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.

June 1963

Author's Foreword to the Revised American Edition

At the beginning I must try to make clear the direction and aim of this book. Although descriptive, it is not without purpose. I do not limit myself to describing my findings with cold objectivity in the manner of a research worker reporting what he sees under a microscope. I am keenly aware that I am myself involved in technological civilization, and that its history is also my own. I may be compared rather with a physician or physicist who is describing a group situation in which he is himself involved. The physician in an epidemic, the physicist exposed to radioactivity: in such situations the mind may remain cold and lucid, and the method objective, but there is inevitably a profound tension of the whole being.

Although I have deliberately not gone beyond description, the reader may perhaps receive an impression of pessimism. I am neither by nature, nor doctrinally, a pessimist, nor have I pessimistic prejudices. I am concerned only with knowing whether things are so or not. The reader tempted to brand me a pessimist should begin to examine his own conscience, and ask himself what causes him to make such a judgment. For behind this judgment, I believe, will always be found previous metaphysical value judgments, such
as: "Man is free," "Man is lord of creation," "Man has always overcome challenges" (so why not this one too?); "Man is good." Or again: "Progress is always positive"; "Man has an eternal soul, and so cannot be put in jeopardy." Those who hold such convictions will say that my description of technological civilization is incorrect and pessimistic. I ask only that the reader place himself on the factual level and address himself to these questions: "Are the facts analyzed here false?" "Is the analysis inaccurate?" "Are the conclusions unwarranted?" "Are there substantial gaps and omissions?" It will not do for him to challenge factual analysis on the basis of his own ethical or metaphysical presuppositions.

The reader deserves and has my assurance that I have not set out to prove anything. I do not seek to show, say, that man is determined, or that technique is bad, or anything else of the kind.

Two other factors may lead the reader to the feeling of pessimism. It may be that he feels a rigorous determinism is here described that leaves no room for effective individual action, or that he cannot find any solution for the problems raised in the book. These two factors must now engage our attention.

As to the rigorous determinism, I should explain that I have tried to perform a work of sociological reflection, involving analysis of large groups of people and of major trends, but not of individual actions. I do not deny the existence of individual action or of some inner sphere of freedom. I merely hold that these are not discernible at the most general level of analysis, and that the individual's acts or ideas do not here and now exert any influence on social, political, or economic mechanisms. By making this statement, I explicitly take a partisan position in a dispute between schools of sociology. To me the sociological does not consist of the addition and combination of individual actions. I believe that there is a collective sociological reality, which is independent of the individual. As I see it, individual decisions are always made within the framework of this sociological reality, itself pre-existent and more or less determinative. I have simply endeavored to describe technique as a sociological reality. We are dealing with collective mechanisms, with relationships among collective movements, and with modifications of political or economic structures. It should not be surprising, therefore, that no reference is made to the separate, inde-

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dependent initiative of individuals. It is not possible for me to treat the individual sphere. But I do not deny that it exists. I do not maintain that the individual is more determined today than he has been in the past; rather, that he is differently determined. Primitive man, hemmed in by prohibitions, taboos, and rites, was, of course, socially determined. But it is an illusion—unfortunately very widespread—to think that because we have broken through the prohibitions, taboos, and rites that bound primitive man, we have become free. We are conditioned by something new: technological civilization. I make no reference to a past period of history in which men were allegedly free, happy, and independent. The determinisms of the past no longer concern us; they are finished and done with. If I do refer to the past, it is only to emphasize that present determinants did not exist in the past, and men did not have to grapple with them then. The men of classical antiquity could not have found a solution to our present determinisms, and it is useless to look into the works of Plato or Aristotle for an answer to the problem of freedom.

Keeping in mind that sociological mechanisms are always significant determinants—of more or less significance—for the individual, I would maintain that we have moved from one set of determinants to another. The pressure of these mechanisms is today very great; they operate in increasingly wide areas and penetrate more and more deeply into human existence. Therein lies the specifically modern problem.

This determinism has, however, another aspect. There will be a temptation to use the word fatalism in connection with the phenomena described in this book. The reader may be inclined to say that, if everything happens as stated in the book, man is entirely helpless—helpless either to preserve his personal freedom or to change the course of events. Once again, I think the question is badly put. I would reverse the terms and say: if man—if each one of us—abandons his responsibilities with regard to values; if each of us limits himself to leading a trivial existence in a technological civilization, with greater adaptation and increasing success as his sole objectives; if we do not even consider the possibility of making a stand against these determinants, then everything will happen as I have described it, and the determinants will be transformed into inevitabilities. But, in describing sociological currents, I obviously
cannot take into account the contingent decisions of this or that individual, even if these decisions could modify the course of social development. For these decisions are not visible, and if they are truly personal, they cannot be foreseen. I have tried to describe the technical phenomenon as it exists at present and to indicate its probable evolution. Fatalism is not involved; it is rather a question of probability, and I have indicated what I think to be its most likely development.

What is the basis for this most likely eventuality? I would say that it lies in social, economic, and political phenomena, and in certain chains of events and sequences. If we may not speak of laws, we may, at any rate, speak of repetitions. If we may not speak of mechanisms in the strict sense of the word, we may speak of interdependencies. There is a certain logic (though not a formal logic) in economic phenomena which makes certain forecasts possible. This is true of sociology and, to a lesser degree, of politics. There is a certain logic in the evolution of institutions which is easily discernible. It is possible, without resorting to imagination or science fiction, to describe the path that a social body or institutional complex will follow. An extrapolation is perfectly proper and scientific when it is made with care. Such an extrapolation is what we have attempted. But it never represents more than a probability, and may be proved false by events.

External factors could change the course of history. The probable development I describe might be forestalled by the emergence of new phenomena. I give three examples—widely different, and deliberately so—of possible disturbing phenomena:

1) If a general war breaks out, and if there are any survivors, the destruction will be so enormous, and the conditions of survival so different, that a technological society will no longer exist.

2) If an increasing number of people become fully aware of the threat the technological world poses to man's personal and spiritual life, and if they determine to assert their freedom by upsetting the course of this evolution, my forecast will be invalidated.

3) If God decides to intervene, man's freedom may be saved by a change in the direction of history or in the nature of man.

But in sociological analysis these possibilities cannot be considered. The last two lie outside the field of sociology, and confront us with an upheaval so vast that its consequences cannot be as-

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sessed. But sociological analysis does not permit consideration of these possibilities. In addition, the first two possibilities offer no analyzable fact on which to base any attempt at projection. They have no place in an inquiry into facts; I cannot deny that they may occur, but I cannot take them rationally into account. I am in the position of a physician who must diagnose a disease and guess its probable course, but who recognizes that God may work a miracle, that the patient may have an unexpected constitutional reaction, or that the patient—suffering from tuberculosis—may die unexpectedly of a heart attack. The reader must always keep in mind the implicit presupposition that if man does not pull himself together and assert himself (or if some other unpredictable but decisive phenomenon does not intervene), then things will go the way I describe.

The reader may be pessimistic on yet another score. In this study no solution is put forward to the problems raised. Questions are asked, but not answered. I have indeed deliberately refrained from providing solutions. One reason is that the solutions would necessarily be theoretical and abstract, since they are nowhere apparent in existing facts. I do not say that no solutions will be found. I merely aver that in the present social situation there is not even a beginning of a solution, no breach in the system of technical necessity. Any solutions I might propose would be idealistic and fanciful. In a sense, it would even be dishonest to suggest solutions: the reader might think them real rather than merely literary. I am acquainted with the "solutions" offered by Emmanuel Mounier, Pierre Teilhard de Chardin, Ragnar Frisch, Jean Fourastié, Georges Friedmann, and others. Unfortunately, all these belong to the realm of fancy and have no bearing on reality. I cannot rationally consider them in analyzing the present situation.

However, I will not make a final judgment on tomorrow before it arrives. I do not presume to put chains around man. But I do insist that a distinction be made between diagnosis and treatment. Before a remedy can be found, it is first necessary to make a detailed study of the disease and the patient, to do laboratory research, and to isolate the virus. It is necessary to establish criteria that will make it possible to recognize the disease when it occurs, and to describe the patient's symptoms at each stage of his illness.
This preliminary work is indispensable for eventual discovery and application of a remedy.

By this comparison I do not mean to suggest that technique is a disease of the body social, but rather to indicate a working procedure. Technique presents man with multiple problems. As long as the first stage of analysis is incomplete, as long as the problems are not correctly stated, it is useless to propose solutions. And, before we can pose the problems correctly, we must have an exact description of the phenomena involved. As far as I know, there is no over-all and exact description of the facts which would make it possible to formulate the problems correctly.

The existing works on the subject either are limited to a single aspect of the problem—the effect of motion pictures on the nervous system, for example—or else propose solutions without the requisite preliminary study. I offer these pages as a first effort in laying the necessary groundwork; much more work will have to follow before we can see what man's true response is to the challenge before him.

But this must not lead the reader to say to himself: "All right, here is some information on the problem, and other sociologists, economists, philosophers, and theologians will carry on the work, so I have simply got to wait." This will not do, for the challenge is not to scholars and university professors, but to all of us. At stake is our very life, and we shall need all the energy, inventiveness, imagination, goodness, and strength we can muster to triumph in our predicament. While waiting for the specialists to get on with their work on behalf of society, each of us, in his own life, must seek ways of resisting and transcending technological determinants. Each man must make this effort in every area of life, in his profession and in his social, religious, and family relationships.

In my conception, freedom is not an immutable fact graven in nature and on the heart of man. It is not inherent in man or in society, and it is meaningless to write it into law. The mathematical, physical, biological, sociological, and psychological sciences reveal nothing but necessities and determinisms on all sides. As a matter of fact, reality is itself a combination of determinisms, and freedom consists in overcoming and transcending these determinisms. Freedom is completely without meaning unless it is related to necessity, unless it represents victory over necessity. To say that freedom is graven in the nature of man, is to say that man is free because he obeys his nature, or, to put it another way, because he is conditioned by his nature. This is nonsense. We must not think of the problem in terms of a choice between being determined and being free. We must look at it dialectically, and say that man is indeed determined, but that it is open to him to overcome necessity, and that this act is freedom. Freedom is not static but dynamic; not a vested interest, but a prize continually to be won. The moment man stops and resigns himself, he becomes subject to determinism, He is most enslaved when he thinks he is comfortably settled in freedom.

In the modern world, the most dangerous form of determinism is the technological phenomenon. It is not a question of getting rid of it, but, by an act of freedom, of transcending it. How is this to be done? I do not yet know. That is why this book is an appeal to the individual's sense of responsibility. The first step in the quest, the first act of freedom, is to become aware of the necessity. The very fact that man can see, measure, and analyze the determinisms that press on him means that he can face them and, by so doing, act as a free man. If man were to say: "These are not necessities; I am free because of technique, or despite technique," this would prove that he is totally determined. However, by grasping the real nature of the technological phenomenon, and the extent to which it is robbing him of freedom, he confronts the blind mechanisms as a conscious being.

At the beginning of this foreword I stated that this book has a purpose. That purpose is to arouse the reader to an awareness of technological necessity and what it means. It is a call to the sleeper to awake.

Jacques Ellul

La Marrienne, Pessac, Gironde, France
January 1964
Author's Preface to the
French Edition

Let us, first of all, clear up certain misunderstandings that inevitably arise in any discussion of technique.

It is not the business of this book to describe the various techniques which, taken together, make up the technological society. It would take a whole library to describe the countless technical means invented by man; and such an undertaking would be of little value. Moreover, quite enough elementary works describing the various techniques are already available. I shall frequently allude to some of these techniques on the assumption that their applications or their mechanics are familiar to the reader.

I do not intend to draw up a balance sheet, positive or negative, of what has been so far accomplished by means of these techniques, or to compare their advantages and disadvantages. I shall not repeat what has so often been stated, that through technology the work week has been materially shortened, that living standards have risen, and so forth; or, on the other side of the ledger, that the worker has encountered many difficulties in adapting to the machine. Indeed, no one is capable of making a true and itemized account of the total effect of existing techniques. Only fragmentary and superficial surveys are possible.
Finally, it is not my intention to make ethical or aesthetic judgments on technique. A human being is, of course, human and not a mere photographic plate, so that his own point of view inevitably appears. But this does not preclude a deeper objectivity. The sign of it will be that worshippers of technique will no doubt find this work pessimistic and haters of technique will find it optimistic.

I have attempted simply to present, by means of a comprehensive analysis, a concrete and fundamental interpretation of technique.

That is the sole object of this book.

J. E.

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idea of universalism, did not allow techniques to grow. Men refused to conform to any uniform law, even when it operated for their own good. This is the complex way when finance directors and parliamentary counselors refused to utilize new and precise techniques of accounting and legislative supremacy; in the most summary way when the peasants rejected new and rational methods of recruitment proposed for the army.

The world had to wait for the eighteenth century to see technical progress suddenly explode in every country and in every area of human endeavor.

The Industrial Revolution. The term industrial revolution is applied exclusively to the development of machinery, but that is to see only one side of it. In actual fact, the industrial revolution was merely one aspect of the technical revolution. It is preposterous that a specialist such as Lewis Mumford can write that he has found in the various modes of exploiting energy the key to the evolution of technique and the moving force behind its transformations. In his view, a first period, which lasted until about 1750, knew only hydraulic energy; a second period, from 1750 to 1880, is the age of coal; and a third, that of electricity. (The use of nuclear energy has only recently appeared; it is perhaps to be reckoned as part of the age of electricity.)

Mumford’s thesis is incomprehensible unless technique is re-defined as the machine; Mumford actually makes this identification. His distinction is then valid as a plan for the historical study of machines, but it is totally invalid for the study of technical civilization. When technical civilization is considered as a whole, this classification and explanation are shockingly summary and superficial. Norbert Wiener likewise rejects the classification founded on the different sources of energy. For him there has been only one industrial revolution, and that consisted in the replacement of human muscle as a source of energy. And he adds, there is a second revolution in the making whose object is the replacement of the human brain. Of this last we have as yet only prepositions and indications. We are not yet there. What we are witnessing at the moment is a rearrangement of the world in an intermediate stage; the change is not in the use of a natural force but in the application of technique to all spheres of life.

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The technical revolution meant the emergence of a state that was truly conscious of itself and was autonomous in relation to anything that did not serve its interests—a product of the French Revolution. It entailed the creation of a precise military technique (Frederick the Great and Napoleon) in the field of strategy and in the fields of organization, logistics, and recruitment; the beginning of economic technique with the physiocrats, and later the liberals in administration and police power; it was the period of rationalized systems, unified hierarchies, card indices, and regular reports. With Napoleon particularly, there was a tendency toward mechanization which resulted from the application of technique to more or less human spheres of action.

The revolution also entailed the exertion and the regrouping of all the national energies. There were to be no more loafers (under the French Revolution, they were imprisoned), no more privileged persons, no special interests. Everyone must serve in accordance with the strictures of technique.

From the judicial point of view, the technical revolution entailed the great systematization of law in the Napoleonic codes and the definitive suppression of spontaneous sources of law; for example, custom. It involved the unification of legal institutions under the iron rule of the state and the submission of law to policy. And throughout Europe, except in Great Britain, the nations, amazed by such an efficient operation, abandoned their traditional judicial systems in favor of the state.

This systematization, unification, and clarification was applied to everything—it resulted not only in the establishment of budgetary rules and in fiscal organization, but in the systematization of weights and measures and the planning of roads. All this represented technique at work. From this point of view, it might be said that technique is the translation into action of man’s concern to master things by means of reason, to account for what is subconscious, make quantitative what is qualitative, make clear and precise the outlines of nature, take hold of chaos and put order into it.

In intellectual activity the same effort was evident, particularly in the creation of an intellectual technique for history and biology. The principles established by Descartes were applied and resulted not only in a philosophy but in an intellectual technique.

These phenomena are so far from being sources of energy that it
can scarcely be maintained that mechanical transformation brought about all the rest. In fact, the widespread mechanical development, spurred by the exploitation of energy, came after most of these other techniques. It would almost seem that the order was reversed, that the appearance of these other techniques was necessary to the evolution of the machine—which certainly had no greater influence on society than, say, the organization of the police.

The revolution resulted not from the exploitation of coal but rather from a change of attitude on the part of the whole civilization. Here we are faced with a most difficult question: Why, after such slow progress for centuries, did such an eruption of technical progress take place in a century and a half? Why, at a certain moment in history, did something become possible which had not seemed possible before? We must confess that the ultimate reason escapes us. Why did inventions suddenly burst forth in the second half of the eighteenth century? We cannot say. Here we are at the center of the mystery of invention, which strangely came to life for this brief moment.

The inventions of the nineteenth century are much more easily explained. A kind of chain reaction was set up: the discoveries made at the beginning of the century generated those that followed. There was a logical and foreseeable succession of events, once the first steps had been taken.

But why were the first steps taken? We will never know, and, in any case, that is not the purpose of this investigation. We ask rather why technical inventions have proliferated so radically and developed to the point where they threaten to engulf society. Why did the limitless applicability of the sciences become a reality when hitherto it had been restrained and equivocal? The Greeks knew that machines could be utilized; why did it devolve upon the nineteenth century to utilize them? The question, indeed, is why the nineteenth century not only made applications but did so on such a grand scale. Leonardo da Vinci invented a prodigious number of useful devices (the alarm clock, the silk-winder, a machine for carding textile fabrics, and so on), and proposed many technical improvements (double-hulled ships, the universal joint, conical gears, etc.). Why did none of his inventions and improvements find practical application?

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There are a number of general answers. One can relate everything to scientific progress, for example. The eighteenth and nineteenth centuries saw advances in application, not in pure knowledge or in speculation. It is useless to recount the scientific evolution of this period or to enumerate the sensational series of principles and laws formulated and applied at this time. Parentetically, it might be noted that the scientific revolution began as early as the first half of the seventeenth century. Experiments were then performed to prove the exactness of quantitative hypotheses. Moreover, a psychological transformation occurred which led to the consideration of phenomena as worthy of study in themselves. This prepared the way for technical progress, but it cannot explain it. These scientific discoveries represent necessary conditions—but not imperatives. It is evident that applications are impossible without principles, but, once principles have been established, applications do not necessarily follow. Applications may be made out of simple curiosity, as among the Greeks or among the makers of automatons in the eighteenth century. (These automatons were not without experimental value. Research in cybernetics today likewise ends in the making of automatons.)

The close link between scientific research and technical invention appears to be a new factor in the nineteenth century. According to Mumford, "The principal initiatives came, not from the inventor-engineer, but from the scientist who established the general law." The scientist took cognizance both of the new raw materials which were available and of the new human needs which had to be met. Then he deliberately oriented his research toward a scientific discovery that could be applied technically. And he did this either out of simple curiosity or because of definite commercial and industrial demands. Pasteur, for instance, was encouraged in his bacteriological research by wine producers and silkworm growers.

In the twentieth century, this relationship between scientific research and technical invention resulted in the enslavement of science to technique. In the nineteenth century, however, science was still the determining cause of technical progress. The society of the eighteenth century was not yet mature enough to allow the systematic development of inventions. As Siegfried Giedion says, the France of that period was a testing ground. Ideas proliferated but
could take no final form until society had undergone a transformation.

What distinguishes the eighteenth century is that applications were made for reasons of utility; soon the only justification of science was applicability. Most historians of technique content themselves with invoking philosophy to explain this.

The philosophy of the eighteenth century did indeed favor technical applications. It was naturalistic and sought not only to know but also to exploit nature. It was utilitarian and pragmatic. It concerned itself with easing human life, with bringing more pleasure into it and simplifying its labor. For the eighteenth century, man's life was narrowly confined to the material; it seemed evident that the problem of life would be resolved when men were able to work less while consuming more. The goal of science thus appeared to be fixed by philosophy.

This philosophy was concrete; it was bound up with material results. What cannot be seen cannot be judged, and this explains this century's judgment of history: that the foundation of civilizations is technique, not philosophy or religion.

For these admirable philosophers, technique had the enormous superiority of manifesting itself in a concrete way and of leaving its tracks for all to read. Voltaire and Diderot were its principal exponents. But I am unable to give this philosophy the highest place in the history of the development of techniques. It played a role, but it was not the prime force behind the technical movement. To say it was would be to exaggerate the force of these philosophic ideas and systems, which affected only a small minority of Frenchmen and a minute elite abroad. The technical movement was a European movement; the ideas of these philosophic minorities could scarcely have penetrated Europe in such a way as to make evident to everyone the excellence of technical progress. We have only to recall popular reactions to machinery—for example, to Vaucanson's loom, to the first steamboat, and to the first blast furnaces. These philosophic ideas scarcely suffice to explain the remarkable mobilization of all human forces in the nineteenth century.

It is even questionable whether this philosophy was universally accepted. At other times there have been utilitarian currents in philosophy, but they represented only one branch of philosophy among several and did not lead to such a radical transformation of society.

The optimistic atmosphere of the eighteenth century, more than this philosophy, created a climate favorable to the rise of technical applications. The fear of evil diminished. There was an improvement in manners; a softening of the conditions of war; an increasing sense of man's responsibility for his fellows; a certain delight in life, which was greatly increased by the improvement of living conditions in nearly all classes except the artisan; the building of fine houses in great numbers. All these helped persuade Europeans that progress could only be achieved by the exploitation of natural resources and the application of scientific discoveries.

This state of mind created, in the second half of the eighteenth century, a kind of good conscience on the part of scientists who devoted their research to practical objects. They believed that happiness and justice would result from their investigations; and it is here that the myth of progress had its beginning.

It is clear that this atmosphere was favorable to technical development. But, in itself, it was not enough. How, then, are we to explain the sudden blossoming of technique in the nineteenth century? (The eighteenth century was only the preliminary phase of technical application; the nineteenth century is the really interesting period.) I feel that this transformation of civilization can be explained by the conjunction in time of five phenomena: the fruition of a long technical experience; population expansion; the suitability of the economic environment; the plasticity of the social milieu; and the appearance of a clear technical intention.

The first of these factors must not be neglected; every modern technical application had ancestors. Arthur Vierendeel and Lewis Mumford have analyzed these preparations. Every invention has its roots in a preceding technical period, and every period bears in itself "not only the trivial residue but also the valuable survivals of past technologies, and the nuclei of new ones." What appears to be genuinely new is the formation of a "technical complex," which, according to Mumford, consists of a series of partial inventions that combine into an ensemble. This unit begins to function when the greatest number of its constituents have been assembled, and its trend is toward continuous self-perfection. From 1000 to about 1750, there had been a slow fermentation which had no immediate
consequences but which had amassed materials in every area of life. They had only to be drawn on for the technical miracle to take place. This continuity has been analyzed by Virendeel in particular, and Wiener emphasizes it when he writes: "It is interesting to reflect on the fact that every tool possesses a genealogy and is the result of the tools which served to make it." This enormous sum of experiments, of apparatus, of inquiries was put to use abruptly at the end of an evolutionary period which had lasted for nearly ten centuries without social catastrophe. Continuity of this kind was important because it made unnecessary the transmission of the technical legacy from one civilization to another, an operation which inevitably involves the loss of a part of it, especially a part of the social forces that apply to nontechnical areas. This continuity is found in all fields of technique, from finance to transport. If technical progress does not appear at a given moment, it is only because the social milieu is not completely favorable. But it is ripening underground, it is self-perpetuating even while it is dormant, as in the seventeenth century. This long preparation was necessary as support and foundation for the structure of the nineteenth century was to build; it represented what Charles Morazé in his Essai sur la civilisation d'Occident calls "collective incubation." This incubation, consisting of millions of accumulated experiments, was the preparation for the moment of formulation, of expression.

A second factor was equally necessary: the population expansion. Here again we find ourselves face to face with a familiar problem. For two decades population studies in relation to the development of civilization have demonstrated that there is a close link between technique and population: the growth of population entails a growth of needs which cannot be satisfied except by technical development. From another viewpoint, a population expansion offers favorable grounds for research and technical growth by furnishing not only the necessary market but also the requisite human material.

The third condition has been analyzed by Vincent. If technical progress is to take place, the economic milieu must combine two apparently contradictory traits: it must be at once stable and in flux. The foundations of economic life must be stable so that primary technical research can be devoted to well-defined objects
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upon the popular consciousness and contributed to the collapse of the belief in these taboos.

At the same time (and this is the second factor which made for the plasticity of the social milieu) a systematic campaign was waged against all natural groups, under the guise of a defense of the rights of the individual; for example, the guilds, the commons, and federalism were attacked, this last by the Girondists. There were movements against the religious orders and against the privileges of Parliament, the Universities, and the Hospitals. There was to be no liberty of groups, only that of the individual. There was likewise a struggle to undermine the family. Revolutionary legislation promoted its disintegration; it had already been shaken by the philosophy and the fervors of the eighteenth century. Revolutionary laws governing divorce, inheritance, and paternal authority were disastrous for the family unit, to the benefit of the individual. And these effects were permanent, in spite of temporary setbacks. Society was already atomized and would be atomized more and more. The individual remained the sole sociological unit, but, far from assuring him freedom, this fact provoked the worst kind of slavery.

The atomization we have been discussing conferred on society the greatest possible plasticity—a decisive condition for technique. The breakup of social groups engendered the enormous displacement of people at the beginning of the nineteenth century and resulted in the concentration of population demanded by modern technique. To uproot men from their surroundings, from the rural districts and from family and friends, in order to crowd them into cities still too small for them; to squeeze thousands into unlit lodgings and unhealthy places of work; to create a whole new environment within the framework of a new human condition (it is too often overlooked that the proletariat is the creation of the industrial machine)—all this was possible only when the individual was completely isolated. It was conceivable only when he literally had no environment, no family, and was not part of a group able to resist economic pressure; when he had almost no way of life left.

Such is the influence of social plasticity. Without it, no technical evolution is possible. For the individual in an atomized society, only the state was left: the state was the highest authority and it became omnipotent as well. The society produced was perfectly malleable in the image of its masters.
and remarkably flexible from both the intellectual and the material points of view. The technical phenomenon had its most favorable environment since the beginning of history.

At the same time, by a historical coincidence (whether fortuitous or not, I shall not undertake to say), what I have called a clear technical intention came into being. In all other civilizations there had been a technical movement—more or less extensive work of this kind—but not a mass intention, clearly understood and deliberately guiding the whole society in a technical direction.

Geddes says of the period from 1750 to 1850: "Invention was a part of the normal course of life. Everyone invented. Every entrepreneur dreamed of more rapid and economical means of fabrication. The work was done unconsciously and anonymously. Nowhere else and never before was the number of inventions per capita as great as in America in the 60's of that century."

It is possible that a similar phenomenon took place in prehistoric times when technique appeared out of sheer necessity. Pressed on all sides, man reacted by creating technique. In historical times the situation changed, however. Homo sapiens had by then established his supremacy over the other mammals with respect to natural forces. Some technical efforts had been pursued, now in one field, now in another; for example, in the military art of the Assyrians or in the art of construction of the Egyptians. There were always individuals who possessed a clear vision of technical supremacy; say, Archimedes in mechanics, or Loyola in spiritual technique. But we almost never find the distinctive characteristic of our time—a precise view of technical possibilities, the will to attain certain ends, application in all areas, and adherence of the whole of society to a conspicuous technical objective. All these, taken together, constitute what I have termed a clear technical intention.

Whence arose this intention? Many causes conspired to produce it, among them the influence of the philosophy of the eighteenth century, reinforced by the philosophy of Hegel and later that of Marx. But there were other factors which were as important. What really produced the general movement in favor of technique was special interest.

This technical movement has been studied by men as different as Descartes and Marcé. But it was only when industrial self-inter-

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est, for the sake of efficiency, demanded a search for the "one best way to do work" that research was begun by Gilbeth in the field of technique, with the amazing results we see today.

Special interest was and is the great motive force behind the development of technical consciousness—but not necessarily any particular interest; say, the capitalistic interest or the moneyed interest. The state interest was the first to become conscious in France, at the time of the Revolution. The state developed political and industrial technique, and later, with Napoleon, military and judicial technique, because it found them to be potent forces against its enemies within and without. The state protected "the arts and the sciences" (in reality, techniques) not out of greatness of spirit or concern for civilization, but out of the instinct for power. After the state, it was the bourgeoisie who discovered how much profit could be extracted from a consciously developed technique. In fact, the bourgeoisie has always been more or less involved with technique. They were the initiators of the first financial techniques and, later on, of the modern state. At the beginning of the nineteenth century, they saw the possibilities of drawing huge profits from this system, especially as they were favored by the crumbling "of morals and religion" and felt themselves free, in spite of the idealistic smoke screen they raised, to exploit individuals. This class put the interests of technique before the interests of individuals, who had to be sacrificed in order that technique might progress. It is solely because the bourgeoisie made money, thanks to technique, that technique became one of their objectives.

This alliance is well known and we need recall but a few facts. James Watt, his steam engine perfected, was ruined and at a dead end. It was a bourgeois, Matthew Boulton, who grasped the industrial and financial possibilities of Watt's invention and decided to apply it. Two further facts are pertinent: commercial capitalism preceded industrial capitalism; industry owed its rise to the accumulation of capital originating from commerce. And where did industrialization first occur and become most widespread? In England, because capitalism was more highly developed there and the bourgeoisie more at liberty to act than anywhere else. This is well known. The union between the bourgeoisie and technique was expressed not only in the development of factories, but much
more subtly in the fact that the majority of technicians came from this class. It was the bourgeoisie which promoted the advance of science.

Moreover, the bourgeoisie were so well aware of the relation between economic success and the scientific foundations of that success that they kept in their own hands, almost as a monopoly, the instruction which was the only means of access to the great schools and faculties that trained the technicians of science and the technicians of society.⁴

Technical progress is a function of bourgeois money. Yet today the Marxists claim that the bourgeoisie either have attempted to restrain technical progress or make it serve the purposes of war. Their claim, however, does not prevent history from contradicting their theories. Marx himself would never have made such statements; what is true today was not true in his time.

However, this self-interest of the bourgeoisie was not enough to carry the whole of society along with it—witness the popular reactions against technical progress. As late as 1838, one of the demands of the workers was the suppression of machinery. This is easily understood. The standard of living had not risen, men still suffered from the loss of equilibrium in their lives brought about by a too rapid injection of technique, and they had not yet felt the intoxication of the results. The peasants and the workers bore all the hardships of technical advance without sharing in the triumphs. For this reason, there was a reaction against technique, and society was split. The power of the state, the money of the bourgeoisie were for it; the masses were against.

In the middle of the nineteenth century the situation changed. Karl Marx rehabilitated technique in the eyes of the workers. He preached that technique can be liberating. Those who exploited it enslaved the workers, but that was the fault of the masters and not of technique itself.

Marx was perhaps not the first to have said this, but he was the first to convince the masses of it. The working class would not be liberated by a struggle against technique but, on the contrary, by technical progress itself, which would automatically bring about the collapse of the bourgeoisie and of capitalism. This reconcilia-

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⁴ The author includes here not only faculties such as the École Polytechnique, but also administrative tribunals such as the Conseil d’État. (Trans.)
Cromwell gave the initial and primary impulse to social plasticity; as all writers agree, after this date a rigid social hierarchy no longer existed in England. The supreme value was productive and efficient labor which permitted the industrious to rise high on the social ladder (William Pitt is a good example). The king no longer represented divine authority, nor was he able to resist the nation. No longer was there sociological rigidity based on the royal person or on the power of money. It would be an error to interpret sociologically the England of the eighteenth century in accordance with the stability which is discernible in the nineteenth, and which was achieved after the technical revolution, when society had entered new paths. In the eighteenth century, England was essentially mobile and unstable in all its structures. Christianity itself was not the conservative force it proved to be on the Continent. Two great currents divided English society before the advent of Methodism: the Church of England and the Puritans. The Puritans, even after their political failure, were the predominant influence. In keeping with the trend the Reformation set, they exploded all prevailing religious taboos and developed a practical and utilitarian mentality that emphasized the use and even the exploitation of the good things of this world given by God to men. The relationship of this trend to the development of capitalism is well known. The Church of England had favored tolerance since the end of the eighteenth century and had adopted as its leading principle Bishop Warburton's idea of social utility. Here, too, there was a kind of secularization of religion. Religion is no longer the framework of society; it can no longer impose its taboos or forms upon it. Rather, it integrates itself into society, adjusts to it, and adopts the notion of social utility as criterion and justification. At the same time the disintegration and atomization of English social groups occurred—brought about not so much by the influence of the state (as in France) as by the destruction of peasant society which began in the early eighteenth century and of which Defoe and Swift were such eloquent witnesses.

The peasant commune and the peasant family were slowly ruined in the eighteenth century. The historian notes the collapse, relentless and more rapid than in France, of a whole society which had been in equilibrium until then. The struggle between the landed and the moneyed interests ended with the victory of the

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...industrial interests. It is not important here to detail the ways a new industrial society, based on the moneyed interest, came into being. Only rich entrepreneurs bought up the great estates and took the place of the old gentry, but that is not our concern. Our concern is with merchants whose influence changed the organic structure of the traditional world. The small landowners and the yeomen were eliminated or reduced to an agricultural proletariat, or they were forced to migrate to the city. The rural corporations were ruined, the communes passed almost completely into the hands of the new lords and ceased to constitute coherent sociological units. The movement was accelerated by the application of new agricultural methods, which were accepted much more rapidly in France. The enclosure of the commons, which in France took place chiefly after 1780, began in England in 1720. The new agricultural techniques were plainly so superior that it was not possible to preserve the old "open field" system—the commons, the pastures, and the fields; thus the final blow was dealt to the old, organic, peasant society. The peasant could not survive as such, and with him, the whole of society entered into a state of flux. The plasticity we refer to came about in England as a result of this evolution in the use of land, which furnished the technical movement with the necessary impetus: apathetic, vacant, and uprooted. Not only was this impetus necessary for the development of industry; the masses thus created were indispensable to faith in techniques and the creed of techniques.

To summarize: social plasticity came about earlier in England than in France, and the technical movement developed along with it. Moreover, the state, which was dominant in French society, did not have the same influence in Great Britain.

This applies also to the development of a clear technical consciousness. In Great Britain this consciousness appeared as a bourgeois interest. The spirit behind the introduction of new techniques in the rural districts was very different from that which characterized France a short time later. The technical movement in France was launched by the monarchy and took a scientific form: the academies and the research institutes propagated the new techniques throughout the country; and the nobles applied them, very often disinterestedly. In England, profit was from the very beginning the prime motive. And empiricism was the dominant factor
because technique was more efficient. Techniques were developed because it paid to develop them; commercial activity found them advantageous. This was true in agriculture as well as in industry.

The English technical movement was marked by the fact that all the different financial systems (banks, stock exchanges, insurance companies) were perfected. The clear consciousness of the value of technique expressed itself primarily in terms of money, and was located at the center of the systems of distribution. And the acceleration of invention in this area influenced all other techniques. The British state attained this clear technical consciousness at a comparatively last date, and then only when it saw that techniques were to its immediate interest.

This phenomenon of technical clarity sometimes came about through an association of the interests of the state and the interests of private individuals. In steelmaking, for example, the fact that Henry Cort was supplier to the Admiralty was decisive, in 1750, for the application and development of steel puddling. The state found in this procedure an excellent means of improving its naval vessels. However, it was competition with the Napoleonic empire that started His Majesty's government down the road of technique.

Thereafter, both governments understood that only technical efficiency in all governmental relations and enterprises could command the paths of peace as well as the affairs of war. The English state henceforth had the same influence on the development of techniques as the French revolutionary state had exerted through the establishment of a clear technical consciousness. The way had already been paved in England by the emergence of the British bourgeoisie. Whatever the differences in its development in England and France, however, the technical consciousness that appeared was identical in both countries.

In the United States this took place at the beginning of the nineteenth century. Until then, the society of this country was inorganic. But at that time the American social milieu was favorable; moreover, the Americans profited from the technical consciousness evolved in Europe, and so they arrived immediately at a model for technique. Gedion has noted that the Americans began by mechanizing complex operations, which produced the assembly line, whereas the Europeans tended to mechanize simple opera-

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tions, such as spinning. This American accomplishment was the result of the exceptional flexibility of the American milieu.

These conditions were not found in the other European countries: Spain, Italy, Germany, Austria, Russia. In these nations the social structures remained as they were and the social hierarchy was not attacked. The taboos of religion were fanatically respected, and those of society were not questioned. The Inquisition and the Tribunal of the Empire jealously guarded the spiritual and sociological divisions of society. This world was already undermined, ruined, and emptied of content, but its rigid forms were universally accepted as good. There were few changes in the cities and none at all in the rural areas. The traditional organism remained intact. And when enlightened despotism began to create some excitement, this world was so little prepared that it exhausted itself in the struggle against the old social structures. Consider, for example, the fate of Peter the Great, Joseph II, and the melancholy and celebrated Marquis de Pombal.

Great inventions may have been made in Germany and Russia during this period. Everyone is familiar with the claims of Hitler, and later of Stalin, that all important discoveries were made in their respective countries. Allowing for exaggeration, there is perhaps some truth in these claims. But the discoveries were not applied, and only application counts in the rise of technique. Application did not take place because the felicitous combination of factors we have discussed was lacking. The social milieu of these countries, their spiritual tendencies, group psychology, sociological structures, and past history were all unfavorable to the rise of technique. The state in some countries, principally Russia, was favorable to it; but a clear technical consciousness on the part of the state alone was obviously insufficient to open the door to the great mobilization of men and things necessary for this uniform progress.

The joint occurrence of the five factors we have briefly analyzed explains the exceptional growth of technique. Never before had these factors coincided. They are, to summarize: (1) a very long technical maturation or incubation without decisive checks before the final flowering; (2) population growth; (3) a suitable economic milieu; (4) the almost complete plasticity of a society mal-
leable and open to the propagation of technique; (5) a clear technical intention, which combines the other factors and directs them toward the pursuit of the technical objective. Some of these conditions had existed in other societies; for example, the necessary technical preparation and the destruction of taboos in the Roman Empire in the third century. But the unique phenomenon was the simultaneous existence of all five—all of them necessary to bring about individual technical invention, the mainspring of everything else.

What else can history teach us? Only the vanity of believing we can impose our theories on history. Any philosophy which asserts that human experience repeats itself is ineffectual.

CHAPTER 2

THE CHARACTEROLOGY OF TECHNIQUE

In discussing technique today it is impossible not to take a position. And the position we take is determined by a historical choice, conscious or unconscious.

Acknowledging that the technical phenomenon is a constant of human history, is there anything new about its present aspect? There are two distinct positions on this question. The first maintains that there is no more real technical innovation in the modern world than there was in the Stone Age. Jean Fourastié asks humorously whether prehistoric man, the first time he saw a bronze sword used, did not feel as menaced by it as we feel by the atom bomb. It would seem, then, that technical innovations have always had the same surprising and unwelcome character for men. (This is an inexhaustible source of jokes for motion pictures and cartoons.) If we become frightened, we are merely obeying ancestral instincts. There is no more real reason to be frightened by the