

Introduction

The purpose of this study is to attempt to stimulate awareness of the significance of technical objects. Culture has become a system of defense designed to safeguard man from technics. This is the result of the assumption that technical objects contain no human reality. We should like to show that culture fails to take into account that in technical reality there is a human reality, and that, if it is fully to play its role, culture must come to terms with technical entities as part of its body of knowledge and values. Recognition of the modes of existence of technical objects must be the result of philosophic consideration; what philosophy has to achieve in this respect is analogous to what the abolition of slavery achieved in affirming the worth of the individual human being.

The opposition established between the cultural and the technical and between man and machine is wrong and has no foundation. What underlies it is mere ignorance or resentment. It uses a mask of facile humanism to blind us to a reality that is full of human striving and rich in natural forces. This reality is the world of technical objects, the mediators between man and nature.

Culture behaves towards the technical object much in the same way as a man caught up in primitive xenophobia behaves towards a stranger. This kind of misoneism directed against machines does not so much represent a hatred of the new as a refusal to come to terms with an unfamiliar reality. Now, however strange this reality may be, it is still human, and a complete culture is one that enables us to discover that this stranger is indeed human. Still, the machine is a stranger to us; it is a stranger in which what is human is locked in, unrecognized, materialized and enslaved, but human nonetheless. The most powerful cause of alienation in the world of today is based on misunderstanding of

the machine. The alienation in question is not caused by the machine but by a failure to come to an understanding of the nature and essence of the machine, by the absence of the machine from the world of meanings, and by its omission from the table of values and concepts that are an integral part of culture.

Culture is unbalanced because, while it grants recognition to certain objects, for example to things aesthetic, and gives them their due place in the world of meanings, it banishes other objects, particularly things technical, into the unstructured world of things that have no meaning but do have a use, a utilitarian function. Faced with such a marked defensive negative attitude on the part of a biased culture, men who have knowledge of technical objects and appreciate their significance try to justify their judgment by giving to the technical object the only status that today has any stability apart from that granted to aesthetic objects, the status of something sacred. This, of course, gives rise to an intemperate technicism that is nothing other than idolatry of the machine and, through such idolatry, by way of identification, it leads to a technocratic yearning for unconditional power. The desire for power confirms the machine as a way to supremacy and makes of it the modern philtre (love-potion). The man who wishes to dominate his fellows creates the android machine. He abdicates in favour of it and delegates his humanity to it. He tries to construct the thinking machine and dreams of being able to construct the willing machine or the living machine, so that he can lag behind it, without anxiety, freed from all danger and exempt from all feelings of weakness, while enjoying a vicarious triumph through what he has invented. In this case, then, once through an imaginative process the machine has become a robot, a duplicate of man, but without interiority, it is quite evidently and inevitably nothing other than a purely mythic and imaginary being.

Our precise aim is to show that there is no such thing as a robot; that a robot is no more a machine than a statue is a living being; that is merely a product of the imagination, of man's fictive powers, a product of the art of illusion. Nevertheless, the notion of the machine in present-day culture incorporates, to a considerable extent, this mythic representation of the robot. No cultivated man would allow himself speak of things or persons painted on a canvas as veritable realities with an interior life and a will, good or bad. Despite this, the cultivated man does allow himself to speak of machines which threaten mankind, as if he were attributing to these objects a soul and a separate and autonomous existence which grants them the possession of feelings and of intentions towards mankind.

Our culture thus entertains two contradictory attitudes to technical objects. On the one hand, it treats them as pure and simple assemblies of material that are quite without true meaning and that only provide utility. On the other hand, it assumes that these objects are also robots, and that they harbour intentions hostile to man, or that they represent for man a constant threat of aggression or insurrection. Thinking it best to preserve the first character, culture strives to prevent the manifestation of the second, and speaks of putting the machine in the service of man, in the belief that reducing it to slavery is a sure means of preventing rebellion of any kind.

In fact, this inherent contradiction in our culture arises from an ambiguity in our ideas about automatism--and this is where the hidden logical flaw lies. Idolators of the machine generally assume that the degree of perfection of a machine is directly proportional to the degree of automatism. Going beyond what can be learnt from experience, they suppose that an increase in and improvement of automatism would lead to the bringing into oneness and mutual interconnection of all machines--the creating of a machine made up of all machines.

Now, in fact, automatism is a fairly low degree of technical perfection. In order to make a machine automatic, it is necessary to sacrifice many of its functional possibilities and many of its possible uses. Automatism, and that

use of it in the form of industrial organisation which we call automation, has an economic or social, rather than a technical, significance. The real perfecting of machines, which we can say raises the level of technicality, ~~has nothing to do with~~ ~~does not correspond to~~ an increase in automatism but, on the contrary, relates to the fact that the functioning of the machine conceals a certain margin of indetermination. It is such a margin that allows for the machine's sensitivity to outside information. It is this sensitivity to information on the part of machines, much more than any increase in automatism that makes possible a technical ensemble. A purely automatic machine completely closed in on itself in a predetermined operation could only give summary results. The machine with superior technicality is an open machine, and the ensemble of open machines assumes man as permanent organizer and as a living interpreter of the inter-relationships of machines. Far from being the supervisor of a squad of slaves, man is the permanent organizer of a society of technical objects which need him as much as musicians in an orchestra need a conductor. The conductor can direct his musicians only because, like them, and with a similar intensity, he can interpret the piece of music performed; he determines the tempo of their performance, but as he does so his interpretative decisions are affected by the actual performance of the musicians; in fact, it is through him that the members of the orchestra affect each other's interpretation; for each of them he is the real, inspiring form of the group's existence as group; he is the central focus of interpretation of all of them in relation to each other. This is how man functions as permanent inventor and coordinator of the machines around him. He is among the machines that work with him.

The presence of man in regard to machines is a perpetual invention. Human reality resides in machines ^{as} human actions fixed and crystalized in functioning structures. These structures need to be maintained in the course of their

functioning, and their maximum perfection coincides with their maximum openness, that is, with their greatest possible freedom in functioning. Modern calculating machines are not pure automata; they are technical beings which, over and above their automatic adding ability (or decision-making ability, which depends on the working of elementary switches), possess a very great range of circuit-commutations which make it possible to programme the working of the machine by limiting its margin of indetermination. It is because of this primitive margin of indetermination that the same machine is able to work out cubic roots or to translate from one language to another a simple text composed of a small number of words and turns of phrase.

It is also by the medium of this margin of indetermination, and not by automatisms, that machines can be grouped into coherent ensembles so as to exchange information with each other through the intermediacy of the human interpreter as coordinator. Even when the exchange of information between two machines is direct (such as between a pilot oscillator and another oscillator synchronized by impulses), man intervenes as the being who regulates the margin of indetermination so as to make it adaptable to the greatest possible exchange of information.

Now, we might ask ourselves who can achieve an understanding of technical reality and introduce it to our culture? It is only with the greatest difficulty that a man attached to a single machine by his work and the routine actions of every day could arrive at such an understanding; an accustomed relationship does not promote this understanding, because doing the same thing over and over blurs, in the stereotypy of acquired gestures, any awareness of structures and function. The fact of managing a business that uses machines, or of owning one, offers no greater likelihood of understanding than does working in one; it creates abstract attitudes towards the machine, causing it to be viewed, not in its own

right, but in terms of its costs and the results of its operation. Scientific knowledge, which sees in a technical object the practical application of a theoretical law, ~~is not on the proper level of technical awareness either.~~ ^{is not on the proper level of technical awareness either.} ~~is not on the proper level of the technical domain either.~~ Rather, it would seem that the attainment of the understanding in question ^{could} be the achievement of an organization engineer who is, as it were, a sociologist or psychologist of machines, a person living in the midst of this society of technical beings as its responsible and creative conscience.

In order to restore to culture the really general character which it has lost, it must be possible to reintroduce an understanding of the nature of machines, of their mutual relationships and their relationships with man, and of the values involved in these relationships. This understanding necessitates the existence of the technologist or mechanologist, side by side with the psychologist and the sociologist. Furthermore, the basic systems of causality and regulation which constitute the axioms of technology should be taught universally in the way that the basics of literary culture are taught. An introduction to technics should be put on the same level as scientific education. It is as objective as the use of the arts and it influences practical applications as much as does the theory of physics; it can arrive at the same degree of abstraction and of symbolization. A child should know the meanings of self-regulation or positive reaction as well as he knows mathematical theorems.

This cultural reform carried out by a process of broadening rather than destroying, could give back to present-day culture the real regulating power it has lost. As the basis of meanings, modes of expression, proofs and forms, a culture establishes regulatory communication among those who share that culture. A particular culture arises from the life of the group and, by furnishing norms and systems, informs the actions of those who insure the exercise of authority. Now, before the great development in technics, culture incorporated by virtue of

systems, symbols, qualities and analogues, the main kinds of technics that are the source of living experience. Present-day culture does no such thing; it does the contrary. Present-day culture is ancient culture incorporating as dynamic systems artisanal and agricultural techniques of earlier centuries, and doing so in such a way that these systems mediate between groups of people and their leaders and give rise to a basic distortion which results from our inadequacies vis-a-vis things technical. Power becomes literature; it has to do with the manipulation of opinion, with pleading based on appearances, ^{and with} rhetoric. The exercise of authority is false because there no longer exists an adequate code of relationships between the reality governed and the beings who govern. The reality governed is made up of man and machines; the code is based on the experience of man working with tools; this very experience is both weakened and remote, because those who use the code have not, like Cincinnatus, just left the handles of the plough. To put it simply, the symbol is weakening and the reality is absent. A regulatory relationship of circular causality cannot be established between the whole of governed reality and the function of authority: information no longer achieves its purpose because the code has become inadequate for the type of information it should transmit. The type of information which expresses the simultaneous and correlative existence of men and machines should involve the systems by which machines function and the values which they imply. Culture, which has become specialized and impoverished, must once again become general. Such an extension of culture is of value both politically and socially because it suppresses one of the main causes of alienation and because it re-establishes regulatory information: it can give man the means of thinking about his existence and his situation in terms of the reality that surrounds him. The task of enlarging and deepening culture has an especially philosophical function, because it leads to a critique of a certain number of myths and stereotypes, such as the

idea of the robot and the notion of automata catering to a lazy and fully satisfied humanity.

To bring about the understanding of which we speak, we might attempt to define the technical object in itself by a method of concretization and of functional over-determination, proving that the technical object is the end-product of an evolution and that it is something which cannot be considered as a mere utensil. The modalities of this genesis make it possible to grasp the three levels of the technical object and their temporal, non-dialectic coordination: the element, the individual, and the ensemble.

Once the technical object has been defined in terms of its genesis, it is possible to study the relationship between technical objects and other realities, in particular man as adult and as child.

Finally, considered as the object of an assessment of values, the technical object can give rise to very diverse attitudes, depending on whether it is considered at the level of element, individual, or ensemble. At the element level, its improvement does not lead to any upset that causes anxiety arising out of conflict with acquired habits: it leads to an eighteenth-century climate of optimism, with its introduction of the idea of continued and limitless progress and the constant betterment of man's lot. On the other hand, the machine as technical individual becomes for a time man's adversary or competitor, and the reason for this is that man centralized all technical individuality in himself, at a time when only tools existed. The machine takes the place of man, because man as tool-bearer used to do a machine's job. To this phase corresponds the dramatic and impassioned idea of progress as the rape of nature, the conquest of the world, the exploitation of energies. The will for power is expressed in the technicist and technocratic excessiveness of the thermodynamic era, which has taken a direction both prophetic and cataclysmal. Then, at the level of the technical ensembles of the twentieth century,

thermodynamic energeticism is replaced by information theory, the normative content of which is eminently regulatory and stabilizing: the development of technics seemed to be a guarantee of stability. The machine, as an element in the technical ensemble, becomes the effective unit which augments the quantity of information, increases negentropy, and opposes the degradation of energy. The machine is a ^{result}~~work~~ of organization and information; it ^{resembles}~~is like~~ life and cooperates with life in its opposition to disorder and to the levelling out of all things that tend to deprive the world of its powers of change. The machine is something which fights against the death of the universe; it slows down, as life does, the degradation of energy, and becomes a stabilizer of the world.

Such a modification of the philosophic view of technical objects heralds the possibility of making the technical being part of culture. This integration, which was not possible in a definitive way either at the level of elements or at the level of individuals, is possible and has a greater chance of stability at the ensembles level. Once technical reality has become regulatory, it can be integrated into culture, which is itself essentially regulatory. Such an integration could only have been possible by addition at the time when technicality resided in elements, or by effraction and revolution at the time when technicality resided in new technical individuals. Today, technicality tends to reside in ensembles. For this reason, it can become a foundation for culture, to which it will bring a unifying and stabilizing power, making culture ~~respond~~ respond to the reality which it expresses and which it governs.

PART ONE

The Genesis and Evolution of Technical Objects

CHAPTER I"THE GENESIS OF THE TECHNICAL OBJECT:
THE PROCESS OF CONCRETIZATION"I. Abstract Technical Object and Concrete Technical Object

Every technical object undergoes a genesis. It is difficult, however, to define the genesis of each technical object, because the individuality of technical objects is modified in the course of the genesis. What we can ^{do}~~do~~ is to define technical objects with reference to the technical species to which they belong, but we can only do so with difficulty. Species are easy to identify summarily for practical purposes, in so far as we are willing to understand the technical object in terms of the practical end it is designed to meet. But such specificity as this is illusory, for no fixed structure corresponds to its defined use. We can get the same result from very different functionings and structures: steam-engines, petrol-engines, turbines, ^{and} engines powered by springs or weights are all engines; yet, for all that, there is a more apt analogy between a spring-engine and a bow or cross-bow than between the former and a steam-engine; a clock with weights has an engine analogous to a windlass, while an electric clock is analogous to a house-bell or buzzer. Usage brings together heterogeneous structures and functions in genres and species which get their meaning from the relationships between their particular