qualifications (albeit mind numbing and slaving), even when, beyond chain work, they rise up to intellectual tasks. There is an intelligence that is used to enlist instead of awakening, as national socialism proved in its day. But precisely, the interdependence and qualification in the dialectic network cannot be limited to an execution that has become sclerotic. As the objects to manipulate are synergic, an ever-growing number of workers are forced to access a critical knowledge, one that is inventive and that focuses on varied, wide wholes [89].

This is not a view of the mind, and proving this is the insistency of economists on the urgency of a type of training that (at each work position) should not be the narrow specialisation where many technical schools are still confined or the old general knowledge floating above or besides specialisations, but a training that should direct everyone, through his own speciality, towards the whole where it works, in such a way that the person can go beyond it sufficiently to be apt to at least grasp the reorganisations of the whole. The democratisation of studies that we are witnessing is not only a humanitarian measure (or else it would not have successfully completed) but it is a necessity of the concrete network. The latter supposes very high competences (we only need to think of the great universities, such as Princeton) but also a very large pool of comprehensive, inventive workforce, a need that goes so far that a certain lowering of the level of studies to generalise its access has even been suggested.

It follows that, contrary to Russell's opinion, a society of utter exploitation is incompatible with a developed, concrete technique. It is possible that a clique should take over a synergic network and destroy it, but not that it should develop it or even maintain it unless it progressively ceased to be a clique and favoured, against all odds, emancipation and reciprocity. This is what Stalinist society illustrates. The latter started off as a police dictatorship before moving – using the very logic of the technique it instigated and that was sliding from abstraction to concreteness – to a society where the critical mind and values of reciprocity ended up (probably despite and against the will of its promoters) demanding a more humane climate [90].

Anyway, concrete technique corrodes every class. If by that we understand any group of individuals sharing the same interests and defending them with some cleverness and pride, it goes without saying that human societies will always comprise classes. Yet, the word infers something else. It implies that the group in question opposes to the others, that it feels that it is *naturally* inferior or superior, that it attributes itself with an irreplaceable mission inscribed in the great scheme of things, even if this mission – like the Marxist proletariat – is to overthrow every partitioning. Yet, such a class – in the strong sense – is endlessly demolished, crumbling from the inside by the concrete machine. The latter gives place to a reciprocity and a reorganisation of function showing their contingence and preventing their sacralization into classes. We are witnessing a secularisation of the role. Until recently, a man was a greengrocer, an intellectual, or a military; an aristocrat, a bourgeois, a labourer; he lived in the city or was a peasant; he was a coloniser or was colonised. He has some memories of that, but the world in which he lives, the way in which he exerts his function increasingly forces him to only appear as a man, only a man, in the eyes of others and his own. There is no place for the stable aristocracies of the blood, money or investiture, but only for a general semi-elite from which a fluent super-elite [91] emerges, in the most varied places and according to extremely varied or momentary needs. Classes are endlessly re-forming, but they are constantly coming undone too, sometimes ceasing to be classes [92]. And we could say the same for nations. There is a ferment of unanimity in the dialectic network. Not only does the network force us to conceive ever-vaster political and economic wholes, but also (against all odds) it conjoins them increasingly

narrowly [93]. Let us recognise that the thinning of the class does not promise alone a cultural future. In the past, it was often a sign of fatigue, and today we denounce the lifelessness of some American milieus encouraged by the new technical mentality towards a lowering of the social barriers. However, a book like William Whyte's *The Organisation Man* [94] would tend to suggest optimism precisely through its criticisms. The book testifies of the stagnation – but one that is denounced, hence outdated – by an author and an audience. Concrete technique – since it includes social issues as one of its factors – propels it from within. A network built on the synergy of the machine and man favours *human relations* whose consequences can be egalitarian, even oppressive, but its necessities of invention force it – in the short term – to test them as such and contradict them. To pastiche a Heidegger formula, tomorrow's society will – by structure – endlessly question its structure itself. If it seems capable of promising itself a creative future, it is not because through ignoring unbalance, but because the latter (in virtue of the needs of differentiation and of reorganisation of the concrete network) will always be considered and undertaken.

2D. THE CONFIRMING LIMITATIONS

The above could lead us to think that concrete technique answers the first criteria of a viable civilisation: creativity [95]. But does it also satisfy to the second: self-regulation, or the capacity to re-establish balance when it is compromised? It seems obvious, as the object of a large number of our cybernetic structures is precisely ensuring homeostasis, and as the *feedback* has become a concept that is as familiar to economists and sociologists as to engineers. However, if we consider every one of the implications of a concrete network, we find that it faces a double threat from that point of view.

2D1. The difficult forecast

Old nature had its vices but its advantages too. Its course, envisaged at large scale in both time and space, was relatively self-regulating. With its simple laws of natural selection, of adaptation to the milieu, of compensation via anti-bodies, it always ended up returning health after plagues and the jungle after fires. Even human psyche - whether cradled or shocked - alternated declines and renaissances. At the opposite, if the synergic technique allows man (for the first time in history) to dominate his destiny by creating an artificial nature, if it governs the landscape, the conservation and propagation of the specie, the education, the work and even the opinion – hence eliminating the wrongful self-regulations at short term – it is not to say that it should succeed brilliantly in the long term.

We should fear that synergy, because of its very coherence, should lead to irreversible deteriorations in certain areas. This is not likely in machines per say, where a faulty programme can always be corrected. But it is the case for medicine where the dietary artificiality, the use of antibiotics, the accrued radiations could – in the long term – engender irreversible degeneracy. And it can be particularly feared in our economic, social, and educational plans. The global re-organisations of our exchange systems, opinion campaigns – including those that favoured mental hygiene in Scandinavia, social conformism in the USA, and bellicose in China

– could very well overlap their mechanisms of compensation seeing as their action is more concerted and extended.

We should thereby be able to forecast a long way away [96]. Yet, forecast is not easy in a synergic world because the clear vision of a concrete scheme supposes that its conception, or even its realisation is completed. To judge it, we must know the effect of each element on all the others, on all of them on the milieu, and inversely. We can still guess rather easily what a machine-related system is to become, for instance as to the resistance of materials, because the object – or its scale model – can be subject to tests (let us think of ventilating fans for scale models of planes or architecture) drawing a sufficient outline of its future. Nothing here prevents us from practicing a *lesting to destruction* that is rich in teachings. But the task becomes more complicated in medicine where we must rely on thin statistical prognostications to suppose the long-term effects of a radiation. And we are practically helpless in everything related to psyches, where no strict calculation, resistance or probability can help us. We are confronted to a paradoxical situation. More than any technique, synergy forces us to foresee, and its complexity prevents us from seeing where the forecast would be most useful.

No argument will allow us to exclude these pessimistic suppositions that require many restrictions. Firstly, we must not attribute every catastrophe in the future to the idea of synergy. Should western economy incur a great crisis one day, or even an impasse, the fault would not systematically fall upon the synergic will that increasingly animates it, but should fall upon the leftovers of a dynamist mentality that proved itself in the great crisis of 1930.

Then, it is excessive to think that forecast is impossible in an economical and psychological synergy. A global functioning prefigures, if not in its parts, at least in the approached totalities. On the other hand, despite its brisk returns, dialectic does not systematically have to be consumed for us to know where it leads. Hence, there is no need to despair that we are reducing the huge split separating our forecast in human sciences from the previsions that we enjoy in the physic techniques [97], particularly as we have shown an interest in these.

Finally, when we fear that synergy should get carried away in a monstrous, exclusive direction, we all too soon forget that it is not an idealistic construction and that the artificial nature that it built still includes eternal nature in a dialectic relation. The educator, the economist and the psychologist may plan insofar as their planning is concrete and that it corrects itself through the naturalness it assumes. It is in the diktats of dynamism that the cleavages could be definite rather than being reduced to more or less unhappy development phases.

Hence, if we cannot exclude the hypothesis of a severe, even fatal, disturbance in the psychological factors of a synergic network, the only means of prevention lies in the tightening and the extension of these synergies. The excesses of concreteness call for concreteness. That this should make us happy or unhappy, its limits confirm it.

2D2. Atomic violence

A second limitation of the concrete network comes from its most elaborate product: the atomic weapon. The latter is indeed a fruit. We can say that these engines converging the network into a point where it self-destructs do not belong to the synergic mentality and are

hence not a sequel of dynamism; the fact remains that this new technique is capable of combining the motor and informational synergies of an anti-airplane post or an intercontinental missile. Furthermore, we can say that it bears within itself the fabrication of engines of that type as a permanent possibility and threat.

We cannot stress the peril enough. It seems to lie in the fact, as Günther Anders [98] noted, that men seem inapt to think it. The masses only reacted to this sporadically. Politicians and military continue to speak and act as though they had traditional weapons between their hands, albeit more powerful. Even pacifists, who boast that they see the menace and want to share their clairvoyance, usually express themselves in outdated categories where there are more good sentiments than objective views.

This powerlessness is hardly surprising. Our imagination and our sensitivity are not capable of realising such a volume of destruction, of perceiving the monstrosity of an action where there is no tangible proportion between the effect (the catastrophe) and the cause (the turn of a key), where thousands of kilometres separate the aggressor from its victim, where the victim itself (as we saw in Hiroshima) does not feel to be the object of an aggression but rather of a natural cataclysm where there is no more hatred, no more passion, no more heat of the fight from the assailer or the assailed. In such a way that a being who is incapable of harming a fly – or in any case of cutting the throat of another human being – can demonstrate the technical serenity of a Truman before and after Hiroshima. Both our morals and our laws fail us if we qualify these means that no longer have an end, if not of the destruction of the means and the ends. And our vocabulary cannot even designate the process. It can provide us with the term war, which is improper, as we cannot speak of war when the victim is without resistance, when it is highly probable that there is no winner, or one that it so mutilated that he cannot recognise himself anymore. We are, both intellectually and affectively, completely helpless before the atomic weapon.

However, our engines of destruction are becoming so powerful that it is not easy to draw the limit to their territory, the information network between aggressors and defenders is getting so narrow, and the responses between the camps are so instantaneous that any atomic strategy seems to be deemed to failure both in time and space. Our nuclear armament offers us increasingly terrifying catastrophes, albeit increasingly improbable. We must hope that the impasses to which it leads will trigger, in a more or less distant future, a quick jolt to political conscience that will lay it to sleep forever.

In any event, and this is the conclusion that concerns our intention, atomic rockets will change nothing to the current process of concreteness. They can suppress it at any given moment, but they cannot slow or incurve its course. The fact that man not only knows that he is perishable (something that has always suited him), but that his culture and perhaps the entire humanity are perishable at any moment seems beyond his capacity of representation to give him a sentiment of a closed horizon, slowing down cultures and forecasting decadence. No, that whether human defence versus atomic defence should move to a plethoric armament or that it should force us – through a dialectic come-back – to a general disarmament and a lowering of borders, its sole cultural role – apart a possible destruction – will go to a reinforcement of the synergy – machine-related in a first while and economic, political and social in a second time.

We always come back to the idea that concreteness feeds concreteness. So much so that the dialectic schemes, with all the consequences that we recognised in the order of artificial nature are alone in inscribing themselves in the lineage of the reflected emergence of a culture.

* * *

The synergic technique so profoundly shaped the time and space in which we evolve, its structures command our gestures, thoughts, desires so intimately that it would not be impossible to deduce – from these general characters – all the other domains of our culture: of science, the art, and ethics.

But this way of doing could present a danger. It is not because two cultural sectors present similar traits that one has necessarily borrowed from the other, even if the other is more visible. They were perhaps inspired in a reciprocal enlightenment, unless they both arose from what we can call, along with the *Kulturgeschichte*, the spirit of the times, which has not come out of nowhere. It is the result of accomplished works. By crossing their influences, it elaborated an original synthesis of images, feelings, wills that then turn back to the works to give them, in the most varied sectors, some common traits. On the other hand, we must admit, with Marx, that technical conditions fundamentally command a cultural moment. However, we should add – as Marx does and as existentialist Marxism insists – that super-structures are original that they spontaneously react on infrastructures, and that they also count as the real causes (material, in Marxist language) of the situation [99].

This is why we are now going to discuss the humanist characters of our science, our art, our ethic, by envisaging them for what they are without attempting to take them out of our former analysis, even if we must encounter them at every turn.

Henri Van Lier

Translation by Paula Cook

Le nouvel âge, Ed. Casterman, Paris, 1962

Notes:

[1] *Technique et Civilisation, 1934 (translated from English, 1950). We owe the distinction between 'paleotechnique' and 'neotechnique' to Patrick GEDDES, Cities in Evolution, 1915. Mumford prolonged the paleontological vocabulary of the latter by defining a first phrase, 'eotechnical'.*

[2] *Cf. A. LBROI-OOTOHAN, Le gâte et la Parole, I. Technique et Langage, Albin Michel, 1964.*

[3] Slavery is a result of technical poverty while it encourages it at the same time. Crude slavery does not improve the machine. Furthermore, it is often incapable of maintaining it. Cf. Friedrich KLBMH, Technik, eine Geschichtle ihrer Problème, 1954. In the latter, we find the material of this note and the following, illustrated by an engraving and a quotation.

[4] Starting with the Odyssea, 'méchanaomai' means weaving, particularly in wrong part. Let us think of the French 'machiner' (to hatch).

[5] Machinisme et Philosophie, 2nd edition., P.U.F., 1947.

[6] Mumford stressed that glass also contributed to the rise of the western mind by favouring the impossible, objective observation of the stars, which had up to then been sacred, and the lunar worlds (in vitro), and by allowing man to see himself in the mirror that he perfects from the 13th to the 17th century, with the reflective and self-biographic consequences that we know. Paper allowed for the account book, the support of capitalism. Op. cit., pp. 118-122, 129.

[7] It is certainly attested at the end of the 12th century. However, some authors date it back to year 1000. This, by linking it to the founding of the Germanic empire and the Capetian kingdom, to the reform of Cluny and the first roman basilicas, to the musical revolution of Guy d'Arezzo (cf. Jacques CHAILLEY, Histoire musicale du Moyen Age) would mean that the origins of the 'Faustian' civilisation is a whole phenomenon that is – almost too – satisfying for the mind.

[8] Ernst JÜNGER, Traité du Sablier, 1954 (translation by H. Plard, Monaco, 1967).

[9] On the content of this paragraph, cf. Wiener, Cybernétique et Société, 1949 (translation 1952), pp. 208-210.

[10] Immediately in simple machines (lever, pulley, hoist, inclined plane), and indirectly in compound machines (potter's turn, loom).

[11] For the ancients, the contempt for technique is inspired by prejudices of social casts and by the withering of philosophers convinced of the superiority of the intelligible over the sensible (Plato, Gorgiaa and Lois; Plutarque, Archimedes; Seneque, Ad Lucilium; Saint Thomas of Aquina, Summa theologica). Similar judgement will pursue the artisans and artists until the Renaissance, as testified by Da Vinci's efforts to refute it. We find it again in the article 'Mécanique' of Richelet's French dictionary (1680): 'This word signifies what is opposite to liberal and honourable… Its sense is vile, ugly and not worth an honest, liberal person'. All this is theory. Ulysses claims that he built his nuptial bed; Socrates had philosophers' predilections for manual workers; and it is also an interest that is not solely practical but theoretical that we find in the Diversarum artium schedulae of the monk Théophile (11th century), in the Didascalicon of Hughes de Saint-Victor, in the writings of Robert Grosseteste, of Roger Bacon, Pierre de Maricourt (13th century). From this viewpoint, Aristotelianism marks a step back, and we shall have to wait for the end of the eotechnical era (the 17th century of Fr Bacon, Descartes, Leibniz, and particularly the 18th century of the Encyclopaedia) before the artisan is fully appreciated.

[12] Primitive legends are very harsh for the latter: Greek Vulcan limps, German Wierland is crippled, Jewish Tubalcain is a descendent from Cain, and we know of Prometheus misadventures, related to the trade. In the primitive, the blacksmith is usually a sorcerer. It is less of a unfavourable judgement on technique in general than on the arts of the forge, which were suspect to the pastoral, agricultural and marine people, and mysterious simply because it called upon a strongly sacralized element, fire.

[13]On these faults, cf. MUMFROD, op. cit., referring particularly to Werner SOMBART, Luxus und Kapitalismus, Munich, 1913.

[14] The encyclopaedia and the progress of sciences and techniques, Centre international de synthèse, P.U.F., 1952.

[15] More precisely, the thesis of Nef rests on the difference of dates that he notes between England – which is sheltered from war and whose rise begins in approximately 1785 – and the most advanced countries of Europe, theatres of military operations, where the movement only starts around 1815. In any event, the author rebels against the date of 1760 proposed by Toynbee the Elder. CL La Route de la guerre totale, Paris, 1949.

[16] Cf. Paul MANTOUX, La Révolution industrielle au XVIII

[17] See the texts in Fr. KLEMM, op. cit., pp. 188-195 and 253-257; or, more generally, Max WEBBR, Die Protestantische Ethik und der Geist des Kapitalismus.

[18] In actual fact, things were more complex. In his 1690 machine, Papin used a piston but did not anticipate a separation between boiler and cylinder. In his 1698 steam pump, Savery envisaged and realised this separation, albeit abandoning the piston. In his 1706 steam pump, Papin, aware of Savery's invention, used the separation but retrograded by replacing the piston of his first machine by a simple separation floater between the steam and the pumped water. Around 1710, Newcomen designed a steam pump with separation and piston. But it was still a single action pump (once lifted, the piston was brought down by the atmospheric pressure exerted on its superior

side) and the cylinder was used both for the expansion and condensation of steam, with considerable losses of energy of cold and hot in the same link.
In 1763, Watt, as he was repairing a Newcomen (machine) in Glasgow, offered to remedy to this wasting by maintaining the cylinder constantly at the same temperature as the steam. To achieve this, he wrapped it with a steam-jacket and decided that the steam condensation would take place in a recipient that was separated from the cylinder: the condenser. Once again, this machine was a single action machine. Finally, in 1782, he patented a double-action machine that applied the steam and the void of the two sides of the piston. On the other hand, he stopped the steam before it reached the end of its course with a throttle-valve, the rest of the thrust being obtained by expansion. The previous year, he had devised a system (the sun-and-planet motion) to transform the alternative movement of the piston in the rotary movement of an axel that could activate several machines.

Watts did not build high-pressure engines. Nor did he build machines without condensers (with open air exhaust) that he had announced from 1769, and that suppose high pressures. Yet, this machine was so deeply engraved in the spirit of his discoveries and was about to follow so quickly that the question arouse if, susceptible as he was, he had not given up because the principle was already included in Jacob Leupold's Theatrum Machinarum (1725), strictly theoretically as it may have been. Papin had already told Leibniz that 'the action of the pressure is not limited like the action of suction', albeit in the very narrow framework of his first machine.

[19] We are well aware that the abandon of the spectacle is linked to an internal evolution of western painting that started with the Renaissance, and that tended towards a pure painting. But even that evolution can be explained – amongst others – by the de-sacralization of appearances favoured by the decadence of the craft industry. Hence, in the Conversations with Charbonnier (Plon, 1961), Claude Lévi-Strauss defines impressionism as an effort 'to exploit more intensively… the weakened area that was still available' and to 'teach men to be content with the small change of a nature that was forever gone for them' (quoted by Jean Peil, 'Critique', n° 167).

[20] On the relations between aesthetics and the machine in the 19th century, cf. Pierre FRANCASTEL, Art et technique, 1956.

[21] Cf. MUMFORD, Technique and civilisation, 1934 (translation, 1950), pp. 141-193. On the English school, early 20th century, that we see Graham Greene's childhood memories.

[22] Cf. Fr. SCHNABEL, Deutsche Geschichte im neunzehnten Jahrhundert, Freiburg i. Br., 1930, vol. III : Erfahrungswissenschaften und Technik. Yet, we should not forget that England made a very modern effort to lick its wounds by creating highly impartial commissions that were not only economic but also

[23] The steam machine was doubly centralising: it was so much larger that it was more efficient and, like all former sources of energy (whether human, animal, hydraulic or wind-operated) it used a system of mechanical transmission where the tiniest spatial distance led to enormous losses.

[24] Yet, we find in the pseudo-Aristotle's Mechanical problems (chapter 1): 'is extraordinary what is accomplished naturally without us knowing the causes; in the same way, what is done against nature, using art, in view of the human needs: in many aspects, nature works against the needs of man, for it knows its own path'. The 'agains't that we find here, traditional in Greek philosophy, is very innocent: it is not a question of disfiguring nature but, through imperceptible 'modifications', harmonising it with human needs.

[25] Cf. Friedrich DESSAUER, Streit um die Technik, Herder, 1959.

[26]Friedrich DESSAUER, who insists on the doctrinal deficiency of technicians, attributes it to the anteriority – in every area – of specific problems over general problems. We feel that the explanation is too short.

[27] These phenomenon are as linked to a key status of the machine than to Stalin's political deviation. In any event, they point to the insufficiency of Lenin's slogan: 'Socialism + electrification = communism'.

[28] The cenacle of Columbia University, where the personality of (economist and theoretician of the machine) Thornstein Veblen was about to dominate, was to the dynamic machine the equivalent of the encyclopaedia to the static machine: throughout surveys, it explains energetism, rationalises it, while at the same time it concludes it and announces a new age.

[29] If we were to doubt the transformations that the suppression of rarity comprises, or more radically the possibility of a society where rarity would no longer rule, we should read the interesting article (Diogène n° 20), in which Georges Dumézil comments the sermon on the inconveniences of richness (Easter 1646) by Father

Francesco Davila to the Inca whose language, conceived in a regime of abundance and mutual aid, did not have words setting a rich person apart.

[30] Germans make a difference between Antreibsmaschinen (Kraftmaschinen) and qualitätschaffende Maschinen ; we feel that 'moulding' is less ambiguous than 'quality'.

[31] Cf. G. ANDERS, Die Antiquiertheit des Menschen : Die Welt als Phantom und Matrize, Munich, 1956.

[32] Others will speak of rationalisation (Lilje), objectivism (Simme), which we feel is more equivoque.

[33] This last theme was developed by JASPERS, La situation spirituelle de notre époque, 1930 (translation 1951).

[34] Let us recall a few names: Ortegat y Gasset, Duhamel, A. Huxley, Spengler, F.-G. Jünger, Rustow, Gabriel Marcel, Thibon, De Corte...

[35] Atomic energy, which is centralising in its modes of production and requires considerable gatherings of men and material, is decentralising in its modes of utilisation, where its feeble volume (easily transportable) makes it independent from the mining site.

[36] Du mode d'existence des objets techniques, Paris, Aubier, 1958.

[37] We shall remember that its aim was to come as near as possible to the ideal cycle of any thermal machine defined by Carnot in his Reflections on the power of fire (1824), a work of pure theory.

[38] Cybernetics or Control and Communication in the Animal and the Machine, 1948 (2nd edition, New York, 1961).

[39] Cf. Gilbert SIMONDON, op. cit., p. 22.

[40] Cf. Ken W. PURDY, An Entirely New Engine, The Atlantic Monthly, July 1960.

[41] SIMONDON, op. cit., 28-46.

[42] That of oil under pressure for instance, of which Simondon stresses that it both lubricates the generator, isolates the coiling, conducts the heat of the coiling to the carter, opposes to the entry of water in the latter through the gland of the axel since its pressure is higher to that of the water outside. Op. cit., p. 54.

[43] SIMONDON, op. cit., p. 55-56.

[44] Here, we speak of the vulgar Aristot elianism that alone influenced the vision of the ancient machine, and that Aristotle is far from avoiding in his manner of speaking. For the most subtle aspects of his theory, cf. DUBARLE, La causalité dans la philosophie d'Aristote, in Histoire de la philosophie et métaphysique, Desclée De Brouwer, 1955. The distinction between matter and form is even more precise in this Kantian definition of the machine: 'ein Körper, dessen bewegende Kraft von seiner Figur abhängt', Metaphysische Anfangsgründe der Naturwissenschaft, 1786. Cuvier also said that machines are vivified geometry.

[45] As long as we will not have an atomic engine, we will not be capable of converting nuclear energy into kinetic (machine-related) energy any other way than going through caloric energy, which includes a great yield loss. Any new technique first undergoes an abstract stage, even in an era of concreteness. However, synergic schemes already intervene, either in the overheating that improves the steam cycle, or in the self-regulation that improves the fuel cycle.

[46] Obviously, this is not applicable to certain slow engines(such as the heavy factory Diesel), which are specifically designed to burn very diverse and unrefined oils. However, we could show how, even in this case, the matter of the fuel and the machine-related structure are more or less intimately linked.

[47] As every good observer of the machine will have noted, technician man is not only preoccupied with productivity. He is very sensitive to the character of the objects that he builds. There is a style of the machine. Cf. Manfred SCHRÖTER, Philosophie der Technik, Munich, 1934.

[48] In summary, calculators can both be analogical or logical (numeric, digital), and exploit the spatial connection of as many organs as there are operations or the sequential connections of a few organs according to a programme. This gives way to four great types, of which the most used are the analogical machines that analogically calculate through a spatial connection, and the logical machines (or computers) that calculate numerically (digitally) using a programmed sequential connection. Cf. John VON NEUMANN, The Computer and the Brain, Yale University Press, New Haven, 1958.

[49] Through a metallic wire linked to the mobile magnet and plunging – according to the needs – into a conductor bath with potential gradient. Cf. W. R. ASHBY, Design for a brain, Chapman and Hall, 1952.

[50] Struck by governing machines (governor = regulator), and that the latter rest above all on the transfer of information, Wiener gave the name cybernetic (kubernètès = pilot) to the theory of information in general. The title of his first book is explicit in this sense: Cybernetics or Control and Communication in the Animal and the Machine.

[51] Currently, there is an ambient severity for the toys of the author of The living Brain. For instance, Silvio CECCATO, Cybernétique, 'Diogène', n° 53.

[52]We shall find a pertinent critic of the hasty assimilations made by cyberneticists between machines and living in R. RUYER, La Cybernétique et l'origine de l'information, Paris, 1954.

[53] For two elements, there are seven possible modes of behaviour: 1) A and B are inactive; 2) A is active although B is not; 3) B is active although A is not; 4) A and B are active; 5) A drives B; 6) B drives A; 7) A and B reciprocally drive each other. For a thousand elements, there are around 10.300.000 possible behaviours. This – we shall note – does not allow for calculating the number of possible behaviours of the human brain with its billions of cells, as we should have to define how many of these cells are homologous, and if every interconnection is possible. Cf. GREY WALTER, op. cit., pp. 86-87.

[54] The brain functions with a very reduced voltage and a spatial disposition, and this double economy seems to condition the apparition of life and consciousness. To come closer, we should have to replace – in our cybernetic engines – the crude connections of thermion lamps for electrochemical connections as elegant as those that the biologist encounters. If we were to succeed, we would have entered a technical new age, that of the living machine. Although the hypothesis cannot be excluded in a more or less distant future, we should not reflect on this in this study of our present cultural situation.

[55] It seems that every efficient communication of a structure can be called an information, and it is not illegitimate to say that the variations of the barometric pressure 'inform' the recording barometer or that sound waves, which are electrically transmitted via the telephone or the radio 'inform' receptor machines or recorders. This objective definition of the information – which is in conformity with the primitive sense of the word – also has the immense advantage of being accessible at measure. If information is essentially the progress of an efficient structural order, it will be the opposite of a 'de-structuring', of a diminution of order. This diminution of order bears a name in physic: entropy. Hence, the information can be considered as the opposite of entropy, and will be as measurable as the latter. Cf. Raymond RUYER, La Cybernétique et l'Origine de l'information, Paris, 1954, p. 9, demonstrating the dangers of the physic definition of a phenomenon that is initially psychological.

[56] Let us recall that the 19th century did not clearly conceive the physical originality of the order, which he only considered according to the energy. The first principle of thermodynamic showed that an engine requires a cold source and a hot source, meaning some sort of arrangement of quick and slow molecules. The second principle of thermodynamic stated that an isolated system tends to its most probable state, meaning that the quantity of disorder – or entropy – could only increase. The theory of information allows to see that this concept was not necessarily limited to the energetic, as it serves to measure the 'quantity of information' of a message. The latter is even greater that the message is more or less uncoordinated, less 'probable'. It increases in arithmetical proportion when the improbability increases in geometrical proportion. Hence, it is equivalent to the logarithm of improbability or, if we prefer, the negative logarithm of probability – just like the entropy of a system is equal to the positive logarithm of its probability.

[57]Ancient myths prove the desire to construct a living being – particularly a man. In the German legend, Saint Albert the Great is less a saint or a savant than the inventor of a Homunculi that opened his door, saluted and introduced guests, until the day when Saint Thomas Aquinas, who was welcomed by its master, destroyed the sacrilegious creature with a wooden stick. Cf. DESSAUER, op. cit., p. 121.

[58] We shall remember the Chestertionian apologue of the man who finds a rope and a telephone in the desert. What can be done with a telephone but phone? There are a thousand uses to a rope. 'To uproot one of these simple, venerable kitchen utensils, we would have to rip out one thousand roots, and not just one. Almost all of these old institutions are quadruped – some centipede'.

[59]Both term and theme endlessly come back in the work of Gilbert Simondon, op ? cit.

[60] The example of Huston for space flights speaks for itself.

[61] From this viewpoint, it is instructive to follow the evolution of the IBM organisation.

[62] Under this angle, there are no differences between States (these gigantic firms) and giant firms (these supranational states), except that the mutation is not as easy for the former.

[63] Cf. Paul FITTS, Engineering Psychology and Equipment Design, in « Handbook of Experimental Psychology, edited by S. S. Stevens, London-New York, 1951.

[64] Cf. We find an echo of these new preoccupations in A. CHAPANIS, Research Techniques in Human Engineering, Baltimore, 1959: 'Two centuries ago, man was no more than a complicated system of levers and nervous and blood vessels. Fifteen years ago it was only a servo. Now, it is no more than a channel conveying information. Call it a machine if you like, but do not underestimate him when you experiment on him. It is a non-linear machine; a machine programmed with a taping that you do not know; a machine that endlessly changes its programming without warning you; a machine that seems to be particularly subject to background noises; a machine that thinks, that has attitudes and emotions; a machine that can try to device your efforts to discover its functioning, - something that it sometimes manages brilliantly', pp. 15-16.

[65] We still neglect the hypothesis of a living machine, which does not seem to concern today's humanism. Cf. note 54.

[66] Cf. R. RUYER, op. cit. et Structures des automates et liberté, in 'Structures et Liberté', Paris, 1958, where we find such happy formulas as: 'man is an automaton once that he assembled himself using a conscious effort, but not as long as he is assembling himself. When I do a mental calculation, I am necessarily both machine and engineer'.

[67] The role of questioning is well illustrated by the to-and-fro of questions and answers between the machine and the operator with the electronic file; the role of the project appears at best in the 'operational research' where, according to the aims of a Chief of Staff, every form of technical exploration of the situation is enforced, leaving the decision to the commandment.

[68] Sir John Thomson feels that we have not enjoyed every possible party of domestication. Since the antiquity, domestication has not progressed much. The best orange-collecting machine is probably the monkey. Cf. L'Avenir prévisible, Calmann-Lévy, 1958.

[69] True invention is not a honing, nor an adjunction. It comprises the leap from one form to another, where the novel situation of elements cannot be conceived before the problem is solved. Cf. SIMONDON, op, cit., pp. 50 to 60.

[70] On productivity, cf. MUMFORD, op. cit., 103 to 237.

[71] Cf. amongst one thousand other examples, Colloquium on the project of an African Asian common market, published in 'Correspondence d'Orient', issue n° 1, particularly the communications between professors Berque and Cerulli, and Henri Haustrate.

[72] It goes so far that the constraint and the talent (negligible factors in 19th century economy where homo oeconomicus defined himself by exchange and competition) today take on a meaning that is not solely moral but specifically economic. Cf. Fr. PERROUX, Economie et Société: Contrainte, Echange, Don, P.U.F., 1960.

[73] There are numerous interpretations of Heraclites, each more hazardous than the next. However, they all stress the obedience of phenomenon to a Logos, as unsettling as we imagine it to be.

[74] Cf. Georges LUKACS, the present situation of critical realism that pertinently opposes naturalism and realism, 1957 (translation N.R.F., 1960).

[75] This principle is never clearly shown but is underlying in George Thomson's foreseeable future (1955, English translation for Calmann-Lévy, 1958), where we find ampler developments on the examples put forward here on rain, Chlorella and Krylium.
[76] It is suggestive to compare the difference in mentality that separates two declarations by scholarly that were also scientists: 'One day will come when everyone will carry his own nitrogen tablet, his own little lump of fat, his own little piece of starch or sugar, a little jar of aromatic herbs blended to personal taste… all of which will have been manufactured economically and in inexhaustible quantities by our factories'. (Berthelot, Science et Morale, Calmann-Lévy, 1897), and: 'If the taste of mushrooms persists – and it will certainly persist – it will probably be easier to grow them than to manufacture them' (THOMSON, op. cit., 1955).

[77] Friedrich DESSAUER, Streit tun die Technik, Kurzauffassung, Herder, 1959, that contains the essence on his philosophy der Technik, dated 1934.

[78] The word 'technique' has expressed many a different reality throughout the ages. In a first while, Socrate's and Plato's 'technè' designates a property (not of objects but of man) that possesses an operative virtue: it belongs to the world of the static machine where the worker is the essence and is only prolonged by the instrument. Secondly, the word qualifies engines (spatial) and processes (temporal) as they become autonomous, replacing man. However, the objects, the actions, the problems and the solutions hence qualified remain individual and do not yet form a domain. Thirdly, the technique, since the late 19th century, increasingly designates the domain of technical objects and processes envisaged as a totality: from 1877, Ernst Kapp's Grundlinien einer Philosophie der Technik use the word in that sense. (On the three former acceptations, cf. DESSAUER, op. cit.). Currently, the adjective can qualify our world in general. The technique is no longer a kingdom in our universe but has become a dimension, an essential property of the universe itself.

[79] Let us think of the 'technical milieu 'described by Georges Friedmann.

[80] Here, we use the word in its religious and profane meaning. It then covers every collective rite where humanism expresses and founds itself.

[81] Like Aristotle after Plato insists in his theory of the form, principle of perfection, imprinting in a matter, principle of imperfection and of numeric multiplication. Dante will also say: perch' a risponder la materia è sorda (Par. I, 129).

[82] Cf. WIENER, Cybernétique et Société, 1949 (translation Deux Rives, 1952), pp. 153-154; 163-164; 219.

[83] Let us go back to the outline of the recent Wankel motor, supra p. 41.

[84] The French language lacks a word expressing the technical act that the Germans call Gestaltung: 'training', 'conformation', 'configuration' mark the result rather than the action. 'Arrangement' and 'disposition' lead to think that we are talking of elements that were already defined and that would only require combining; 'forming' suggests the impression of a pre-conceived idea into a matter. We are left with 'act of configuration'. We shall wonder if this defect of vocabulary is at the root of the French equivoque on applied technical science, or if to the contrary the equivoque explains the verbal deficiency.

[85] We prefer 'instauration' to 'creation' because the word marks that it is about the production of a new being (Etienne Souriau), while at the same time this novelty is the result not of a demiurge but of a labourer-being.

[86] The wording is unfortunate. It leads us to think that the artist is disinterested, whereas he can be quite greedy (Rubens), and that the technician is interested, although he often acts disinterested, just like the artist. Instead of making the distinction between 'interested' and 'disinterested' we should be able to – like in German – distinguish 'with finality' (mit Zweck) from 'without finality' (ohne Zweck). Indeed, Kant clearly opposes Ziel. The human goal that man pursues and that, both in technique and in art, can have no relation with the work (glory, gain, proselytism), and Zweck, the instrumental finality whose work is the means, and the technical object is alone in possessing (and an art like architecture in that that it is technical). We should thereby say that, in opposition to the artist, the configurator without instrumental finality, the technician is an instrumental configurator. This shows that his activity does not necessarily proceed from economic or vital needs and can sometimes – very often even – come from the specifically human desire of introducing order where there is none.

[87] Günther Anders maintained that today's man would feel a sort of shame faced to the machine, the shame of Prometheus (prometheische scham) in front of his most perfect creature… shame of his body, shame of being born instead of having been built. We have probably started to transform our anatomy and our physiology (let us just think of vitamins, stimulants, tranquilisers, contraceptives, and to the diverse sort of transplants), and our organism has also become somewhat artificial. Yet, these improvements are very little in comparison to the brilliant progresses of the machine. In such a way that it is currently our dated body (antiquary) that represents an obstacle to space flights (hence the necessity of a training), it is the slowness of our brain that prevents us from benefiting from the electronic calculators, etc. From there, notes Anders, the need of the most industrialised of our contemporaries to align with the machine. The proof lies with make up, as the latter, in some countries, extends from the nails to the smile (Cf. Die Antiquiertheit des Menschen, Munich, 1958). And perhaps there is some of that in every mechanised societies, particularly in those that moved from industrialisation without having known a coherent and deep preliminary culture (such as America and Scandinavia). But we should not draw the conclusion that we are ashamed of ourselves and that we have given up Protegra's' pretension of being the measure of all things. For man is as much his products and his projects than his body and his brain, particularly when his products and projects become his prolonged body and brain. And indeed, the reverential fear in front of the machine, which was yesterday the choice of essayists, seems to be rapidly vanishing.

[88] Bertrand RUSSELL, Science, puissance, violence, Bruxelles, 1954.

[89] It is assuredly to designate this plurinodal structure that terms like polyarchy (Dahl and Lindblom), polyhierarchy (Louis Armand), polysynodie (Michel Massenet), etc. are currently blossoming.

[90] Cf. Isaac DEUTSCHER, La Russie après Staline, Le Seuil, 1953.

[91] Furthermore, the notion of elite, and consequently the notion of 'social promotion' are completely outdated. Our interdependent society has nothing to do with yesterday's conic societies where one was forced to climb up or down, where the base obeyed the tip or the tip obeyed the base. Thinking about it, careerism and talentism are the backward sequels of the dynamist era. Cf. G. COHEN-SÉAT et P. FOUOEYROLIAS, L'action sur l'homme : Cinéma et télévision, Paris, Denoël 1961, where the authors attribute to the filmic image what we feel is the result of the general structures of the contemporary world.

[92] We know enough of the adoption of middle class attitudes by the labourer, which triggers the despair of the trade unionist, and in return, the democratisation of the bourgeois in clothing, pleasures, and morals. Both movements were commanded by the participation to the same technical world. Perhaps more important from a humanist viewpoint (liturgical, poetic, artistic) was the disappearance of the divide between city and countryside, as they were assimilated one to the other via means of diffusion and communication, and more still by the exploitation of the soil using processes transforming the field into a factory and the peasant into an engineer. Finally, the feeling, of equality that the colonised no longer doubt in relationship with yesterday's colonisers is also owed to the fact that the technical object confers power to anyone who has assimilated (or who knows that he will be able to assimilate) the handling.

[93] Cf. Pierre URI, Dialogue des continents, Pion, 1963.

[94] New York, 1956 (Translated from American English, Pion, 1959), particularly in the chapters on Park Forest, a suburb of Chicago.

[95] This essential notion that we find a little everywhere in the sciences of today's is well illustrated in MASLOW, Motivation and Personality, New York, 1954; inspired by Bergson but deeply transformed, it supports the research of J.-L. Moreno for more than thirty years. Cf. Fondements de la sociométrie, P. U. F., 1954.

[96] Hence, there are around 300 engineers working for Bell Telephone who are in charge of imagining the situation in the ten or twenty years to come. We know that the object of the Centre International de Prospective is to 'study the technical, scientific, economic and social causes that accelerate the evolution of the modern world and the prevision of the situations that could arise from their conjugated influences'.

[97] Cf. for example J. FOURASTIÉ, La Prévision de l'évolution économique contemporaine, Diogène n° 5 and most of the author's other works.

[98] Der Mann auf der Brücke, Tagebuch aus Hiroshima und Nagasaki, Munich, 1959, to which we shall borrow the substance of this paragraph and the next.

[99] Cf. André GORZ, La Morale de l'Histoire, Le Seuil, 1959.