Note to the Reader

I think the task of the reader will be lightened if at the outset I attempt a definition of *technique*. The whole first chapter is devoted to making clear what constitutes technique in the present-day world, but as a preliminary there must be a simple idea, a definition.

The term *technique*, as I use it, does not mean machines, technology, or this or that procedure for attaining an end. In our technological society, *technique* is the *totality of methods rationally arrived at and having absolute efficiency* (for a given stage of development) in *every* field of human activity. Its characteristics are new; the technique of the present has no common measure with that of the past.

This definition is not a theoretical construct. It is arrived at by examining each activity and observing the facts of what modern man calls technique in general, as well as by investigating the different areas in which specialists declare they have a technique.

In the course of this work, the word *technique* will be used with varying emphasis on one or another aspect of this definition. At one point, the emphasis may be on rationality, at another on efficiency or procedure, but the over-all definition will remain the same.

Finally, we shall be looking at technique in its sociological aspect;

that is, we shall consider the effect of technique on social relationships, political structures, economic phenomena. Technique is not an isolated fact in society (as the term *technology* would lead us to believe) but is related to every factor in the life of modern man; it affects social facts as well as all others. Thus technique itself is a sociological phenomenon, and it is in this light that we shall study it.

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Technical Operation and Technical Phenomenon. With the use of these few guideposts, we can now try to formulate, if not a full definition, at least an approximate definition of technique. But we must keep this in mind: we are not concerned with the different individual techniques. Everyone practices a particular technique, and it is difficult to come to know them all. Yet in this great diversity we can find certain points in common, certain tendencies and principles shared by them all. It is clumsy to call these common features Technique with a capital T; no one would recognize his particular technique behind this terminology. Nevertheless, it takes account of a reality—the technical phenomenon—which is worldwide today.

If we recognize that the method each person employs to attain a result is in fact, his particular technique, the problem of means is raised. In fact, technique is nothing more than *means* and the *ensemble of means.* This, of course, does not lessen the importance of the problem. Our civilization is first and foremost a civilization of means; in the reality of modern life, the means, it would seem, are more important than the ends. Any other assessment of the situation is mere idealism.

Techniques considered as methods of operation present certain common characteristics and certain general tendencies, but we cannot devote ourselves exclusively to them. To do this would lead to a more specialized study than I have in mind. The technical phenomenon is much more complex than any synthesis of characteristics common to individual techniques. If we desire to come closer to a definition of technique, we must in fact differentiate between the technical operation and the technical phenomenon.

The technical operation includes every operation carried out in accordance with a certain method in order to attain a particular end. It can be as rudimentary as splintering a flint or as complicated as programming an electronic brain. In every case, it is the method which characterizes the operation. It may be more or less effective or more or less complex, but its nature is always the same. It is this which leads us to think that there is a continuity in technical operations and that only the great refinement resulting from scientific progress differentiates the modern technical operation from the primitive one.

Every operation obviously entails a certain technique, even the

gathering of fruit among primitive peoples—climbing the tree, picking the fruit as quickly and with as little effort as possible, distinguishing between the ripe and the unripe fruit, and so on. However, what characterizes technical action within a particular activity is the search for greater efficiency. Completely natural and spontaneous effort is replaced by a complex of acts designed to improve, say, the yield. It is this which prompts the creation of technical forms, starting from simple forms of activity. These technical forms are not necessarily more complicated than the spontaneous ones, but they are more efficient and better adapted.

Thus, technique creates means, but the technical operation still occurs on the same level as that of the worker who does the work. The skilled worker, like the primitive huntsman, remains a technical operator; their attitudes differ only to a small degree.

But two factors enter into the extensive field of technical operation: consciousness and judgment. This double intervention produces what I call the technical phenomenon. What characterizes this double intervention? Essentially, it takes what was previously tentative, unconscious, and spontaneous and brings it into the realm of clear, voluntary, and reasoned concepts.

When André Leroi-Gourhan tabulates the efficiency of Zulu swords and arrows in terms of the most up-to-date knowledge of weaponry, he is doing work that is obviously different from that of the swordsmith of Bechuanaland who created the form of the sword. The swordsmith's choice of form was unconscious and spontaneous; although it can now be justified by numerical calculations, such calculations had no place whatever in the technical operation he performed. But reason did, inevitably, enter into the process because man spontaneously imitates nature in his activities. Accomplishments that merely copy nature, however, have no future (for instance, the imitation of birds' wings from Icarus to Ader). Reason makes it possible to produce objects in terms of certain features, certain abstract requirements; and this in turn leads, not to the imitation of nature, but to the ways of technique.

The intervention of rational judgment in the technical operation has important consequences. Man becomes aware that it is possible to find new and different means. Reason upsets pragmatic traditions and creates new operational methods and new tools; it examines rationally the possibilities of more extensive and less rigid

experimentation. Reason in these ways multiplies technical operations to a high degree of diversity. But it also operates in the opposite direction: it considers results and takes account of the fixed end of technique—efficiency. It notes what every means devised is capable of accomplishing and selects from the various means at its disposal with a view to securing the ones that are the most efficient, the best adapted to the desired end. Thus the multiplicity of means is reduced to one: the most efficient. And here reason appears clearly in the guise of technique.

In addition, there is the intervention of consciousness. Consciousness shows clearly, and to everybody, the advantages of technique and what it can accomplish. The technician takes stock of alternative possibilities. The immediate result is that he seeks to apply the new methods in fields which traditionally had been left to chance, pragmatism, and instinct. The intervention of consciousness causes a rapid and far-flung extension of technique.

The twofold intervention of reason and consciousness in the technical world, which produces the technical phenomenon, can be described as the quest of the one best means in every field. And this "one best means" is, in fact, the technical means. It is the aggregate of these means that produces technical civilization.

The technical phenomenon is the main preoccupation of our time; in every field men seek to find the most efficient method. But our investigations have reached a limit. It is no longer the best relative means which counts, as compared to other means also in use. The choice is less and less a subjective one among several means which are potentially applicable. It is really a question of finding the best means in the absolute sense, on the basis of numerical calculation.

It is, then, the specialist who chooses the means; he is able to carry out the calculations that demonstrate the superiority of the means chosen over all others. Thus a science of means comes into being—a science of techniques, progressively elaborated.

This science extends to greatly diverse areas; it ranges from the act of shaving to the act of organizing the landing in Normandy, or to cremating thousands of deportees. Today no human activity escapes this technical imperative. There is a technique of organization (the great fact of organization described by Toynbee fits very well into this conception of the technical phenomenon), just as

there is a technique of friendship and a technique of swimming. Under the circumstances, it is easy to see how far we are from confusing technique and machine. And, if we examine the broader areas where this search for means is taking place, we find three principal subdivisions of modern technique, in addition to the mechanical (which is the most conspicuous but which I shall not discuss because it is so well known) and to the forms of intellectual technique (card indices, libraries, and so on).

1) *Economic technique* is almost entirely subordinated to production, and ranges from the organization of labor to economic planning. This technique differs from the others in its object and goal. But its problems are the same as those of all other technical activities.

2) *The technique of organization* concerns the great masses and applies not only to commercial or industrial affairs of magnitude (coming, consequently, under the jurisdiction of the economic) but also to states and to administration and police power. This organizational technique is also applied to warfare and insures the power of an army at least as much as its weapons. Everything in the legal field also depends on organizational technique.

3) *Human technique* takes various forms, ranging all the way from medicine and genetics to propaganda (pedagogical techniques, vocational guidance, publicity, etc.). Here man himself becomes the object of technique.

We observe, in the case of each of these subdivisions, that the subordinate techniques may be very different in kind and not necessarily similar one to another as techniques. They have the same goal and preoccupation, however, and are thus related. The three subdivisions show the wide extent of the technical phenomenon. In fact, nothing at all escapes technique today. There is no field where technique is not dominant—this is easy to say and is scarcely surprising. We are so habituated to machines that there seems to be nothing left to discover.

Has the fact of technique no intrinsic importance? Does it spring merely from the march of time? Or does it represent a problem peculiar to our times? Our discussion of the biology of technique will bring us face to face with this question. But first we must survey in detail the vast field which the technical phenomenon covers, in order to become fully cognizant of what it signifies.

on all that is spontaneous or irrational. This rationality, best exemplified in systematization, division of labor, creation of standards, production norms, and the like, involves two distinct phases: first, the use of "discourse" in every operation; this excludes spontaneity and personal creativity. Second, there is the reduction of method to its logical dimension alone. Every intervention of technique is, in effect, a reduction of facts, forces, phenomena, means, and instruments to the schema of logic.

The second obvious characteristic of the technical phenomenon is artificiality. Technique is opposed to nature. Art, artifice, artificial: technique as art is the creation of an artificial system. This is not a matter of opinion. The means man has at his disposal as a function of technique are artificial means. For this reason, the comparison proposed by Emmanuel Mounier between the machine and the human body is valueless. The world that is being created by the accumulation of technical means is an artificial world and hence radically different from the natural world.

It destroys, eliminates, or subordinates the natural world, and does not allow this world to restore itself or even to enter into a symbiotic relation with it. The two worlds obey different imperatives, different directives, and different laws which have nothing in common. Just as hydroelectric installations take waterfalls and lead them into conduits, so the technical milieu absorbs the natural. We are rapidly approaching the time when there will be no longer any natural environment at all. When we succeed in producing artificial *aurorae boreales,* night will disappear and perpetual day will reign over the planet.

I have given only brief descriptions of these two well-known characteristics. But I shall analyze the others at greater length; they are technical automatism, self-augmentation, monism, universalism, and autonomy.

Characteristics of Modern Technique

Automatism of Technical Choice. "The one best way": so runs the formula to which our technique corresponds. When everything has been measured and calculated mathematically so that the method which has been decided upon is satisfactory from the rational point

of view, and when, from the practical point of view, the method is manifestly the most efficient of all those hitherto employed or those in competition with it, then the technical movement becomes self-directing. I call the process *automatism*.

There is no personal choice, in respect to magnitude, between, say, 3 and 4; 4 is greater than 3; this is a fact which has no personal reference. No one can change it or assert the contrary or personally escape it. Similarly, there is no choice between two technical methods. One of them asserts itself inescapably: its results are calculated, measured, obvious, and indisputable.

A surgical operation which was formerly not feasible but can now be performed is not an object of choice. It simply is. Here we see the prime aspect of technical automatism. Technique itself, *ipso facto* and without indulgence or possible discussion, selects among the means to be employed. The human being is no longer in any sense the agent of choice. Let no one say that man is the agent of technical progress (a question I shall discuss later) and that it is he who chooses among possible techniques. In reality, he neither is nor does anything of the sort. He is a device for recording effects and results obtained by various techniques. He does not make a choice of complex and, in some way, human motives. He can decide only in favor of the technique that gives the maximum efficiency. But this is not choice. A machine could effect the same operation. Man still appears to be choosing when he abandons a given method that has proved excellent from some point of view. But his action comes solely from the fact that he has thoroughly analyzed the results and determined that from another point of view the method in question is less efficient. A good example is furnished by the attempts to deconcentrate our great industrial plants after we had concentrated them to the maximum possible degree. Another example would be the decision to abandon certain systems of high production in order to obtain a more constant productivity, although it might be less per capita. It is always a question of the improvement of the method in itself.

The worst reproach modern society can level is the charge that some person or system is impeding this technical automatism. When a labor union leader says: "In a period of recession, productivity is a social scourge," his declaration stirs up a storm of protest and condemnation, because he is putting a personal judgment before the

technical axiom that what can be produced must be produced. If a machine can yield a given result, it must be used to capacity, and it is considered criminal and antisocial not to do so. Technical automatism may not be judged or questioned; immediate use must be found for the most recent, efficient, and technical process.

Communism's fundamental criticism of capitalism is that financial capitalism checks technical progress that produces no profits; or that it promotes technical progress only in order to reserve for itself a monopoly. In any case, as Rubinstein points out, technical progress occurs under capitalism for reasons which have nothing to do with technique, and it is this fact which is to be criticized. Since the Communist regime is oriented toward technical progress, the mark of the superiority of Communism is that it adopts all technical progress. Rubinstein concludes his study by remarking that this progress is the goal of all efforts in the Soviet Union, where it is said to be possible to allow free play to technical automatism without checking it in any way.

Another traditional analysis supplements Rubinstein's. This serious study, carried out by Thorstein Veblen, maintains that there is a conflict between the machine and business. Financial investment, which originally accelerated invention, now prolongs technical inactivity. Capitalism does not give free play to technical activity, the goal of which is that a more efficient method or a more rapidly acting machine should *ipso facto* and automatically replace the preceding method or machine. Capitalism does not give free play to these factors because it inadmissibly subordinates technique to ends other than technique itself, and because it is incapable of absorbing technical progress. The replacement of machines at the tempo of technical invention is completely impossible for capitalist enterprise because there is no time to amortize one machine before new ones appear. Moreover, the more these machines are improved, and hence become more efficient, the more they cost.

The pursuit of technical automatism would condemn capitalist enterprises to failure. The reaction of capitalism is well known: the patents of new machines are acquired and the machines are never put into operation. Sometimes machines that are already in operation are acquired, as in the case of England's largest glass factory in 1932, and destroyed. Capitalism is no longer in a position to pursue technical automatism on the economic or social plane. It

is incapable of developing a system of distribution that would permit the absorption of all the goods which technique allows to be produced. It is led inevitably to crises of overproduction. And in the same way it is unable to utilize the manpower freed by every new technical improvement. Crises of unemployment ensue.

Thus we return to the old schema of Marx: it is the automatism of technique, with its demand that everything be brought into line with it, that endangers capitalism and heralds its final disappearance. This is an accurate criticism, and reveals two things. First, that we are correct in speaking of automatism. If the situation of capitalism is indeed as described, it is so because technical progress acts automatically. The choice between methods is no longer made according to human measure, but occurs as a mechanical process which nothing can prevent. Capitalism, in spite of all its power, will be crushed by this automatism. Second, that for the men of our time, this automatism is just and good. If Communism can make this critique of capitalism a successful springboard for propaganda, it is only because the criticism is valid. And it is valid because everything can be called into question (God first of all), except technical progress. There is nothing left to do but wonder at a mechanism that functions so well and, apparently, so tirelessly. But, above all else, no finger must be laid upon it, nor its automatism interfered with. It is in this that the headway of technical progress becomes automatic; when modern man renounces control over it and cannot bring himself to raise his hand against it so as to make the choice himself.

This, then, is the first aspect of technical automatism. Inside the technical circle, the choice among methods, mechanism, organizations, and formulas is carried out automatically. Man is stripped of his faculty of choice and he is satisfied. He accepts the situation when he sides with technique.

Let us examine the second aspect of automatism. When we leave the technical domain proper, we find a whole ensemble of nontechnical means; among them a kind of preliminary process of elimination is taking place. The various technical systems have invaded all spheres to the point that they are everywhere in collision with modes of life which were heretofore nontechnical. Human life as a whole is not inundated by technique. It has room for activities that are not rationally or systematically ordered. But the collision

between spontaneous activities and technique is catastrophic for the spontaneous activities.

Technical activity automatically eliminates every nontechnical activity or transforms it into technical activity. This does not mean, however, that there is any conscious effort or directive will.

From the point of view which most interests modern man, that of yield, every technical activity is superior to every nontechnical activity. Take, for example, politics. It used to be said that politics was an art, consisting of finesse, aptness, a particular kind of ability, even genius; in short, of personal qualities which seemed to operate by chance. If politics was to become a technical activity, chance must be eliminated. The results to be obtained must be certain. Unpredictability, which all men share to a greater or lesser degree, must also be eliminated. Rules had to be established for this particularly unstable game if certainty of result was to be achieved. The difficulty was great, but not greater, perhaps, than the difficulty involved in harnessing atomic energy.

It was Lenin who established political technique. He did not succeed in formulating a complete set of principles for it, but from the beginning he attained a twofold result. Even a mediocre politician, by the application of the "method," was able to achieve a good average policy, to ward off catastrophes, and to assure a coherent political line. Moreover, the method was far superior to nontechnical policy; the same result could be obtained with fewer resources and with much less expense.

On the military plane, the technique applied by Hitler (and it was a technique, not military genius as with Napoleon—although it is a mark of genius to develop a technique for war or for politics) not only enabled him to achieve what was not necessarily a direct result of his technique but, more important, it enabled him to resist for three years an adversary who possessed approximately a fivefold superiority in all areas—in numbers of men and military machines, in economic power, and so on. This capacity to resist resulted from the remarkable military technique of the Germans and from the perfectly developed relationship they worked out between nation and army.

In the same way, the political technique of Lenin's school made, and is making, possible the achievement of successes over all other political forms, even when these political forms are able to bring

infinitely superior resources to bear. The tide of Leninian policy retreats for certain periods before the superior weight of the enormous politico-economic machines of the opponents. But to such a political technique only another political technique can be opposed; and since the American political technique, for example, is so inferior, it must deploy instead an enormous expenditure of resources. The superiority of a technique to enormous but inefficiently used resources and machinery means that the point at which technique inserts itself becomes a real turning point. The milieu into which a technique penetrates becomes completely, and often at a stroke, a technical milieu. If a desired result is stipulated, there is no choice possible between technical means and nontechnical means based on imagination, individual qualities, or tradition. Nothing can compete with the technical means. The choice is made a priori. It is not in the power of the individual or of the group to decide to follow some method other than the technical. The individual is in a dilemma: either he decides to safeguard his freedom of choice, chooses to use traditional, personal, moral, or empirical means, thereby entering into competition with a power against which there is no efficacious defense and before which he must suffer defeat; or he decides to accept technical necessity, in which case he will himself be the victor, but only by submitting irreparably to technical slavery. In effect he has no freedom of choice.

We are today at the stage of historical evolution in which everything that is not technique is being eliminated. The challenge to a country, an individual, or a system is solely a technical challenge. Only a technical force can be opposed to a technical force. All else is swept away. Serge Tchakotin reminds us of this constantly. In the face of the psychological outrages of propaganda, what reply can there be? It is useless to appeal to culture or religion. It is useless to educate the populace. Only propaganda can retort to propaganda, or psychological rape to psychological rape. Hitler formulated this long before Tchakotin. He writes, in *Mein Kampf:* "Unless the enemy learns to combat poison gas with poison gas, this tactic, which is based on an accurate evaluation of human weaknesses, must lead almost mathematically to success."

The exclusive character of technique gives us one of the reasons for its lightning progress. There is no place for an individual today unless he is a technician. No social group is able to resist the pres-

sures of the environment unless it utilizes technique. To be in possession of the lightning thrust of technique is a matter of life or death for individuals and groups alike; no power on earth can withstand its pressures.

Will the technical phenomena of today be able to maintain itself, or must it suffer in its turn impairment or even liquidation? It is difficult to see ahead, and, in any case, this is not the place to try to do so. Doubtless, technique has its limits. But when it has reached these limits, will anything exist outside them? Its limits are presupposed by its object and its method. But is it not succeeding in undermining everything which is outside it? Beyond its precise and limited compass, whatever its size, will there remain anything in existence? We shall be answering this question all through this book. Within the technical circle nothing else can subsist because technique's proper motion, as Jünger has shown, tends irresistibly toward completeness. To the degree that this completeness is not yet attained, technique is advancing, eliminating every lesser force. And when it has received full satisfaction and accomplished its vocation, it will remain alone in the field. Technique thus reveals itself at once destroyer and creator, and no one wishes or is able to master it.

Self-augmentation. The self-augmentation of technique also has two aspects. At the present time, technique has arrived at such a point in its evolution that it is being transformed and is progressing almost without decisive intervention by man. Modern men are so enthusiastic about technique, so assured of its superiority, so immersed in the technical milieu, that without exception they are oriented toward technical progress. They all work at it, and in every profession or trade everyone seeks to introduce technical improvement. Essentially, technique progresses as a result of this common effort. Technical progress and common human effort come to the same thing. Vincent analyzes with great subtlety the multitude of factors which intervene, each in its small way, in technical progress: the consumer, accumulation of capital, research bureaus and laboratories, and the organization of production, which acts "in some sense mechanically." Technical progress appears to Vincent to be "the resultant" of all these factors. In one sense, technique indeed progresses by means of minute improvements which are the result of common human efforts and are indefinitely additive until

they form a mass of new conditions that permit a decisive forward step. But it is equally true that technique sharply reduces the role of human invention. It is no longer the man of genius who discovers something. It is no longer the vision of a Newton which is decisive. What is decisive is this anonymous accretion of conditions for the leap ahead. When all the conditions concur, only minimal human intervention is needed to produce important advances. It might almost be maintained that, at this stage of evolution of a technical problem, whoever attacked the problem would find the solution.

The example of the steam engine and its manifold successive small alterations is well known. This example is being repeated today in all fields.

The accretion of manifold minute details, all tending to perfect the ensemble, is much more decisive than the intervention of the individual who assembles the new data, adds some element which transforms the situation, and thus gives birth to a machine or to some spectacular system that will bear his name.

This is the way progress takes place in the field of education, too. After the general direction given by initiators (like Decroly or Montessori), it is the findings of thousands of educators which ceaselessly nourish the improvement of technique. In fact, educational systems are completely transformed as a result of practice—without any one's being quite aware of it. In industrial plants, the discovery of details is utilized in another way: to create interest on the part of the worker in his work. The worker is asked not only to use the machine he operates, but also to study it to find flaws in its operation, then to find remedies against these faults, and in addition to determine how its productivity might be improved. The result is the "suggestion box" by means of which workers may indicate their ideas and plans for improvement.

This collective, anonymous research advances techniques almost everywhere in the world by a like impulse, a striking result of self-augmentation. It is noticeable that identical technical inventions are produced simultaneously in many countries. To the degree that science is taking on a more and more technical aspect, these discoveries are made everywhere at the same time—a further indication that scientific discoveries are, in reality, governed by technique.

The smashing of the atom and the atomic bomb are characteris-

tic of this simultaneity. In Germany, Norway, the U.S.S.R., the United States, and France, research had reached almost the same point in 1939. But circumstances upset European technical evolution and gave superiority to the United States. Among these circumstances were the invasion of Norway and France, the collapse of Germany several months after the discovery, and the lack of means and raw material in the U.S.S.R. What is true of scientific inventions is much more true of technical inventions. Only lack of means halts progress in certain countries. The more advanced a country is in the employment of technique, the more material is required, whether in numbers of men, raw materials, or complexity of machines. A country must be wealthy to exploit techniques to a maximum. And when the country is able to do this, technique returns a hundredfold increase in its wealth. This is another element in self-augmentation.

It is still necessary to justify the term *self-augmentation*, since it appears to be contradicted by what I have just been saying. If technical advance is assured by the joint effort of thousands of technicians, each of whom makes his contribution, it would seem impossible to speak of self-augmentation. But there is another aspect which must be brought to light.

There is an automatic growth (that is, a growth which is not calculated, desired, or chosen) of everything which concerns technique. This applies even to men. Statistically, the number of scientists and technicians has doubled every decade for a century and a half. Apparently this is a self-generating process: technique engenders itself. When a new technical form appears, it makes possible and conditions a number of others. To take a plain and elementary example: the internal-combustion engine made possible and conditioned the techniques of the automobile, the submarine, and so on. In the same way, once a technical procedure has been discovered, it is applicable in many fields other than the one for which it was primarily invented. The techniques of "operational research," for example, were devised to help make certain military decisions. But it was immediately noted that they could be applied wherever any decision had to be made. As Baraché, a specialist in these techniques, says: "The nature of the problems themselves was secondary . . the methods of approach and the tech-

niques employed proved to have a general scope." The same could be said for the techniques of organization. There is, therefore, a self-augmentation of the areas of application.

This does not necessarily mean an infinite or indefinite augmentation of technique. I do not wish at this point to enter the realm of prognosis, but predictions of the more or less rapid extinction of technical progress seem to me to be contradicted by the facts. Whether it be Lewis Mumford, say, declaring that the era of mechanical progress is almost at an end, or Colin Clark announcing the transition of secondary mechanical activities to tertiary activities, they are exhibiting what can only be termed a dangerous confidence.

Lewis Mumford shows that certain of our inventions cannot be improved, that the possible domain of mechanical activity cannot be extended, and that mechanical progress is limited by the nature of the physical world. This last is true. But we are far from knowing the total possibilities of the physical world. And after Mumford had written that statement fifteen years ago, servomechanisms, radar, and atom smashing were discovered. It is obvious that the augmentation of machines cannot be unlimited. But, so as not to rest our hopes on an alleged stagnation, it will be enough for this progress to continue for another century.

What is true of mechnical techniques is also true of economic techniques. I agree fully with the remarks of Léon Hugo Dupriez when he points out the error of the "stagnationists"—of Wolf, for example, who writes: "The law of the limit of technico-economic development is that past progress closes the door to future progress. For future progress there remains in every case only a margin, only a fraction, indeed only a small fraction, of past progress." Dupriez's exposure of the error of statements like this seems to me so convincing that I shall content myself with referring the reader to his work.

On the other hand, Lewis Mumford shows (and, from another perspective, this is also Colin Clark's thought) that the best organization will tend to reduce the use of certain machines. This is rigorously exact. But this "best organization" is precisely technique itself and, moreover, it comprises a mechanical element as well. When Fourastié announces an augmentation of the tertiary, non-mechanized sector, the extraordinary progress of administrative

mechanization of the last ten years must be considered. This mechanization completely modifies the conditions of human work by what has been termed "the replacement of the organic and the psychological by the mechanical." It is certain that this fact will entail the same social crisis of unemployment as in the "secondary" sector. To take an example, the tabulator adds and prints 45,000 numbers an hour (as compared with 1,500 for a trained employee). It reads, calculates, analyzes, and prints 150 lines a minute. A punching machine, attached to it, produces the punched cards which recapitulate the results. The Gamma (a magnetic-drum machine) has a "memory" with a capacity for 200,000 individual items of data. A 1960-model calculating machine can handle 40,000 operations a second. The machine, along with organizational development, is now the means of reducing both the number of employees and expenses, and also of reducing, on the collective plane, the tertiary sector of manpower.

We can hardly agree that mechanical augmentation is decelerating. We are simply in another phase of technical progress: the phase of assimilation, organization, and conquest of the other areas. Here the progress to be made seems limitless, and consists primarily in the efficient systematization of society and the conquest of the human being. All that can be said is that, at best, technical activity has changed its field of operation; it cannot be said that it has slowed down.

Moreover, nothing argues that subsequently technical activity will not again turn toward the world of machines with renewed vigor. On the whole, it is the principle of the combination of techniques which causes self-augmentation.

Self-augmentation can be formulated in two laws:

1. *In a given civilization, technical progress is irreversible.*

2. *Technical progress tends to act, not according to an arithmetic, but according to a geometric progression.*

The first of these laws—and we base our conviction on the whole of history—makes us certain that every invention calls forth other technical inventions in other domains. There is never any question of an arrest of the process, and even less of a backward movement. Arrest and retreat only occur when an entire society collapses. In the transition to a successor, a certain number of technical procedures are lost. But, in the framework of the same civilization,

technical progress is never in question. Later I shall examine the reasons for this. Technical progression is of the same nature as the process of numbering; there is no good ground for halting the progression, because after each number we can always add 1. In technical evolution also, it seems that limits no longer exist. Improvements that result from the application of technique to the matter at hand (whether it be physical or social) can be added uninterruptedly; there is no reason for arresting the process. In arguing thus, the qualification must be made that this can be said only of the *ensemble* of techniques, of the technical phenomenon, and not of any particular technique. For every technique taken by itself there apparently exist barriers that act to impede further progress, barriers to the addition of new inventions—but these can sometimes be cleared, as the sound barrier has been for aircraft. For the technical phenomenon in its ensemble, however, a limitless progress is open. This progress, as Wiener has shown, is a necessity. Since techniques, proportionally to their development, exhaust the resources of nature, it is indispensable to fill the vacuum so created by a more rapid technical progress. Only inventions perpetually more numerous and automatically increasing can make good the unheard-of expenditures and the irremediable consumption of raw materials such as wood, coal, petroleum, and even water.

What is it that determines this progression today? We can no longer argue that it is an economic or a social condition, or education, or any other human factor. Essentially, the preceding technical situation alone is determinative. When a given technical discovery occurs, it has followed almost of necessity certain other discoveries. Human intervention in this succession appears only as an incidental cause, and no one man can do this by himself. But anyone who is sufficiently up-to-date technically can make a valid discovery which rationally follows its predecessors and rationally heralds what is to follow.

Two points must be made more precise here. First, the technical consequences of a technical improvement are not necessarily of a kind. Thus, a purely mechanical discovery may have repercussions in the domain of social techniques or in that of organizational techniques. For example, machines that use perforated cards affect statistics and the organization of certain business enterprises. Con-

versely, some kind of social technique (for instance, full employment) may entail an improvement in the techniques of economic production.

Here we note the interdependence of techniques which is stated in the second law of self-augmentation: technical progress tends to be brought about according to a geometric progression. A technical discovery has repercussions and entails progress in several branches of technique and not merely in one. Moreover, techniques combine with one another, and the more given techniques there are to be combined, the more combinations are possible. Thus, almost without deliberate will, by a simple combination of new data, incessant discoveries take place everywhere; and whole fields are opened up to technique because of the meeting of several currents. Material techniques of communication, psychological techniques, commercial techniques, techniques of authoritarian government, all combine to produce the important phenomenon of propaganda, which represents a new technique independent of all the rest and necessarily produced as a consequence of the preceding phenomena.

This second law of self-augmentation explains a characteristic of the technical movement which has engaged the attention of contemporary sociologists. This is the unevenness of technical development. Enormous disparities exist not only in the various global areas of technical expansion but also in each field within the various sectors. Technique progresses more rapidly in one branch than in another—and certain retrogressions are always possible. To Frankel this unevenness of development is the key to the disturbances of equilibrium and the social difficulties that the technical phenomenon provokes. According to Frankel, if all branches evolved in the same rhythm, there would be no problem. Frankel's view, certainly too simple, is probably not inexact. However, it explains little. In fact, these clashing rhythms cannot be altered because of technical automatism.

Fourastié is right in arguing that technical progress is unpredictable. It cannot be known with certainty even a short time in advance in what quarter the new technical invention will be produced, precisely because such inventions are, for the most part, the result of self-augmentation. (Of course, a distinction must be made between invention and discovery.) Short of halting progress by force

in an advanced sector, there are no means of bringing these rhythms back into harmony; and the role of the individual is progressively weakened.

The final point to make in discussing self-augmentation is that technique, in its development, poses primarily technical problems which consequently can be resolved only by technique. The present level of technique brings on new advances, and these in turn add to existing technical difficulties and technical problems, which demand further advances still. This is a concrete problem in town planning. A large city supposes a concentration of the means of transport, air control, traffic organization, and so on. Each of these permits the city to grow even larger and promotes new technical advances. For example, to make housework easier, garbage-disposal units have been put into use which allow the garbage to run off through the kitchen sinks. The result is enormous pollution of the rivers. It is then necessary to find some new means of purifying the rivers so that water can be used for drinking. A great quantity of oxygen is required for bacteria to destroy these organic materials. And how shall we oxygenate rivers? This is an example of the way in which technique engenders itself.

The mechanization of administrative work in business offices raises the problem of a necessarily different kind of organization. It is not merely a question of replacing human beings with machines or of speeding up the work (of bookkeeping, for example), but rather of effecting operations of a new type which must be integrated into a new kind of organization. For example, the organization of the whole system of inventory analysis (with its four functions of entering, grouping, totaling, and comparing) becomes necessary. An ensemble of new techniques must be elaborated without which the machine in question would be good for nothing, resulting only in what Mas terms "pseudo-systematization."

The implications of self-augmentation become clearer: the individual's role is less and less important in technical evolution. The more factors there are, the more readily they combine and the more evident is the urgent need for each technical advance. Advance for its own sake becomes proportionately greater and the expression of human autonomy proportionately feebler.

Human beings are, indeed, always necessary. But literally anyone

can do the job, provided he is trained to it. Henceforth, men will be able to act only in virtue of their commonest and lowest nature, and not in virtue of what they possess of superiority and individuality. The qualities which technique requires for its advance are precisely those characteristics of a technical order which do not represent individual intelligence. And here we enter into another area, the nature of the technician.

In this decisive evolution, the human being does not play a part. Technical elements combine among themselves, and they do so more and more spontaneously. In the future, man will apparently be confined to the role of a recording device; he will note the effects of techniques upon one another, and register the results.

A whole new kind of spontaneous action is taking place here, and we know neither its laws nor its ends. In this sense it is possible to speak of the "reality" of technique—with its own substance, its own particular mode of being, and a life independent of our power of decision. The evolution of techniques then becomes exclusively causal; it loses all finality. This is what economists such as Alfred Sauvy mean when they say that "by a slow reversal . . . production is more and more determined by the wishes of individuals in their capacity as producers, than by their decisions as consumers." In reality, it is not the "wishes" of the "producers" which control, but the technical necessity of production which forces itself on the consumers. Anything and everything which technique is able to produce *is* produced and accepted by the consumer. The belief that the human producer is still master of production is a dangerous illusion.

Technique is organized as a closed world. It utilizes what the mass of men do not understand. It is even based on human ignorance. As Charles Camichel says: "The worker cannot understand the workings of modern industry." The individual, in order to make use of technical instruments, no longer needs to know about his civilization. And no single technician dominates the whole complex any longer. The bond that unites the fragmentary actions and disjointedness of individuals, co-ordinating and systematizing their work, is no longer a human one, but the internal laws of technique. The human hand no longer spans the complex of means, nor does the human brain synthesize man's acts. Only the intrinsic monism

of technique assures cohesion between human means and acts. Technique reigns alone, a blind force and more clear-sighted than the best human intelligence.

This phenomenon of self-augmentation gives technique a strangely harsh aspect. It resembles nothing other than itself. Whatever the domain to which it is applied, man or God, technique simply *is;* it undergoes no modifications in the movement which is its being and essence. It is the only locus where form and being are identical. It is only a form, but everything conforms to it. Here technique assumes the peculiar characteristics which make it a thing apart. A precise and well-defined boundary surrounds it: there is that which is technique, and there is everything else, which is not. Whoever passes this boundary and enters into technique is constrained to adopt its characteristics. Technique modifies whatever it touches, but it is itself untouchable. Nothing in nature, or in social or human life, is comparable with it. The intelligence of art or war comes nowhere near that of technique, no more than does the industry of ants or bees. A hybrid but not sterile being, and capable of self-generation, technique traces its own limits and fashions its own image.

Whatever the adaptations nature or circumstances demand of it, technique remains self-identical in its characteristics and its course. Hindrances seem to compel it to become, not something else, but even more itself. Everything it assimilates strengthens it in its traits. There is no hope of seeing it change into a fine and gracious being: it is neither Caliban nor Ariel, but it has been able to take Ariel and Caliban into the unconditioned circles of its universal method.

Monism.[2] The technical phenomenon, embracing all the separate techniques, forms a whole. This monism of technique was already obvious to us when we determined, on the basis of the evidence, that the technical phenomenon presents, everywhere and essentially, the same characteristics. It is useless to look for differentiations. They do exist, but only secondarily. The common features of the technical phenomenon are so sharply

[2] The French word is *unicité* or *insécabilité*. I have adopted "monism" as the English equivalent. "Holism" might have been better. In any case, the accumulated philosophical baggage of both these terms must be rejected and the meaning of the term understood contextually. (Trans.)