

"The Technological Order"  
edited by Carl F. Stover  
Wayne State University Press  
Detroit, Michigan, 1963

## Ideas of Technology

### THE TECHNOLOGICAL ORDER

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Translated by John Wilkinson)

I refer the reader to my book *La Technique*\* for an account of my general theses on this subject. I shall confine myself here to recapitulating the points which seem to me to be essential to a sociological study of the problem:

1. Technique<sup>1</sup> has become the new and specific *milieu* in which man is required to exist, one which has supplanted the old *milieu*, viz., that of nature.

2. This new technical *milieu* has the following characteristics:

- a. It is artificial;
- b. It is autonomous with respect to values, ideas, and the state;
- c. It is self-determining in a closed circle. Like nature, it is a closed organization which permits it to be self-determinative independently of all human intervention;
- d. It grows according to a process which is causal but not directed to ends;
- e. It is formed by an accumulation of means which have established primacy over ends;

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<sup>1</sup> In his book *La Technique*, Jacques Ellul states he is "in substantial agreement" with H. D. Lasswell's definition of technique: "the ensemble of practices by which one uses available resources in order to achieve certain valued ends." Commenting on Lasswell's definition, Ellul says: "In the examples which Lasswell gives, one discovers that he conceives the terms of his definition in an extremely wide manner. He gives a list of values and the corresponding techniques. For example, he indicates as values riches, power, well-being, affection, and so on, with the techniques of government, production, medicine, the family. This notion of value may seem somewhat novel. The expression is manifestly improper. But this indicates that Lasswell gives to techniques their full scope. Besides, he makes it quite clear that it is necessary to bring into the account not only the ways in which one influences things, but also the ways one influences persons." "Technique" as it is used by Ellul is most nearly equivalent to what we commonly think of as "the technological order" or "the technological society." (Trans.)

f. All its parts are mutually implicated to such a degree that it is impossible to separate them or to settle any technical problem in isolation.

3. The development of the individual techniques is an "ambivalent" phenomenon.†

4. Since Technique has become the new *milieu*, all social phenomena are situated in it. It is incorrect to say that economics, politics, and the sphere of the cultural are influenced or modified by Technique, they are rather situated *in* it, a novel situation modifying all traditional social concepts. Politics, for example, is not modified by Technique as one factor among others which operate upon it; the political world is today *defined* through its relation to the technological society. Traditionally, politics formed a part of a larger social whole; at the present the converse is the case.

5. Technique comprises organizational and psycho-sociological techniques. It is useless to hope that the use of techniques of organization will succeed in compensating for the effects of techniques in general; or that the use of psycho-sociological techniques will assure mankind ascendancy over the technical phenomenon. In the former case, we will doubtless succeed in averting certain technically induced crises, disorders, and serious social disequilibria; but this will but confirm the fact that Technique constitutes a closed circle. In the latter case, we will secure human psychic equilibrium in the technological *milieu* by avoiding the psycho-biologic pathology resulting from the individual techniques taken singly and thereby attain a certain happiness. But these results will come about through the *adaptation of human beings to the technical milieu*. Psycho-sociological techniques result in the *modification* of men in order to render them happily subordinate to their new environment, and by no means imply any kind of human domination over Technique.

6. The ideas, judgments, beliefs, and myths of the man of today have already been essentially modified by his technical *milieu*. It is no longer possible to reflect that on the one hand, there are techniques which may or may not have an effect on the human being; and, on the other, there is the human being himself who is to attempt to invent means to master his techniques and subordinate them to his own ends by *making a choice* among them. Choices and ends are both based on beliefs, sociological presuppositions, and myths which are a function of the technological society. Modern man's state of mind is completely dominated by technical values, and his goals are represented only by such progress and happiness as is to be achieved through techniques.

† This point was touched on only incidentally in my book, and is the subject of a note appended to the present paper.

by an ambition stronger than their discipline, some very peculiar enterprises get under way, which might be termed "pseudophilosophies" and "pseudotechniques," respectively, and which usurp in man the place of philosophy's absent mediation." Authentic philosophy of real meaning would bring us to precisely that possibility of mediation between man and the technical phenomenon without which any legitimate attitude is inconceivable. But for such a philosophy to exist would mean that philosophy would first have to cease to be a purely academic technique with a hermetically sealed vocabulary, to become again the property of every man who thinks while he is engaged in the business of being alive.

5. Finally, it is necessary to point out the importance of the relation between the technicians and those who try to pose the technical problem. None of the preceding is more difficult than this, since the technicians have become an authoritarian and closed world. They are armed with good consciences, but likewise with the conviction of their essential rightness and the persuasion that all discourse and reflection of a non-technical nature are verbalisms of no importance. To get them to engage in the dialogue or to question their own creation is an almost superhuman task, the more so that he who will enter this dialogue must be completely aware of what he wants, just what the technician is driving at, and what the technician is able to grasp of the problem. But, as long as such interchange does not take place, nothing will happen, since influencing Technique necessarily means influencing the technicians. It seems to me that this dialogue can only come about by making contact which will represent a *permanent* and *basic* confrontation between technique's pretensions to resolve all human problems and the human will to escape technical determinism.

Such, I think are the five conditions necessary that an opening on the technical problem can even become a possibility.

#### *Note on the Theme: Technical Progress is Always Ambiguous*

It cannot be maintained that technical progress is in itself either good or bad. In the evolution of Technique, contradictory elements are always indissolubly connected. Let us consider these elements under the following four rubrics:

1. All technical progress exacts a price;
2. Technique raises more problems than it solves;
3. Pernicious effects are inseparable from favorable effects; and
4. Every technique implies unforeseeable effects.

#### *1. All Technical Progress Exacts a Price*

What is meant here is not that technical progress exacts a price in money or in intellectual effort, but that, when technical progress adds something on the

one hand, it inevitably subtracts something on the other. It is always difficult to interpret satisfactorily the bald statement that "technical progress is an established fact," because some people cling to traditional social forms, tending to deny any value at all to such progress, and deeming that nothing can be called progress if it casts doubt on established social values. Other persons, on the contrary, hold that Technique produces extraordinary things of a prodigious novelty, bringing about the consequent disappearance of all sorts of valueless junk.

The fact is that, viewed objectively, technological progress produces values of unimpeachable merit, while simultaneously destroying values no less important. As a consequence, it cannot be maintained that there is absolute progress or absolute regress.

Let me give a few simple examples of this reciprocal action. In the first place, let us consider the fact that modern man, thanks to hygiene in particular and to technical progress in general, enjoys a greater life span than ever before. Life expectancy in France today is approximately 60 years, compared, say, to 55 years in 1890 and 30 years about 1800.\* But, even with this indubitable extension of the average life span, all physicians are in agreement that, proportionately to this extension, life has become very much more precarious, i. e., our general state of health has become very much more fragile. Human beings of the present have neither the same resistance as their ancestors to disease or to natural conditions, nor the same endurance; they suffer from a certain nervous "fragility" and a loss of general vitality, sensitiveness of their senses, and so on. In the 60 years during which such studies have been carried out, regression in all these respects has been marked. Thus, though we live longer, we live a reduced life with nothing resembling the vital energy of our ancestors. It is clear that diminution on the one hand has been accompanied by augmentation on the other.

In the sphere of labor, the technical progress of the present has effected a considerable economy of muscular effort; but, at the same time this progress has come to demand a greater and greater nervous effort so that tension and wear and tear on our nerves have inversely increased. Here again, a kind of equilibrium has asserted itself between savings and expense.

To take an instance from the sphere of economics, technical progress allows the creation of new industries. But a just view of the matter would compel us to take into consideration the accompanying destruction of resources. To take a French example, the so-called Lacq case is beginning to be well known. An industrial complex for the exploitation of sulphur and natural gas has been established at Lacq, a simple technical fact. But, from the economic point of view, this is far from being the case, since a serious agricultural problem has arisen because of the excessive destruction of farm products in the region. Up to now, the government has not seen fit to take the matter seriously, although it has been officially estimated in reports to the Chamber that, for 1960, agricultural losses have aggregated two billion francs. Now, the vineyards of Jurançon are being attacked by the sulfuric gases and are disappearing, a not inconsiderable economic loss.

To calculate from the economist's point of view the profits of an industry

\* I must remark that I am very sceptical of the way in which mean life spans are calculated for periods antedating 1800. When the historian says that life expectancy was 20 years in the thirteenth century, his statement can hardly be looked upon as more than a mere joke. There are no means *in principle* of establishing life expectancies for the past.

of this kind, it would at the minimum be necessary to deduct the value of what has been destroyed, in this case two billion francs. It would likewise be necessary to deduct the very considerable expenses of all the necessary protective devices, hospitals (which, incidentally, have not yet been constructed), schools,—in short, of the whole urban complex which has not yet been brought into being but which is nevertheless indispensable. We must have knowledge of how to calculate the *whole*. The Lacq enterprise, counting all the expenses of which we have been speaking, must be reckoned a "deficit" enterprise.

Our last example has to do with the problem of the intellectual culture of the masses. True, today's technical means permit a mass culture to exist. Television allows people who never visited a theatre in their lives to see performances of the great classics. *Paris-Match*, through its articles, allows masses of people who would be in total ignorance without such articles to attain to a certain literary (and even to a certain aesthetic) culture. But, on the other side of the ledger, it must be recorded that this same technical progress leads to an ever increasing cultural superficiality. Technical progress absolutely forbids certain indispensable conditions of a genuine culture, viz., reflection and opportunity for assimilation. We are indeed witnessing the creation of knowledge, since we are in possession of the means of knowing what we could never have known before; but it is nevertheless a superficial development because it is one which is purely *quantitative*.

The intellectual no longer has any time to meditate on a book and must choose between two alternatives: *Either* he reads through a whole collection of books rapidly, of which a little later but a few fragments survive—scattered bits of vague knowledge; *or*, he takes a year to peruse a few books thoroughly. I should like to know who today has the time to take Pascal or Montaigne seriously. To do them justice would require months and months; but today's Technique forbids any such thing. Exactly the same holds for the problem of the "Musée Imaginaire," which Malraux has put so well. We can be in contact with the whole painting and sculpture of humanity; but this availability has no cultural value comparable to that enjoyed by Poussin, who, in his voyage to Rome, passed several years in studying, statue by statue, the ensemble of artistic works at his disposal. He clearly knew nothing of Polynesian or Chinese art, but what he did know had infinitely more educational value for him because it penetrated his personality slowly.

So, once again, we see that Technique allows us to progress quantitatively to the level of culture spoken of, but at the same time interdicts us from making any progress in depth. In the circumstances, is it really possible to speak of "culture" at all? All technical progress exacts a price. We cannot believe that Technique brings us nothing; but we must not think that what it brings it brings free of charge.

## 2. The Problems Posed by Technical Progress

The second aspect of the ambiguity of technical progress concerns the following point: When Technique evolves, it does so by solving a certain number of problems, and by raising others.

The further we advance into the technological society, the more convinced we become that, in any sphere whatever, there are nothing but technical problems. We conceive all problems in their technical aspect, and think that solutions to them can only appear by means of further perfecting techniques. In a certain

sense, we are right; it is true that Technique permits us to solve the majority of the problems we encounter. But we are compelled to note (perhaps not often enough) that each technical evolution raises new problems, and that, as a consequence, there is never *one* technique which solves *one* problem. The technological movement is more complicated; one technique solves one problem, but at the same time creates others.

Let us take some simple examples of this fact. We are well acquainted with the details of the gravest sociological problem faced by the nineteenth century, i. e., that of the proletariat, a problem which we are only now in process of solving (with difficulty). The phenomenon of the proletariat is not to be considered a simple one, and Marx himself did not describe it as "merely" the exploitation of the workers by certain wicked capitalists. His explanation of the "proletarian condition" was very much more profound; he demonstrated that the proletariat was a result of the division and the mechanization of labor. He expressly states that "it is necessary to pass through the stage represented by the proletariat." For Marx, therefore, the problem is not, say, a moral one, with "bad guys exploiting good guys." Marx never puts the problem in this way; he always poses it as lying outside good or bad moral qualities, external to value judgments, and on the level of fact. And the fact is the fact of the division of labor, and of the machine, giving rise to a society in which exploitation is inevitable, i. e., drawing off surplus values. The phenomenon of the proletariat is therefore, even in the Marxian analysis, the result of technical progress. The machine and the division of labor allowed, from the economic point of view, an extraordinary expansion, but, at the same time, and as a result of the same movement, posed the social problem which it has taken a whole century to resolve.

Let us consider in the same way the extension of the above problem as it appears in the questions which will eventually but certainly be posed by the so-called "automation." Again, automation is not just another simple economic fact; indeed, we are gradually coming to realize that it will entail difficulties which, from our present point of view, can only be characterized as insurmountable. *First* of all, automation implies a production of goods in a relatively constant series of types. This means that when production has been automated, it is no longer possible to vary types, so that an unavoidable condition of immobilism with regard to production must ensue. An automated production line, considered in its full context of operation, is so expensive that amortization must occur over terms so long that the exclusive production of certain types of goods without any possibility of modification must be a consequence. *But*, up to the present, no commercial market of the capitalist world is suited to the absorption of the production of an unchanging line of goods. No presently existing Western economic organization, *on the commercial plane*, is prepared to find an answer to automated production.

Another difficulty of automation is the fact that it will result in a massive diminution of the necessary labor force. The simplistic reaction to this problem will clearly be to hold that the solution is easy. It is not necessary to cut down on the number of the workers but only to diminish the number of daily working hours of each. This solution is quite clearly impossible for a very simple reason. Automation cannot be applied to any arbitrarily selected industry or production, and this for reasons which are basic and not due to the temporary exigencies of, say, the money market. Certain kinds of production can and will be automated; certain others cannot and will never be automated. Consequently, it is not

possible to cut down working hours over the working class as a whole. There are industrial sectors in which the workers would conceivably work one hour per day, whereas in others the workers would have to continue working a normal day of eight hours. Hence, as a result of automation, there will be extended sectors of the economy emptied of manpower, while other sectors will continue on the normal standard.

Diebold estimates that in the single year 1955-1956, in the United States, automation reduced the total number of working hours by seven per cent. In the automated plants of the Ford Motor Company there was a reduction of personnel by 25 per cent; and in 1957, in industrial branches in which automation gained most (in particular in the manufacture of electric bulbs and in the very highly automated chemical industry), it was possible to dispense with the services of 800,000 workers. In other words, automation does not result in labor saving favorable to the workers, but is expressed through unemployment and employment disequilibrium.

It might be alleged that the situation described is true of capitalist countries but cannot be identical in socialist. This statement is not exact; in socialist countries the problem likewise is posed, primarily because of socialist egalitarianism. The problem is the same for the Soviet Union, for example, where automation is commencing, as for the United States. There will be specialized workers in some industries who will be freed from the necessity to work in one way or another, while in other branches of industry the eight-hour day will have to remain in force, a situation clearly unacceptable to the egalitarian theories of socialism.

A *second* problem is bound to arise in connection with the *retraining* of the "liberated" workers for jobs in new industrial sectors in which there is a shortage of manpower. But, such retraining more often than not presents enormous difficulties, since the disemployed worker is generally semi-skilled (or unskilled) and a completely new apprenticeship is implied of such a nature as to steer him toward other branches of industry.

A *third* difficulty occasioned by automation is the problem of *wages*. The wage problem produced by automation has, up till now, not been solved. How is it possible to fix a wage scale for automated industrial plants? It cannot be done on the piecework plan—machines do all the work. It cannot be done on the basis of time put in on the job. If it is desired to reduce unemployment by reducing the work day to, say, two or three hours, a given worker would only be employed for a very short period each day. Should such a worker, then, be paid according to a wage schedule which pays him for two hours of work at the equivalent of a worker who must work eight? The injustice of such a procedure is clear. How, then, should wages be calculated in an automated industry? One is forced to the admission that the relation between wages and productivity, on the one hand, and between wages and job time, on the other, *must* disappear. Wages will be calculated only as a function of the purchasing power given to the worker (with a view to maximum consumption) by dividing the total production value by the total number of workers. Such a method is really the only one feasible. Since 1950, in Russia, it has actually been tried twice. But the results were unsatisfactory, and it very soon became necessary to return to the system of hourly wages, since, in the present state of affairs, the necessary calculations prove unfeasible. But then the difficulties mentioned above (inherent in calculating either according to job-time or according

to production) return, and, at the moment, wage calculation in automated industries is completely shrouded in uncertainties.

Still another problem is presented by the fact that modern economic crises most often result from a "distortion" between the different economic sectors, more exactly, from unequal growth of the different sectors. Here, automation must prove to be an economic factor much to be feared: There will not only be disparity of economic growth between the automated and the non-automated industrial sectors, but still more between industry and agriculture. *Either* capitalist countries must look forward to an increase of crises due to automation, *or* they must adopt planning aimed at rectifying the distortions (and planning by authoritarian measures, as in the Soviet Union). At the present time, even the Soviet planners find that their planning is insufficient to meet the problems of automation, since it is not "flexible" enough, on the one hand, and not "extensive" enough to re-equilibrate the out-of-phase sectors, on the other.

Here, then, are a number of problems (and there are a great many others) with which we must expect to be confronted by the fact of automation, all of which furnish us with examples of our thesis that Technique raises, in proportion to its progress, problems of greater and greater difficulty.

Let me indicate one final example of this, i. e., the problem of overpopulation, resulting from the application of medical and prophylactic health techniques, the final result of which is the suppression of infant mortality and the prolongation of human life. The phenomenon of overpopulation, in its turn, produces the tragic phenomenon of underconsumption. A century hence, all of us *without exception* will be menaced by a general underconsumption which will afflict the whole human race, *if* the expansion of the world's population increases. Here we are confronted by a problem clearly provoked by certain techniques, certain *positive techniques*.

The common factor of all these examples is that technical progress raises whole complexes of problems which we are in no position to solve. Examples of such problems are literally innumerable.

### 3. *The Evil Effects of Technique are Inseparable from the Good*

An idea frequently to be encountered in superficial inquiries concerning Technique is the following: "At bottom, everything depends on the way Technique is employed; mankind has only to use Technique for the good and avoid using it for the bad." A common example of this notion is the usual recommendation to employ techniques for the beneficent purposes of peace and eschew them for the maleficent purposes of war. All then will go well.

Our thesis is that technical progress contains simultaneously the good *and* the bad. Consider automation, the problem which we have just been discussing. It is indisputable that technological unemployment is the result of mechanical progress. It cannot be otherwise. All mechanical progress necessarily entails a saving of labor and, consequently, a necessary technological unemployment. Here we have an ill-omened effect indissolubly connected with one which is in itself beneficial. The progress of mechanization necessarily entails unemployment. The technological unemployment so produced can be resolved by either of two means, which are the only two means economically or politically possible, *viz.*, spreading it out either in *space* or in *time*.

A capitalist economist holds that the solution to unemployment is "that technological unemployment ultimately dies out of itself." This means that the workers

who have been "freed" (the optimistic formula for unemployment) because of technical advances, will ultimately find jobs, either by directing themselves toward industries with manpower shortages or through the fact that new inventions will produce new opportunities of employment and new vocations. The standard example cited in defense of this thesis is that of the vocational opportunities connected with the invention of the automobile. Admittedly, this technological device did suppress a certain number of vocations, but it brought innumerable others into being with the final result that a vast number of persons are now employed by the servicing required by this industry. Hence, the machine in question has actually created employment.

All of this is indeed true. It is nevertheless a terribly heartless view of the situation, because it neglects to mention the *interim* period. It is all very well to say that the worker rendered jobless will, *with the lapse of a certain time*, again find employment . . . and that, after he has been reclassified, unemployment will die out. But, humanly speaking, what is the situation of the unemployed worker in the interim? Here the problem of spreading out unemployment in time is posed.

In the Soviet Union, unemployment of a technological nature (which not only exists but springs from the same sources) is spread out in space. By this I mean that when, in one place new machines are applied and workers "liberated" the affected workers will, without having to wait very long, receive a work-card which tells them in effect: "Two thousand kilometers from here a job has been assigned to you; you are hereby directed to remove yourself to such and such a factory." In one way, such a procedure seems a little less inhuman; but, in another way, it seems just as inhuman as the time procedure of the capitalists, since no account is taken of one's attachments to family, friends, locality, and so on. The human being is only a pawn to be moved about. It is hard to tell, between the capitalist and the socialist ways of handling the problem, which solution presents the worse indecencies.

A further example of the inseparable mingling of good and bad effects is furnished by the noteworthy study of the American sociological historian, J. U. Nef, concerning "industry and war." Nef shows how industrialism, i. e., the development of industry taken as a whole, necessarily prods industrialized societies in the direction of war. His analysis has nothing to do with the inner essence of industrialism; the phenomena described by him lie purely at the level of the human being.

*First*, industrialism gives an increasing population the means to live. It is a law sociologically irrefutable that, the denser the population, the greater the number of wars. This phenomenon is, of course, well known as a *practical* matter to all sociologists, but only Nef has studied it carefully.

*Second*, industrialism creates the media of the press, transmission of information, and transport, and finally the means of making war, all of which make it more and more difficult and even almost impossible to distinguish between the aggressor and the aggressed. At the present, no one knows (and perhaps no one can know) which side has commenced hostilities, a fact not solely due to armaments, but also to facility of transport. The extraordinary rapidity of transport allows an aggression to be launched within 24 hours, or even less, without anyone being able to foresee it. Here, the influence of the press is extremely important, since the press function is to confuse and addle the facts so that no one is able to gain any correct intelligence of them.

*Finally*, Nef indicates that the new means of destruction created by industrialism

have greatly reduced the trouble, the difficulties, and the anguish implied in the act of killing people. A bombardier or artilleryman has no feeling at all of killing anyone; he is in fact able to reach the conclusion that he has killed someone only with the aid of a syllogism. In hand-to-hand combat all the tiresome difficulties of conscience about the evil of murder keep obtruding themselves. In such ways, then, positive elements of industry result essentially (by very complex expedients) in favoring war and even in provoking it, even if no one has the *intention* of using Technique "badly."

Let us consider, as a final example of the relation between good effects and bad effects, the press and information.

It seems to be a simple matter, for example, to distinguish between information and propaganda. But, closer study of the problem reveals that it is practically impossible to make such a distinction. Considering but a few elements of the situation, the problem of information is today no longer that of the necessity of transmitting *honest* information—everybody agrees on this point. On the moral level it is a commonplace that we ought to transmit true information. I merely inquire, "How do we get it?" To remain on the *moral* level is simply not to understand the situation. The *concrete* situation, to take but a single example, is something like the following: Over the wires and into the offices of the Associated Press pass daily up to 300,000 words of world news, approximately equal to an enormous volume of 1000 pages. From this mass of words, it is necessary for the Associated Press, in competition with all the other world agencies, to choose, cut, and re-expedite as quickly as possible, perhaps a twentieth part of the whole to its subscribers. How is it possible to select from such a flood just what should be retained, what is true, what is possibly false, etc.? The editors have no criteria, they are at the mercy of whatever comes in, and (even when they judge in good faith and knowledge) they must essentially judge subjectively. Then again, even if the editor had only true news, how should he assign it a coefficient of importance? To do so is his business, and here the stereotypes of the editor are true enough: The Catholic editor will deem the news of the latest Vatican Council of great significance, information which has not the slightest importance to the Communist editor. What we have to do with here is not a question of bad faith, but of a difference of perspective on the world. The result is that we never know, even under the most favorable circumstances, if a given piece of information is subjective. And we must always bear in mind that this information, whatever it is, has been worked over by at least four or five different pairs of hands.

My reasons for maintaining that good effects are inseparable from bad are now, I trust, clear. And, as communications improve, the freer will be the flow of the news and the more available to all agencies concerned. These factors will play an ever greater role, making the difficulties of editing proportionately more difficult, and the chance of selecting absurd rather than sound news ever greater.

#### 4. All Technical Progress Contains Unforeseeable Effects

The final aspect of the ambiguity of technical progress resides in the following state of affairs: When scientists carry out their researches in one or another discipline and hit upon new technical means, they generally see clearly in what sphere the new technique will be applicable. Certain results are expected and gotten. *But*, there are always secondary effects which had not been anticipated,

which in the primary stage of the technical progress in question could not in principle have been anticipated. This unpredictability arises from the fact that predictability implies complete possibility of experimenting in every sphere, an inconceivable state of affairs.

The most elementary example is furnished by drugs. You have a cold in the head; you take an aspirin. The headache disappears, but aspirin has other actions besides doing away with headaches. In the beginning we were totally oblivious of these side effects; but, I should imagine, by now everyone has read articles warning against the use of aspirin because of its possible dangerous effects, say, on the blood picture. Grave hemorrhages have appeared in people who habitually took two or three aspirins daily. Yet aspirin was thought the perfect remedy a scant ten years ago—on the ground that no side effects were to be feared. Now, such effects begin to appear even in what was, and is, probably the most harmless of all drugs.

Another spectacular example is that of DDT, a chemical which in 1945 was thought to be a prodigiously successful means for the destruction of all kinds of vermin and insects. One of the most admirable things about DDT was that it was said to be completely innocuous toward human beings. DDT was sprinkled over the whole surface of the globe. Then, by accident, it was discovered that in certain areas veal cattle were wasting away and dying. Research revealed that DDT in oily solution causes anemia. Cattle had been dusted with DDT in order to get rid of insects; they had subsequently licked themselves clean and ingested the DDT. The chemical in question passed into their milk and by this route found its way into oily solution, i. e., in the milk fat. Calves suckled by such cows died of anemia, and it is needless to add that the same milk was ingested by human infants. Identical problems are potentially raised by all chemicals consumed by animals or men. Recall the recent example of thalidomide.

This is an example of the so-called secondary effects, effects which are essentially unpredictable and only revealed after the technique in question has been applied on a grand scale, i. e., when it is no longer possible to retrace one's steps.

Another interesting example is furnished by the psycho-sociological studies of the particular psychology of big city dwellers, where, once more, we are confronted with the effect of the technical environment on the human being. One of the principal elements of big city life is the feeling of isolation, loneliness, absence of human contacts, etc. One of the leading ideas of Le Corbusier in his *Maison des Hommes* was the admission that "big city dwellers do not know one another." "Let us create," said Le Corbusier, "great blocks of dwellings where people will meet one another as they did in the village, with everything (grocer, baker, butcher) included in the block so that people will get to know one another and a community will come into being . . ." The result of Le Corbusier's creation was exactly the opposite of what had been planned; problems of loneliness and isolation in such blocks of dwellings proved to be much more tragic than in the normal and traditional city.

Then, it was held (and this is the penultimate word in city planning) that it was necessary to rediscover human groupings on a human scale, not on the scale of a block with, say, 5000 separate dwelling units. In the works and writings of sociologists and of city planners of perhaps seven or eight years ago we read: "At bottom, the only ones who understood what a city was were the people of the Middle Ages, who knew how to create a true city corresponding to the demands of a genuine city-planning technique, i. e., a human community centered about a small square surrounded by small houses, toward which converged the (straight)

city streets, etc. . . ." The new city planners in keeping with these theories, applied them to the suburbs of Chicago, and in particular, to the well known "village" of Park Forest. There, it was thought, was to be found the disincarnate human formula, one which really allows the human being his full scope. But, the most recent sociological and psychological analyses show this model community to represent nothing less than a new and unexpected difficulty. This time, people are traumatized because they are perpetually under the eyes and under the surveillance of their neighbors. The affected group is indeed much reduced in size; but no one dares to budge, because everybody knows just what everybody else is up to, a frightfully constricting situation, to say the least. It is clear that, even with the best intentions and with the application of hypermodern and profound research in psychology and sociology, we only succeed in coming to results in every case which could not possibly have been anticipated.

I shall give one last example of these unforeseeable effects, this time from agriculture, viz., the massive cultivation of certain plants like corn and cotton. The cultivation of these plants in the "new countries" seems to represent undeniable progress. The deforestation of land too heavily forested is a felicitous operation, profitable from every point of view, and consequently, represents technical progress. But, it could not have been anticipated that corn and cotton are plants which not only impoverish the soil, but even annihilate it by the twofold action of removing certain natural elements and destroying the relation between the humus and the soil particles. Both these last are destroyed by the roots of cotton and corn to the degree that, after 30 or 40 years of cultivation of these agricultural products, the soil is transformed into a veritable dust bowl. A strong wind need only to pass over it to reduce it to bare rock.

The phenomenon is world wide, and is to be encountered in the United States, Brazil, and Russia, among others. It is a bone of contention between Khrushchev and certain Soviet agricultural specialists. Khrushchev essentially emphasizes the cultivation of corn, as is well known; but many Soviet specialists insist that this emphasis is a very dangerous one. It allows a very rapid economic progress for, say, 20 years, only to be followed by a destruction of hitherto fertile lands which may last for centuries.

The inquiries of Castro and Vogt have shown that, at the present, in certain regions 20 per cent of cultivated land is threatened with destruction in this way. If this factor is considered in connection with that of population growth, a very considerable difficulty seems to lurk in the offing. If arable land continues to diminish in extent beyond possibility of recovery, our chances of survival diminish correspondingly. Here we have an example of typical and unpredictable secondary effects, effects which in corn and cotton agriculture do not reveal themselves except after 30 years of experience. It is again impossible, therefore, to say whether technical progress is in essence good or bad.

We are launched into a world of an astonishing degree of complexity; at every step we let loose new problems and raise new difficulties. We succeed progressively in solving these difficulties, but only in such a way that when one has been resolved we are confronted by another. Such is the progress of technology in our society. All I have been able to do is to give a few fragmentary examples. What would be necessary in order to comprehend the problem in its entirety is a systematic and detailed study of all these points.

Modern man in choosing is already incorporated within the technical process and modified in his nature by it. He is no longer in his traditional state of freedom with respect to judgment and choice.

II. To understand the problem posed to us, it is first of all requisite to disembarass ourselves of certain fake problems.

1. We make too much of the disagreeable features of technical development, for example, urban over-crowding, nervous tension, air pollution, and so forth. I am convinced that all such inconveniences will be done away with by the ongoing evolution of Technique itself, and indeed, that it is only by means of such evolution that this can happen. The inconveniences we emphasize are always dependent on technical solutions, and it is only by means of techniques that they can be solved. This fact leads to the following two considerations:

- a. Every solution to some technical inconvenience is able only to reinforce the system of techniques *in their ensemble*;
- b. Enmeshed in a process of technical development like our own, the possibilities of human survival are better served by more technique than less, a fact which contributes nothing, however, to the resolution of the basic problem.

2. We hear too often that morals are being threatened by the growth of our techniques. For example, we hear of greater moral decadence in those environments most directly affected technically, say, in working class or urbanized *milieux*. We hear, too, of familial disintegration as a function of techniques. The falseness of this problem consists in contrasting the technological environment with the moral values inculcated by society itself.<sup>2</sup> The presumed opposition between ethical problematics and technological systematics probably at the present is, and certainly in the long run will be, false. The traditional ethical *milieu* and the traditional moral values are admittedly in process of disappearing, and we are witnessing the creation of a new technological ethics with its own values. We are witnessing the evolution of a morally consistent system of imperatives and virtues, which tends to replace the traditional system. But man is not necessarily left thereby on a morally inferior level, although a moral relativism is indeed implied—an attitude according to which everything is well, *provided* that the individual obeys some ethic or other. We *could* contest the value of this development *if* we had a clear and adequate concept of what good-in-itself is. But such judgments are impossible on the basis of our general morality. On *that* level, what we are getting is merely a substitution of a new technological morality for a traditional one which Technique has rendered obsolete.

<sup>2</sup> Cf. K. Horney.

3. We dread the "sterilization" of art through technique. We hear of the artist's lack of freedom, calm, and the impossibility of meditation in the technological society. This problem is no more real than the two preceding. On the contrary, the best artistic production of the present is a result of a close connection between art and Technique. Naturally, new artistic form, expression, and ethic are implied, but this fact does not make art less art than what we traditionally called such. What assuredly is *not* art is a fixation in congealed forms, and a rejection of technical evolution as exemplified, say, in the neo-classicism of the nineteenth century or in present day "socialist realism." The modern cinema furnishes an artistic response comparable to the Greek theater at its best; and modern music, painting, and poetry express, not a canker, but an authentic esthetic expression of mankind plunged into a new technical *milieu*.

4. One last example of a false problem is our fear that the technological society is completely *eliminating* instinctive human values and powers. It is held that systematization, organization, "rationalized" conditions of labor, overly hygienic living conditions, and the like have a tendency to repress the forces of instinct. For some people the phenomenon of "beatniks," "*blousons noirs*,"<sup>3</sup> and "hooligans" is explained by youth's violent reaction and the protestation of youth's vital force to a society which is overorganized, overordered, over-regulated, in short, technicized.<sup>4</sup> But here too, even if the facts are established beyond question, it is very likely that a superior conception of the technological society will result in the integration of these instinctive, creative, and vital forces. Compensatory mechanisms are already coming into play; the increasing appreciation of the aesthetic eroticism of authors like Henry Miller and the rehabilitation of the Marquis de Sade are good examples. The same holds for music like the new jazz forms which are "escapist" and exaltative of instinct; *uem*, the latest dances. All these things represent a process of "*désoulement*"<sup>5</sup> which is finding its place in the technological society. In the same way, we are beginning to understand that it is impossible indefinitely to repress or expel religious tendencies and to bring the human race to a perfect rationality. Our fears for our instincts *are* justified to the degree that Technique, instead of provoking conflict, tends rather to *absorb* it, and to *integrate* instinctive and religious forces by giving them a place within its structure, whether it be by an adaptation of Christianity" or by the creation of new religious expressions like myths and mystiques which are in full compatibility with the techno-

<sup>3</sup> A kind of French beatnik. (Trans.)

<sup>4</sup> The psychoanalyst Jung has much to say along this line.

<sup>5</sup> An untranslatable French play on words. *Désoulement* is an invented word which presumably expresses the opposite of *resoulement*, i. e., repression.

<sup>6</sup> Teilhard de Chardin represents, in his works, the best example of this.

logical society.<sup>7</sup> The Russians have gone farthest in creating a "religion" compatible with Technique by means of their transformation of Communism into a religion.

III. What, then, is the real problem posed to men by the development of the technological society? It comprises two parts: 1. Is man able to remain master<sup>8</sup> in a world of means? 2. Can a new civilization appear inclusive of Technique?

1. The answer to the first question, and the one most often encountered, seems obvious: Man, who exploits the ensemble of means, is the master of them. Unfortunately, this manner of viewing matters is purely theoretical and superficial. We must remember the autonomous character of Technique. We must likewise not lose sight of the fact that the human individual himself is to an ever greater degree the *object* of certain techniques and their procedures. He is the object of pedagogical techniques, psychotechniques, vocational guidance testing, personality and intelligence testing, industrial and group aptitude testing, and so on. In these cases (and in countless others) most men are treated as a collection of objects. But, it might be objected, these techniques are exploited by other men, and the exploiters at least remain masters. In a certain sense this is true; the exploiters *are* masters of the particular techniques they exploit. But, they, too, are subjected to the action of yet other techniques, as, for example, propaganda. Above all, they are spiritually taken over by the technological society; they believe in what they do; they are the most fervent adepts of that society. They themselves have been profoundly technicized. They never in any way affect to despise Technique, which to them is a thing good in itself. They never pretend to assign values to Technique, which to them is in itself an entity working out its own ends. They never claim to subordinate it to any value because for them Technique is value.

It may be objected that these individual techniques have as their end the best adaptation of the individual, the best utilization of his abilities, and, in the long run, his happiness. This, in effect, is the objective and the justification of all techniques. (One ought not, of course, to confound man's "happiness" with capacity for mastery with, say, freedom.) If the first of all values is happiness, it is likely that man, thanks to his techniques, will be in a position to attain to a certain state of this good. But happiness does not contain everything it is thought to contain, and *the absolute disparity between happiness and freedom*

<sup>7</sup> Examples of such myths are: "Happiness," "Progress," "The Golden Age," etc.

<sup>8</sup> French *sujet*. The usual rendering, "subject," would indicate exactly the contrary of what is meant here, viz., the opposite of "object." The present sense of "subject" is that in virtue of which it governs a grammatical object, for example. (Trans.)

remains an ever real theme for our reflections. To say that man should remain *subject* rather than *object* in the technological society means two things, viz., that he be capable of giving direction and orientation to Technique, and that, to this end, he be able to master it.

Up to the present he has been able to do neither. As to the first, he is content passively to participate in technical progress, to accept whatever direction it takes automatically, and to admit its autonomous meaning. In the circumstances he can either proclaim that life is an absurdity without meaning or value; *or*, he can predicate a number of indefinitely sophisticated values. But neither attitude accords with the fact of the technical phenomenon any more than it does with the other. Modern declarations of the absurdity of life are not based on modern technological efflorescence, which none (least of all the existentialists) think an absurdity. And the predication of values is a purely theoretical matter, since these values are not equipped with any means for putting them into practice. It is easy to reach agreement on what they are, but it is quite another matter to make them have any effect whatever on the technological society, or to cause them to be accepted in such a way that techniques must evolve in order to realize them. The values spoken of in the technological society are simply there to justify what is; *or*, they are generalities without consequence; *or* technical progress realizes them automatically as a matter of course. Put otherwise, neither of the above alternatives is to be taken seriously.

The second condition *that man be subject rather than object*, i. e., the imperative that he exercise mastery over technical development, is facilely accepted by everyone. But factually it simply does not hold. Even more embarrassing than the question "How?" is the question "Who?" We must ask ourselves realistically and concretely just who is in a position to choose the values which give Technique its justification and to exert mastery over it. If such a person or persons are to be found, it must be in the Western world (inclusive of Russia). They certainly are not to be discovered in the bulk of the world's population which inhabits Africa and Asia, who are, as yet, scarcely confronted by technical problems, and who, in any case, are even less aware of the questions involved than we are.

Is the arbiter we seek to be found among the *philosophers*, those thinking specialists? We well know the small influence these gentry exert upon our society, and how the technicians of every order distrust them and rightly refuse to take their reveries seriously. Even if the philosopher could make his voice heard, he would still have to contrive means of mass education so as to communicate an effective message to the masses.

—Can the *technician* himself assume mastery over Technique? The trouble here is that the technician is *always* a specialist and cannot make the slightest claim to have mastered any technique but his own. Those for whom Technique bears its meaning in itself will scarcely



discover the values which lend meaning to what they are doing. They will not even look for them. The only thing they can do is to apply their technical specialty and assist in its refinement. They cannot *in principle* dominate the totality of the technical problem or envisage it in its global dimensions. *Ergo*, they are completely incapable of mastering it.

Can the *scientist* do it? There, if anywhere, is the great hope. Does not the scientist dominate our techniques? Is he not an intellectual inclined and fit to put basic questions? Unfortunately, we are obliged to re-examine our hopes here when we look at things as they are. We see quickly enough that the scientist is as specialized as the technician, as incapable of general ideas, and as much out of commission as the philosopher. Think of the scientists who, on one tack or another, have addressed themselves to the technical phenomenon: Einstein, Oppenheimer, Carrel. It is only too clear that the ideas these gentlemen have advanced in the sphere of the philosophic or the spiritual are vague, superficial, and contradictory *in extremis*. They really ought to stick to warnings and proclamations, for as soon as they assay anything else, the other scientists and the technicians rightly refuse to take them seriously, and they even run the risk of losing their reputations as scientists.

Can the *politician* bring it off? In the democracies the politicians are subject to the wishes of their constituents who are primarily concerned with the happiness and well-being which they think Technique assures them. Moreover, the further we get on, the more a conflict shapes up between the politicians and the technicians. We cannot here go into the matter which is just beginning to be the object of serious study.<sup>9</sup> But it would appear that the power of the politician is being (and will continue to be) outclassed by the power of the technician in modern states. Only dictatorships can impose their will on technical evolution. But, on the one hand, human freedom would gain nothing thereby, and, on the other, a dictatorship thirsty for power has no recourse at all but to push toward an excessive development of various techniques at its disposal.

Any of us? An individual can doubtless seek the soundest attitude to dominate the techniques at his disposal. He can inquire after the values to impose on techniques in his use of them, and search out the way to follow in order to remain a man in the fullest sense of the word within a technological society. All this is extremely difficult, but it is far from being useless, since it is apparently the only solution presently possible. But the individual's efforts are powerless to resolve in any way the technical problem in its universality; to accomplish this would mean that *all* men adopt the same values and the same behavior.

<sup>9</sup> See, for example, the reports of the International Congress for Political Science, October, 1961.

2. The second real problem posed by the technological society is whether or not a new civilization can appear which is inclusive of Technique. The elements of this question are as difficult as those of the first. It would obviously be vain to deny all the things that can contribute something useful to a new civilization: security, ease of living, social solidarity, shortening of the work week, social security, and so forth. But a civilization in the strictest sense of the term is not brought into being by all these things.<sup>10</sup>

A threefold contradiction resides between civilization and Technique of which we must be aware if we are to approach the problem correctly:

a. The technical world is the world of material things; it is put together out of material things and with respect to them. When Technique displays any interest in man, it does so by converting him into a material object. The supreme and final authority in the technological society is fact, at once ground and evidence. And when we think on man as he exists in this society it can only be as a being immersed in a universe of objects, machines, and innumerable material things. Technique indeed guarantees him such material happiness as material objects can. But, the technical society is not, and cannot be, a genuinely humanist society since it puts in first place not man but material things. It can only act on man by lessening him and putting him in the way of the quantitative. The radical contradiction referred to exists between technical perfection and human development because such perfection is only to be achieved through quantitative development and necessarily aims exclusively at what is measurable. Human excellence, on the contrary, is of the domain of the qualitative and aims at what is not measurable. Space is lacking here to argue the point that spiritual values cannot evolve as a function of material improvement. The transition from the technically quantitative to the humanly qualitative is an impossible one. In our times, technical growth monopolizes all human forces, passions, intelligences, and virtues in such a way that it is in practice nigh impossible to seek and find anywhere any distinctively human excellence. And if this search is impossible, there cannot be any civilization in the proper sense of the term.

b. Technical growth leads to a growth of power in the sense of technical means incomparably more effective than anything ever before invented, power which has as its object only power. in the widest sense of the word. The possibility of action becomes limitless and absolute. For example, we are confronted for the first time with the possibility of the annihilation of all life on

<sup>10</sup> See appended note on the theme "Technical Progress is Always Ambiguous."

earth, since we have the means to accomplish it. In every sphere of action we are faced with just such absolute possibilities. Again, by way of example, governmental techniques, which amalgamate organizational, psychological, and police techniques, tend to lead to government absolute powers. And here I must emphasize a great law which I believe to be essential to the comprehension of the world in which we live, viz., that when power becomes absolute, values disappear. When man is able to accomplish anything at all, there is no value which can be proposed to him; when the means of action are absolute, no goal of action is imaginable. Power eliminates, in proportion to its growth, the boundary between good and evil, between the just and the unjust. We are familiar enough with this phenomenon in totalitarian societies. The distinction between good and evil disappears beginning with the moment that the ground of action (for example the *raison d'état*, or the instinct of the proletariat) claims to have absolute power and thus to incorporate *ipso facto* all value. Thus it is that the growth of technical means tending to absolutism forbids the appearance of values, and condemns to sterility our search for the ethical and the spiritual. Again, where Technique has place, there is the implication of the impossibility of the evolution of civilization.

c. The third and final contradiction is that Technique can never engender freedom. Of course, Technique frees mankind from a whole collection of ancient constraints. It is evident, for example, that it liberates him from the limits imposed on him by time and space; that man, through its agency, is free (or at least tending to become free) from famine, excessive heat and cold, the rhythms of the seasons, and from the gloom of night; that the race is freed from certain social constraints through its commerce with the universe, and from its intellectual limitations through its accumulation of information. But is this what it means really to be free? Other constraints as oppressive and rigorous as the traditional ones are imposed on the human being in today's technological society through the agency of Technique. New limits and technical oppressions have taken the place of the older, natural constraints, and we certainly cannot aver that much has been gained. The problem is deeper—the operation of Technique is the contrary of freedom, an operation of determinism and necessity. Technique is an ensemble of rational and efficient practices; a collection of orders, schemas, and mechanisms. All of this expresses very well a necessary order and a determinate process, but one into which freedom, unorthodoxy, and the sphere of the gratuitous and spontaneous cannot penetrate. All that these last could possibly introduce is discord and disorder. The more technical actions increase in society, the more human autonomy and initiative diminish. The

more the human being comes to exist in a world of ever increasing demands (fortified with technical apparatus possessing its own laws to meet these demands), the more he loses any possibility of free choice and individuality in action. This loss is greatly magnified by Technique's character of self-determination, which makes its appearance among us as a kind of fatality and as a species of perpetually exaggerated necessity. But where freedom is excluded in this way, an authentic civilization has little chance. Confronted in this way by the problem, it is clear to us that no solution can exist, in spite of the writings of all the authors who have concerned themselves with it. They all make an unacceptable premise, viz., rejection of Technique and return to a pre-technical society. One may well regret that some value or other of the past, some social or moral form, has disappeared; but, when one attacks the problem of the technical society, one can scarcely make the serious claim to be able to revive the past, a procedure which, in any case, scarcely seems to have been, globally speaking, much of an improvement over the human situation of today. All we know with certainty is that it was different, that the human being confronted other dangers, errors, difficulties, and temptations. Our duty is to occupy ourselves with the dangers, errors, difficulties, and temptations of modern man in the modern world. All regret for the past is vain; every desire to revert to a former social stage is unreal. There is no possibility of turning back, of annulling, or even of arresting technical progress. What is done is done. It is our duty to find our place in our present situation and in no other. Nostalgia has no survival value in the modern world and can only be considered a flight into dreamland.

We shall insist no further on this point. Beyond it, we can divide into two great categories the authors who search for a solution to the problem posed by Technique: The first class is that of those who hold that the problem will solve itself; the second, of those who hold that the problem demands a great effort or even a great modification of the whole man. We shall indicate a number of examples drawn from each class and beg to be excused for choosing to cite principally French authors.

Politicians, scientists and technicians are to be found in the first class. In general, they consider the problem in a very concrete and practical way. Their general notion seems to be that technical progress resolves all difficulties *pari passu* with their appearance, and that it contains within itself the solution to everything. The sufficient condition for them, therefore, is that technical progress be not arrested; everything which plagues us today will disappear tomorrow.

The primary example of these people is furnished by the Marxists, for whom technical progress is the solution to the plight of the pro-

letariat and all its miseries, and to the problem posed by the exploitation of man by man in the capitalistic world. Technical progress, which is for Marx the motive force of history, necessarily increases the forces of production, and simultaneously produces a progressive conflict between forward moving factors and stationary social factors like the state, law, ideology, and morality, a conflict occasioning the periodic disappearance of the outmoded factors. Specifically, in the world of the present, conflict necessitates the disappearance of the structures of capitalism, which are so constituted as to be completely unable to absorb the economic results of technical progress, and are hence obliged to vanish. When they do vanish, they of necessity make room for a socialist structure of society corresponding perfectly to the sound and normal utilization of Technique. The Marxist solution to the technical problems is therefore an automatic one since the transition to socialism is *in itself* the solution. Everything is *ex hypothesi* resolved in the socialist society, and humankind finds therein its maturation. Technique, integrated into the socialist society "changes sign": from being destructive it becomes constructive; from being a means of human exploitation it becomes humane; the contradiction between the infrastructures and the suprastructures disappears. In other words, all the admittedly difficult problems raised in the modern world belong to the structure of capitalism and not to that of Technique. On the one hand, it suffices that social structures become socialist for social problems to disappear; and on the other, society *must necessarily* become socialist by the very movement of Technique. Technique, therefore, carries in itself the response to all the difficulties it raises.

A second example of this kind of solution is given by a certain number of technicians, for example, Frisch. All difficulties, according to Frisch, will inevitably be resolved by the technical growth which will bring the technicians to power. Technique admittedly raises certain conflicts and problems, but their cause is that the human race remains attached to certain political ideologies and moralities and loyal to certain outmoded and antiquated humanists whose sole visible function is to provoke discord of heart and head, thereby preventing men from adapting themselves and from entering resolutely into the path of technical progress. *Ergo*, men are subject to distortions of life and consciousness which have their origin, *not* in Technique, but in the conflict between Technique and the false values to which men remain attached. These fake values, decrepit sentiments, and outmoded notions must inevitably be eliminated by the invincible progress of Technique. In particular, in the political domain, the majority of crises arise from the fact that men are still wedded to certain antique political forms and ideas, for example, democracy. All problems will be resolved if power is delivered into the hands of the technicians who alone are capable of directing Technique in its entirety and making of it a positive instrument for human service. This is all the more true in that,

thanks to the so-called "human techniques" (for example, propaganda) they will be in a position to take account of the human factor in the technical context. The technocrats will be able to use the totality of Technique without destroying the human being, but rather by treating him as he should be treated so as to become simultaneously useful and happy. General power accorded to the technicians become technocrats is the only way out for Frisch, since they are the only ones possessing the necessary competence; and, in any case, they are being carried to power by the current of history, the fact which alone offers a quick enough solution to technical problems. It is impossible to rely on the general improvement of the human species, a process which would take too long and would be too chancy. For the generality of men, it is necessary to take into account that Technique establishes an inevitable discipline, which, on the one hand, they must accept, and, on the other, the technocrats will humanize.

The third and last example (it is possible that there are many more) is furnished by the economists, who, in very different ways, affirm the thesis of the automatic solution. Fourastié is a good example of such economists. For him, the first thing to do is to draw up a balance between that which Technique is able to deliver and that which it may destroy. In his eyes there is no real problem: What Technique can bring to man is incomparably superior to that which it threatens. Moreover, if difficulties *do* exist, they are only temporary ones which will be resolved beneficially, as was the case with the similar difficulties of the last century. Nothing decisive is at stake; man is in no mortal danger. The contrary is the case: Technique produces the foundation, infrastructure, and suprastructure which will enable man really to become man. What we have known up to now can only be called the *prehistory* of a human race so overwhelmed by material cares, famine, and danger, that the truly human never had an opportunity to develop into a civilization worthy of the name. Human intellectual, spiritual, and moral life will, according to Fourastié, never mature except when life is able to start from a complete satisfaction of its material needs, complete security, including security from famine and disease. The growth of Technique, therefore, initiates the genuinely human history of the whole man. This new type of human being will clearly be different from what we have hitherto known; but this fact should occasion no complaint or fear. The new type cannot help being superior to the old in every way, *after* all the traditional (and exclusively material) obstacles to his development have vanished. Thus, progress occurs automatically, and the inevitable role of Technique will be that of guaranteeing such material development as allows the intellectual and spiritual maturation of what has been up to now only potentially present in human nature.

The orientation of the other group of doctrines affirms, on the contrary, that man is dangerously imperiled by technical progress; and

that human will, personality, and organization must be set again to rights if society is to be able to guard against the imminent danger. Unfortunately, these doctrines share with their opposites the quality of being too optimistic, in that they affirm that their thesis is even feasible and that man is really capable of the rectifications proposed. I will give three very different examples of this, noting that the attitude in question is generally due to philosophers and theologians.

The orientation of Einstein, and the closely related one of Jules Romains, are well known, viz., that the human being must get technical progress back again into his own hands, admitting that the situation is so complicated and the data so overwhelming that only some kind of "superstate" can possibly accomplish the task. A sort of spiritual power integrated into a world government in possession of indisputable moral authority might be able to master the progression of techniques and to direct human evolution. Einstein's suggestion is the convocation of certain philosopher-scientists, whereas Romains' idea is the establishment of a "Supreme Court of Humanity." Both of these bodies would be organs of meditation, of moral quest, before which temporal powers would be forced to bow. (One thinks, in this connection, of the role of the papacy in medieval Christianity *vis-à-vis* the temporal powers.)

A second example of this kind of orientation is given by Bergson, at the end of his work, *The Two Sources of Morality and Religion*. According to Bergson, initiative can only proceed from humanity, since in Technique there is no "*force des choses*." Technique has conferred disproportionate power on the human being, and a disproportionate extension to his organism. But, "in this disproportionately magnified body, the soul remains what it was, i. e., too small to fill it and too feeble to direct it. Hence the void between the two." Bergson goes on to say that "this enlarged body awaits a supplement of soul, the mechanical demands the mystical," and . . . "that Technique will never render service proportionate to its powers unless humanity, which has bent it earthwards, succeeds by its means in reforming itself and looking heavenwards." This means that humanity has a task to perform, and that man must grow proportionately to his techniques, but that he must *will* it and *force* himself to make the experiment. This experiment is, in Bergson's view, a possibility, and is even favored by that technical growth which allows more material resources to men than ever before. The required "supplement of soul" is therefore of the order of the possible and will suffice for humans to establish mastery over Technique. The same position, it may be added, has in great part been picked up by E. Mounier.

A third example is afforded by a whole group of theologians, most of them Roman Catholic. Man, in his actions in the domain of the technical, is but obeying the vocation assigned him by his Creator. Man, in continuing his work of technical creation, is pursuing the

work of his Creator. Thanks to Technique, this man, who was originally created "insufficient," is becoming "adolescent." He is summoned to new responsibilities in this world which do not transcend his powers since they correspond exactly to what God expects of him. Moreover, it is God Himself who through man is the Creator of Technique, which is something not to be taken in itself but in its relation to its Creator. Under such conditions, it is clear that Technique is neither evil nor fraught with evil consequences. On the contrary, it is good and cannot be dangerous to men. It can only become evil to the extent that man turns from God; it is a danger only if its true nature is misapprehended. All the errors and problems visible in today's world result uniquely from the fact that man no longer recognizes his vocation as God's collaborator. If man ceases to adore the "creature" (i. e., Technique) in order to adore the true God; if he turns Technique to God and to His service, the problems must disappear. All of this is considered the more true in that the world transformed by technical activity *must* become the point of departure and the material support of the new creation which is to come at the end of time.

Finally, it is necessary to represent by itself a doctrine which holds at the present a place of some importance in the Western world, i. e., that of Father Teilhard de Chardin, a man who was simultaneously a theologian and a scientist. His doctrine appears as an intermediate between the two tendencies already sketched. For Chardin, evolution in general, since the origin of the universe, has represented a constant progression. First of all, there was a motion toward a diversification of matter and of beings; then, there supervened a motion toward Unity, i. e., a higher Unity. In the biological world, every step forward has been effected when man has passed from a stage of "dispersion" to a stage of "concentration." At the present, technical human progress and the spontaneous movement of life are in agreement and in mutual continuity. They are evolving together toward a higher degree of organization, and this movement manifests the influence of Spirit. Matter, left to itself, is characterized by a necessary and continuous degradation. But on the contrary, we note that progress, advancement, improvement do exist, and, hence, a power contradicting the spontaneous movement of matter, a power of creation and progress exists which is the opposite of matter, i. e., it is Spirit. Spirit has contrived Technique as a means of organizing dispersed matter, in order simultaneously to express progress and to combat the degradation of matter. Technique is producing at the same time a prodigious demographic explosion, i. e., a greater density of human population. By all these means it is bringing forth "communion" among men; and likewise creating from inanimate matter a higher and more organized form of matter which is taking part in the ascension of the cosmos toward God. Granting that it is true that every progression in the physical and biological order is brought about by a condensation of the ele-

ments of the preceding period, what we are witnessing today, according to Chardin, is a condensation, a concentration of the whole human species. Technique, in producing this, possesses a function of unification *inside* humanity, so that humanity becomes able thereby to have access to a sort of unity. Technical progress is therefore synonymous with "socialization," this latter being but the political and economic sign of communion among men, the temporary expression of the "condensation" of the human species into a whole. Technique is the irreversible agent of this condensation; it prepares the new step forward which humanity must make. When men cease to be individual and separate units, and all together form a total and indissoluble communion, then humanity will be a single body. This material concentration is always accompanied by a spiritual, i. e., a maturation of the spirit, the commencement of a new species of life. Thanks to Technique, there is "socialization," the progressive concentration on a planetary scale of disseminated spiritual personalities into a supra-personal unity. This mutation leads to another Man, spiritual and unique, and means that humanity in its ensemble and in its unity, has attained the supreme goal, i. e., its fusion with that glorious Christ who must appear at the end of time. Thus Chardin holds that in technical progress man is "Christified," and that technical evolution tends inevitably to the "edification" of the cosmic Christ.

It is clear that in Chardin's grandiose perspective, the individual problems, difficulties, and mishaps of Technique are negligible. It is likewise clear how Chardin's doctrine lies midway between the two preceding ones: On the one hand, it affirms a natural and involuntary ascension of man, a process inclusive of biology, history, and the like, evolving as a kind of will of God in which Technique has its proper place; and, on the other, it affirms that the evolution in question implies consciousness, and an intense *involvement* on the part of man who is proceeding to socialization and thus *committing* himself to this mutation.

We shall not proceed to a critique of these different theories, but content ourselves with noting that all of them appear to repose on a too superficial view of the technical phenomenon; and that they are *practically* inapplicable because they presuppose a certain number of *necessary* conditions which are not given. None of these theories, therefore, can be deemed satisfactory.

IV. It does not seem that at the present we are in a position to give a satisfactory reply to the complex of technical problems. All that appears possible is to inquire into the above-mentioned *necessary* conditions for a possible solution.

In any case, it seems to me that we can set forth the following thesis: The further technical progress advances, the more the social problem of mastering this progress becomes one of an ethical and spiritual kind.

In proportion to the degree that man extricates himself from the domain of the material, dominates it, and multiplies thereby the means of exploiting matter, the problem ceases to be one of human possibilities and limits and becomes one rather of knowing which man (or group of men) will exploit technical means, and what will be the enabling moral and spiritual qualities. (In this point I am not far from that, for example, of Bergson.) It is essential not to consider the problem resolved once this has been said; the current attitude is false according to which, once a matter has been pronounced a matter of morality, it is something simple and also automatically resolvable. On the contrary, the more decision depends on a man or a group of them, the more difficult it appears, *if* we take a realistic view of the matter and refuse to admit *a priori* that man is good, democratic, liberal, reasonable, and so on. The difficulty resides in the following points:

- a. It is impossible to trust the spontaneous employment which men will make of the available technical means;
- b. Man, as we have already indicated, is *integrated* into the technological process;
- c. *If* we desire to preserve man's freedom, dignity, and responsibility, it is precluded to act upon him by technical means, like psychology, and so forth. To transform a man into a reasonable being and a good exploiter of techniques *through* certain psychological procedures is precisely to destroy him as a spiritual and ethical subject.

We are thus caught in a dilemma before the decisive question, the question which may well be the penultimate one.

With this preliminary, what are these necessary conditions? I shall note them as they appear to me at the present, starting from that which is more general and working toward that which is more particular.

1. The first thing needed is a correct diagnosis and an effort to achieve a genuine consciousness of the problem. It is necessary to see the situation clearly and to pose the problem correctly if it be desired to know just what is to be done and if adequate answers are to be forthcoming. Inexact formulation of the problem affords no hope of getting a solution. The diagnostic element, on which I do not insist, must be accompanied by a becoming conscious—by passing from the intellectual to the existential, which means that mankind must accept the fact that his existence is "engaged" and involved in this venture, and that his very freedom is at stake. It is necessary to become conscious of the fact that in every domain, Technique has established stricter and stricter domination over the human being. But this consciousness must not be negative—no scientific determinism or divine fatalism before which man can only bow and confess himself unfree. On the contrary, it must be recognized that man *qua* free is subject

to constraints and determinations which his vocation to be free must make him combat and rise clear of. *But*, to the extent that man clings to the illusion of the present that he *is* free (and uses the vocabulary of freedom) conceiving liberty as inalienable; *or*, to the extent that he holds to the conviction that all will be well though he sees that the Technique actually diminishes the area of freedom, and dreams that possibilities of freedom still exist—in all these cases, his natural inertia is leading him to accept a condition of slavery and to pay for his technological happiness with his freedom. It is only by making men conscious to what degree they have become slaves in becoming “happy,” that there is any hope of regaining liberty by asserting themselves, perhaps at the cost of much sacrifice, over the Technique which has come to dominate them. Short of attaining to such consciousness, there is no reason for any human being to lift a finger to secure mastery over his technology.

2. A second essential element consists in ruthlessly destroying the “myth” of Technique, i. e., the whole ideological construction and the tendency to consider technology something possessing sacred character. Intellectuals attempt to insert the technical phenomenon into the framework of their respective intellectual or philosophical systems by attributing to it a quality of supreme excellence; for example, when they demonstrate that Technique is an instrument of freedom, or the means of ascent to historical destiny, or the execution of a divine vocation, and the like. All such constructions have the result of glorifying and sanctifying Technique and of putting the human being at the disposal of some indisputable historical law or other. A further aspect of this element is the *sacred*, i. e., the human tendency spontaneously to attribute sacred value to what so manifestly possesses transcendent power. Technique, in this view, is not solely an ensemble of material elements, but that which gives meaning and value to life, allowing man not only to live but to live well. Technique is intangible and unattackable precisely because *everything* is subject and subordinate to it. Man unconsciously invests with a holy prestige that against which he is unable to prevail. It seems to me that the only means to mastery over Technique is by way of “de-sacralization” and “de-ideologization.” This means that *all* men must be shown that Technique is nothing more than a complex of material objects, procedures, and combinations, which have as their sole result a modicum of comfort, hygiene, and ease; and that it possesses nothing worthy of the trouble of devoting one’s whole life to it, or of commanding an excessive respect, or of reposing in it one’s success and honor, or of sacrificing one’s fellow men. Men must be convinced that technical progress is not humanity’s supreme adventure, but a commonplace fabrication of certain objects which scarcely merit enthusiastic delirium even when they happen to be Sputniks. As long as man worships

Technique, there is as good as no chance at all that he will ever succeed in mastering it.

3. A consequence of this is that, in practice, it is necessary to teach man in his employment of Techniques a certain detachment, an independence with respect to them—and humor. It is naturally very difficult to accomplish this; and above all to get him to give up his illusions, not pretending to be completely free with respect to automobiles, television sets, or jobs, when the plain fact is that he is totally enslaved to them. Man must be capable of questioning at every step his use of his technical goods, able to refuse them and to force them to submit to determining factors other than the technical, say, the spiritual. He must be able to exploit all these goods without becoming unduly attached to them and without becoming convinced that even his most imposing technical conquests are to be taken seriously. Such recommendations must, of course, appear scandalous to contemporary eyes. To affirm that these things have no importance at all in respect to truth and freedom, that it is a matter of no *real* importance whether man succeeds in reaching the moon, or curing disease with antibiotics, or upping steel production, is really a scandal. As long as man does not learn to use technical objects in the right way he must remain their slave. What I am saying refers to Technique itself and *not* to the individual’s use of individual techniques. These two problems are situated on different levels. *But, if the individual cannot attain personal liberty with respect to technical objects, there is no chance that he will be able to respond to the general problem of Technique.* Let us recall once more that what we are setting forth are certain necessary conditions for finding a solution to this general problem.

4. Everything we have said presupposes an effort at reflection which might be thought of as philosophic. If we admit that the technical adventure is a genuine novelty for the human race, that all that it has excogitated up to now can scarcely be of any use to it at the present; if we admit that it can only be by means of a fundamental and arduous search that we will be able to extricate ourselves from the mess we are in, a *truly* philosophic reflection will be necessary. But modern philosophic systems, like existentialism and phenomenology, have small utility because they limit themselves into desuetude with their assertions that philosophy *in principle* can have no purchase on Technique. How, in the nature of things, can a philosophy which is nothing more than a research into the meaning of words, get any grip on the technical phenomenon? Preoccupation with “semantics” is the reason why modern philosophy immures itself in a refusal to come to grips with Technique. As Ducassé has put it in his *Les Techniques et le philosophe*: “Between the refusal of the philosophers, who claim to open up existence to themselves while evading the technical nature of the existent, and the hypocritical humility of the technicians manifested

by an ambition stronger than their discipline, some very peculiar enterprises get under way, which might be termed "pseudophilosophies" and "pseudotechniques," respectively, and which usurp in man the place of philosophy's absent mediation." Authentic philosophy of real meaning would bring us to precisely that possibility of mediation between man and the technical phenomenon without which any legitimate attitude is inconceivable. But for such a philosophy to exist would mean that philosophy would first have to cease to be a purely academic technique with a hermetically sealed vocabulary, to become again the property of every man who thinks while he is engaged in the business of being alive.

5. Finally, it is necessary to point out the importance of the relation between the technicians and those who try to pose the technical problem. None of the preceding is more difficult than this, since the technicians have become an authoritarian and closed world. They are armed with good consciences, but likewise with the conviction of their essential rightness and the persuasion that all discourse and reflection of a non-technical nature are verbalisms of no importance. To get them to engage in the dialogue or to question their own creation is an almost superhuman task, the more so that he who will enter this dialogue must be completely aware of what he wants, just what the technician is driving at, and what the technician is able to grasp of the problem. But, as long as such interchange does not take place, nothing will happen, since influencing Technique necessarily means influencing the technicians. It seems to me that this dialogue can only come about by making contact which will represent a *permanent* and *basic* confrontation between technique's pretensions to resolve all human problems and the human will to escape technical determinism.

Such, I think are the five conditions necessary that an opening on the technical problem can even become a possibility.

*Note on the Theme:  
Technical Progress is Always Ambiguous*

It cannot be maintained that technical progress is in itself either good or bad. In the evolution of Technique, contradictory elements are always indissolubly connected. Let us consider these elements under the following four rubrics:

1. All technical progress exacts a price;
2. Technique raises more problems than it solves;
3. Pernicious effects are inseparable from favorable effects; and
4. Every technique implies unforeseeable effects.

*1. All Technical Progress Exacts a Price*

What is meant here is not that technical progress exacts a price in money or in intellectual effort, but that, when technical progress adds something on the

one hand, it inevitably subtracts something on the other. It is always difficult to interpret satisfactorily the bald statement that "technical progress is an established fact," because some people cling to traditional social forms, tending to deny any value at all to such progress, and deeming that nothing can be called progress if it casts doubt on established social values. Other persons, on the contrary, hold that Technique produces extraordinary things of a prodigious novelty, bringing about the consequent disappearance of all sorts of valueless junk.

The fact is that, viewed objectively, technological progress produces values of unimpeachable merit, while simultaneously destroying values no less important. As a consequence, it cannot be maintained that there is absolute progress or absolute regress.

Let me give a few simple examples of this reciprocal action. In the first place, let us consider the fact that modern man, thanks to hygiene in particular and to technical progress in general, enjoys a greater life span than ever before. Life expectancy in France today is approximately 60 years, compared, say, to 35 years in 1890 and 30 years about 1800.\* But, even with this indubitable extension of the average life span, all physicians are in agreement that, proportionately to this extension, life has become very much more precarious, i. e., our general state of health has become very much more fragile. Human beings of the present have neither the same resistance as their ancestors to disease or to natural conditions, nor the same endurance; they suffer from a certain nervous "fragility" and a loss of general vitality, sensitiveness of their senses, and so on. In the 60 years during which such studies have been carried out, regression in all these respects has been marked. Thus, though we live longer, we live a reduced life with nothing resembling the vital energy of our ancestors. It is clear that diminution on the one hand has been accompanied by augmentation on the other.

In the sphere of labor, the technical progress of the present has effected a considerable economy of muscular effort; but, at the same time this progress has come to demand a greater and greater nervous effort so that tension and wear and tear on our nerves have inversely increased. Here again, a kind of equilibrium has asserted itself between savings and expense.

To take an instance from the sphere of economics, technical progress allows the creation of new industries. But a just view of the matter would compel us to take into consideration the accompanying destruction of resources. To take a French example, the so-called Lacq case is beginning to be well known. An industrial complex for the exploitation of sulphur and natural gas has been established at Lacq, a simple technical fact. But, from the economic point of view, this is far from being the case, since a serious agricultural problem has arisen because of the excessive destruction of farm products in the region. Up to now, the government has not seen fit to take the matter seriously, although it has been officially estimated in reports to the Chamber that, for 1960, agricultural losses have aggregated two billion francs. Now, the vineyards of Jurançon are being attacked by the sulfurous gases and are disappearing, a not inconsiderable economic loss.

To calculate from the economist's point of view the profits of an industry

\* I must remark that I am very sceptical of the way in which mean life spans are calculated for periods antedating 1800. When the historian says that life expectancy was 20 years in the thirteenth century, his statement can hardly be looked upon as more than a mere joke. There are no means *in principle* of establishing life expectancies for the past.

of this kind, it would at the minimum be necessary to deduct the value of what has been destroyed, in this case two billion francs. It would likewise be necessary to deduct the very considerable expenses of all the necessary protective devices, hospitals (which, incidentally, have not yet been constructed), schools,—in short, of the whole urban complex which has not yet been brought into being but which is nevertheless indispensable. We must have knowledge of how to calculate the *whole*. The Lacq enterprise, counting all the expenses of which we have been speaking, must be reckoned a "deficit" enterprise.

Our last example has to do with the problem of the intellectual culture of the masses. True, today's technical means permit a mass culture to exist. Television allows people who never visited a theatre in their lives to see performances of the great classics. *Paris-Match*, through its articles, allows masses of people who would be in total ignorance without such articles to attain to a certain literary (and even to a certain aesthetic) culture. But, on the other side of the ledger, it must be recorded that this same technical progress leads to an ever increasing cultural superficiality. Technical progress absolutely forbids certain indispensable conditions of a genuine culture, viz., reflection and opportunity for assimilation. We are indeed witnessing the creation of knowledge, since we are in possession of the means of knowing what we could never have known before; but it is nevertheless a superficial development because it is one which is purely *quantitative*.

The intellectual no longer has any time to meditate on a book and must choose between two alternatives: *Either* he reads through a whole collection of books rapidly, of which a little later but a few fragments survive—scattered bits of vague knowledge; *or*, he takes a year to peruse a few books thoroughly. I should like to know who today has the time to take Pascal or Montaigne seriously. To do them justice would require months and months; but today's Technique forbids any such thing. Exactly the same holds for the problem of the "Musée Imaginaire," which Malraux has put so well. We can be in contact with the whole painting and sculpture of humanity; but this availability has no cultural value comparable to that enjoyed by Poussin, who, in his voyage to Rome, passed several years in studying, statue by statue, the ensemble of artistic works at his disposal. He clearly knew nothing of Polynesian or Chinese art, but what he did know had infinitely more educational value for him because it penetrated his personality slowly.

So, once again, we see that Technique allows us to progress quantitatively to the level of culture spoken of, but at the same time interdicts us from making any progress in depth. In the circumstances, is it really possible to speak of "culture" at all? All technical progress exacts a price. We cannot believe that Technique brings us nothing; but we must not think that what it brings it brings free of charge.

## 2. The Problems Posed by Technical Progress

The second aspect of the ambiguity of technical progress concerns the following point: When Technique evolves, it does so by solving a certain number of problems, and by raising others.

The further we advance into the technological society, the more convinced we become that, in any sphere whatever, there are nothing but technical problems. We conceive all problems in their technical aspect, and think that solutions to them can only appear by means of further perfecting techniques. In a certain

sense, we are right; it is true that Technique permits us to solve the majority of the problems we encounter. But we are compelled to note (perhaps not often enough) that each technical evolution raises new problems, and that, as a consequence, there is never *one* technique which solves *one* problem. The technological movement is more complicated; one technique solves one problem, but at the same time creates others.

Let us take some simple examples of this fact. We are well acquainted with the details of the gravest sociological problem faced by the nineteenth century, i. e., that of the proletariat, a problem which we are only now in process of solving (with difficulty). The phenomenon of the proletariat is not to be considered a simple one, and Marx himself did not describe it as "merely" the exploitation of the workers by certain wicked capitalists. His explanation of the "proletarian condition" was very much more profound; he demonstrated that the proletariat was a result of the division and the mechanization of labor. He expressly states that "it is necessary to pass through the stage represented by the proletariat." For Marx, therefore, the problem is not, say, a moral one, with "bad guys exploiting good guys." Marx never puts the problem in this way; he always poses it as lying outside good or bad moral qualities, external to value judgments, and on the level of fact. And the fact is the fact of the division of labor, and of the machine, giving rise to a society in which exploitation is inevitable, i. e., drawing off surplus values. The phenomenon of the proletariat is therefore, even in the Marxian analysis, the result of technical progress. The machine and the division of labor allowed, from the economic point of view, an extraordinary expansion, but, at the same time, and as a result of the same movement, posed the social problem which it has taken a whole century to resolve.

Let us consider in the same way the extension of the above problem as it appears in the questions which will eventually but certainly be posed by the so-called "automation." Again, automation is not just another simple economic fact; indeed, we are gradually coming to realize that it will entail difficulties which, from our present point of view, can only be characterized as insurmountable. *First* of all, automation implies a production of goods in a relatively constant series of types. This means that when production has been automated, it is no longer possible to vary types, so that an unavoidable condition of immobilism with regard to production must ensue. An automated production line, considered in its full context of operation, is so expensive that amortization must occur over terms so long that the exclusive production of certain types of goods without any possibility of modification must be a consequence. *But*, up to the present, no commercial market of the capitalist world is suited to the absorption of the production of an unchanging line of goods. No presently existing Western economic organization, *on the commercial plane*, is prepared to find an answer to automated production.

Another difficulty of automation is the fact that it will result in a massive diminution of the necessary labor force. The simplistic reaction to this problem will clearly be to hold that the solution is easy. It is not necessary to cut down on the number of the workers but only to diminish the number of daily working hours of each. This solution is quite clearly impossible for a very simple reason. Automation cannot be applied to any arbitrarily selected industry or production, and this for reasons which are basic and not due to the temporary exigencies of, say, the money market. Certain kinds of production can and will be automated; certain others cannot and will never be automated. Consequently, it is not



possible to cut down working hours over the working class as a whole. There are industrial sectors in which the workers would conceivably work one hour per day, whereas in others the workers would have to continue working a normal day of eight hours. Hence, as a result of automation, there will be extended sectors of the economy emptied of manpower, while other sectors will continue on the normal standard.

Diebold estimates that in the single year 1955-1956, in the United States, automation reduced the total number of working hours by seven per cent. In the automated plants of the Ford Motor Company there was a reduction of personnel by 25 per cent; and in 1957, in industrial branches in which automation gained most (in particular in the manufacture of electric bulbs and in the very highly automated chemical industry), it was possible to dispense with the services of 800,000 workers. In other words, automation does not result in labor saving favorable to the workers, but is expressed through unemployment and employment disequilibrium.

It might be alleged that the situation described is true of capitalist countries but cannot be identical in socialist. This statement is not exact; in socialist countries the problem likewise is posed, primarily because of socialist egalitarianism. The problem is the same for the Soviet Union, for example, where automation is commencing, as for the United States. There will be specialized workers in some industries who will be freed from the necessity to work in one way or another, while in other branches of industry the eight-hour day will have to remain in force, a situation clearly unacceptable to the egalitarian theories of socialism.

A *second* problem is bound to arise in connection with the *retraining* of the "liberated" workers for jobs in new industrial sectors in which there is a shortage of manpower. But, such retraining more often than not presents enormous difficulties, since the disemployed worker is generally semi-skilled (or unskilled) and a completely new apprenticeship is implied of such a nature as to steer him toward other branches of industry.

A *third* difficulty occasioned by automation is the problem of *wages*. The wage problem produced by automation has, up till now, not been solved. How is it possible to fix a wage scale for automated industrial plants? It cannot be done on the piecework plan—machines do all the work. It cannot be done on the basis of time put in on the job. If it is desired to reduce unemployment by reducing the work day to, say, two or three hours, a given worker would only be employed for a very short period each day. Should such a worker, then, be paid according to a wage schedule which pays him for two hours of work at the equivalent of a worker who must work eight? The injustice of such a procedure is clear. How, then, should wages be calculated in an automated industry? One is forced to the admission that the relation between wages and productivity, on the one hand, and between wages and job time, on the other, *must* disappear. Wages will be calculated only as a function of the purchasing power given to the worker (with a view to maximum consumption) by dividing the total production value by the total number of workers. Such a method is really the only one feasible. Since 1950, in Russia, it has actually been tried twice. But the results were unsatisfactory, and it very soon became necessary to return to the system of hourly wages, since, in the present state of affairs, the necessary calculations prove unfeasible. But then the difficulties mentioned above (inherent in calculating either according to job-time or according

to production) return, and, at the moment, wage calculation in automated industries is completely shrouded in uncertainties.

Still another problem is presented by the fact that modern economic crises most often result from a "distortion" between the different economic sectors, more exactly, from unequal growth of the different sectors. Here, automation must prove to be an economic factor much to be feared: There will not only be disparity of economic growth between the automated and the non-automated industrial sectors, but still more between industry and agriculture. *Either* capitalist countries must look forward to an increase of crises due to automation, *or* they must adopt planning aimed at rectifying the distortions (and planning by authoritarian measures, as in the Soviet Union). At the present time, even the Soviet planners find that their planning is insufficient to meet the problems of automation, since it is not "flexible" enough, on the one hand, and not "extensive" enough to re-equilibrate the out-of-phase sectors, on the other.

Here, then, are a number of problems (and there are a great many others) with which we must expect to be confronted by the fact of automation, all of which furnish us with examples of our thesis that Technique raises, in proportion to its progress, problems of greater and greater difficulty.

Let me indicate one final example of this, i. e., the problem of overpopulation, resulting from the application of medical and prophylactic health techniques, the final result of which is the suppression of infant mortality and the prolongation of human life. The phenomenon of overpopulation, in its turn, produces the tragic phenomenon of underconsumption. A century hence, all of us *without exception* will be menaced by a general underconsumption which will afflict the whole human race, *if* the expansion of the world's population increases. Here we are confronted by a problem clearly provoked by certain techniques, certain *positive techniques*.

The common factor of all these examples is that technical progress raises whole complexes of problems which we are in no position to solve. Examples of such problems are literally innumerable.

### 3. *The Evil Effects of Technique are Inseparable from the Good*

An idea frequently to be encountered in superficial inquiries concerning Technique is the following: "At bottom, everything depends on the way Technique is employed; mankind has only to use Technique for the good and avoid using it for the bad." A common example of this notion is the usual recommendation to employ techniques for the beneficent purposes of peace and eschew them for the maleficent purposes of war. All then will go well.

Our thesis is that technical progress contains simultaneously the good *and* the bad. Consider automation, the problem which we have just been discussing. It is indisputable that technological unemployment is the result of mechanical progress. It cannot be otherwise. All mechanical progress necessarily entails a saving of labor and, consequently, a necessary technological unemployment. Here we have an ill-omened effect indissolubly connected with one which is in itself beneficial. The progress of mechanization necessarily entails unemployment. The technological unemployment so produced can be resolved by either of two means, which are the only two means economically or politically possible, viz., spreading it out either in *space* or in *time*.

A capitalist economist holds that the solution to unemployment is "that technological unemployment ultimately dies out of itself." This means that the workers

who have been "freed" (the optimistic formula for unemployment) because of technical advances, will ultimately find jobs, either by directing themselves toward industries with manpower shortages or through the fact that new inventions will produce new opportunities of employment and new vocations. The standard example cited in defense of this thesis is that of the vocational opportunities connected with the invention of the automobile. Admittedly, this technological device did suppress a certain number of vocations, but it brought innumerable others into being with the final result that a vast number of persons are now employed by the servicing required by this industry. Hence, the machine in question has actually created employment.

All of this is indeed true. It is nevertheless a terribly heartless view of the situation, because it neglects to mention the *interim* period. It is all very well to say that the worker rendered jobless will, *with the lapse of a certain time*, again find employment . . . and that, after he has been reclassified, unemployment will die out. But, humanly speaking, what is the situation of the unemployed worker in the interim? Here the problem of spreading out unemployment in time is posed.

In the Soviet Union, unemployment of a technological nature (which not only exists but springs from the same sources) is spread out in space. By this I mean that when, in one place new machines are applied and workers "liberated" the affected workers will, without having to wait very long, receive a work-card which tells them in effect: "Two thousand kilometers from here a job has been assigned to you; you are hereby directed to remove yourself to such and such a factory." In one way, such a procedure seems a little less inhuman; but, in another way, it seems just as inhuman as the time procedure of the capitalists, since no account is taken of one's attachments to family, friends, locality, and so on. The human being is only a pawn to be moved about. It is hard to tell, between the capitalist and the socialist ways of handling the problem, which solution presents the worse indecencies.

A further example of the inseparable mingling of good and bad effects is furnished by the noteworthy study of the American sociological historian, J. U. Nef, concerning "industry and war." Nef shows how industrialism, i. e., the development of industry taken as a whole, necessarily prods industrialized societies in the direction of war. His analysis has nothing to do with the inner essence of industrialism; the phenomena described by him lie purely at the level of the human being.

*First*, industrialism gives an increasing population the means to live. It is a law sociologically irrefutable that, the denser the population, the greater the number of wars. This phenomenon is, of course, well known as a *practical* matter to all sociologists, but only Nef has studied it carefully.

*Second*, industrialism creates the media of the press, transmission of information, and transport, and finally the means of making war, all of which make it more and more difficult and even almost impossible to distinguish between the aggressor and the aggressed. At the present, no one knows (and perhaps no one can know) which side has commenced hostilities, a fact not solely due to armaments, but also to facility of transport. The extraordinary rapidity of transport allows an aggression to be launched within 24 hours, or even less, without anyone being able to foresee it. Here, the influence of the press is extremely important, since the press function is to confuse and addle the facts so that no one is able to gain any correct intelligence of them.

*Finally*, Nef indicates that the new means of destruction created by industrialism

have greatly reduced the trouble, the difficulties, and the anguish implied in the act of killing people. A bombardier or artilleryman has no feeling at all of killing anyone; he is in fact able to reach the conclusion that he has killed someone only with the aid of a syllogism. In hand-to-hand combat all the tiresome difficulties of conscience about the evil of murder keep obtruding themselves. In such ways, then, positive elements of industry result essentially (by very complex expedients) in favoring war and even in provoking it, even if no one has the *intention* of using Technique "badly."

Let us consider, as a final example of the relation between good effects and bad effects, the press and information.

It seems to be a simple matter, for example, to distinguish between information and propaganda. But, closer study of the problem reveals that it is practically impossible to make such a distinction. Considering but a few elements of the situation, the problem of information is today no longer that of the necessity of transmitting *honest* information—everybody agrees on this point. On the moral level it is a commonplace that we ought to transmit true information. I merely inquire, "How do we get it?" To remain on the *moral* level is simply not to understand the situation. The *concrete* situation, to take but a single example, is something like the following: Over the wires and into the offices of the Associated Press pass daily up to 300,000 words of world news, approximately equal to an enormous volume of 1000 pages. From this mass of words, it is necessary for the Associated Press, in competition with all the other world agencies, to choose, cut, and re-expedite as quickly as possible, perhaps a twentieth part of the whole to its subscribers. How is it possible to select from such a flood just what should be retained, what is true, what is possibly false, etc.? The editors have no criteria, they are at the mercy of whatever comes in, and (even when they judge in good faith and knowledge) they must essentially judge subjectively. Then again, even if the editor had only true news, how should he assign it a coefficient of importance? To do so is his business, and here the stereotypes of the editor are true enough: The Catholic editor will deem the news of the latest Vatican Council of great significance, information which has not the slightest importance to the Communist editor. What we have to do with here is not a question of bad faith, but of a difference of perspective on the world. The result is that we never know, even under the most favorable circumstances, if a given piece of information is subjective. And we must always bear in mind that this information, whatever it is, has been worked over by at least four or five different pairs of hands.

My reasons for maintaining that good effects are inseparable from bad are now, I trust, clear. And, as communications improve, the freer will be the flow of the news and the more available to all agencies concerned. These factors will play an ever greater role, making the difficulties of editing proportionately more difficult, and the chance of selecting absurd rather than sound news ever greater.

#### 4. All Technical Progress Contains Unforeseeable Effects

The final aspect of the ambiguity of technical progress resides in the following state of affairs: When scientists carry out their researches in one or another discipline and hit upon new technical means, they generally see clearly in what sphere the new technique will be applicable. Certain results are expected and gotten. *But*, there are always secondary effects which had not been anticipated,

which in the primary stage of the technical progress in question could not in principle have been anticipated. This unpredictability arises from the fact that predictability implies complete possibility of experimenting in every sphere, an inconceivable state of affairs.

The most elementary example is furnished by drugs. You have a cold in the head; you take an aspirin. The headache disappears, but aspirin has other actions besides doing away with headaches. In the beginning we were totally oblivious of these side effects; but, I should imagine, by now everyone has read articles warning against the use of aspirin because of its possible dangerous effects, say, on the blood picture. Grave hemorrhages have appeared in people who habitually took two or three aspirins daily. Yet aspirin was thought the perfect remedy a scant ten years ago—on the ground that no side effects were to be feared. Now, such effects begin to appear even in what was, and is, probably the most harmless of all drugs.

Another spectacular example is that of DDT, a chemical which in 1945 was thought to be a prodigiously successful means for the destruction of all kinds of vermin and insects. One of the most admirable things about DDT was that it was said to be completely innocuous toward human beings. DDT was sprinkled over the whole surface of the globe. Then, by accident, it was discovered that in certain areas veal cattle were wasting away and dying. Research revealed that DDT in oily solution causes anemia. Cattle had been dusted with DDT in order to get rid of insects; they had subsequently licked themselves clean and ingested the DDT. The chemical in question passed into their milk and by this route found its way into oily solution, i. e., in the milk fat. Calves suckled by such cows died of anemia, and it is needless to add that the same milk was ingested by human infants. Identical problems are potentially raised by all chemicals consumed by animals or men. Recall the recent example of thalidomide.

This is an example of the so-called secondary effects, effects which are essentially unpredictable and only revealed after the technique in question has been applied on a grand scale, i. e., when it is no longer possible to retrace one's steps.

Another interesting example is furnished by the psycho-sociological studies of the particular psychology of big city dwellers, where, once more, we are confronted with the effect of the technical environment on the human being. One of the principal elements of big city life is the feeling of isolation, loneliness, absence of human contacts, etc. One of the leading ideas of Le Corbusier in his *Maison des Hommes* was the admission that "big city dwellers do not know one another." "Let us create," said Le Corbusier, "great blocks of dwellings where people will meet one another as they did in the village, with everything (grocer, baker, butcher) included in the block so that people will get to know one another and a community will come into being . . ." The result of Le Corbusier's creation was exactly the opposite of what had been planned; problems of loneliness and isolation in such blocks of dwellings proved to be much more tragic than in the normal and traditional city.

Then, it was held (and this is the penultimate word in city planning) that it was necessary to rediscover human groupings on a human scale, not on the scale of a block with, say, 5000 separate dwelling units. In the works and writings of sociologists and of city planners of perhaps seven or eight years ago we read: "At bottom, the only ones who understood what a city was were the people of the Middle Ages, who knew how to create a true city corresponding to the demands of a genuine city-planning technique, i. e., a human community centered about a small square surrounded by small houses, toward which converged the (straight)

city streets, etc. . . ." The new city planners in keeping with these theories, applied them to the suburbs of Chicago, and in particular, to the well known "village" of Park Forest. There, it was thought, was to be found the distinctively human formula, one which really allows the human being his full scope. But, the most recent sociological and psychological analyses show this model community to represent nothing less than a new and unexpected difficulty. This time, people are traumatized because they are perpetually under the eyes and under the surveillance of their neighbors. The affected group is indeed much reduced in size; but no one dares to budge, because everybody knows just what everybody else is up to, a frightfully constricting situation, to say the least. It is clear that, even with the best intentions and with the application of hypermodern and profound research in psychology and sociology, we only succeed in coming to results in every case which could not possibly have been anticipated.

I shall give one last example of these unforeseeable effects, this time from agriculture, viz., the massive cultivation of certain plants like corn and cotton. The cultivation of these plants in the "new countries" seems to represent undeniable progress. The deforestation of land too heavily forested is a felicitous operation, profitable from every point of view, and consequently, represents technical progress. But, it could not have been anticipated that corn and cotton are plants which not only impoverish the soil, but even annihilate it by the twofold action of removing certain natural elements and destroying the relation between the humus and the soil particles. Both these last are destroyed by the roots of cotton and corn to the degree that, after 30 or 40 years of cultivation of these agricultural products, the soil is transformed into a veritable dust bowl. A strong wind need only to pass over it to reduce it to bare rock.

The phenomenon is world wide, and is to be encountered in the United States, Brazil, and Russia, among others. It is a bone of contention between Khrushchev and certain Soviet agricultural specialists. Khrushchev essentially emphasizes the cultivation of corn, as is well known; but many Soviet specialists insist that this emphasis is a very dangerous one. It allows a very rapid economic progress for, say, 20 years, only to be followed by a destruction of hitherto fertile lands which may last for centuries.

The inquiries of Castro and Vogt have shown that, at the present, in certain regions 20 per cent of cultivated land is threatened with destruction in this way. If this factor is considered in connection with that of population growth, a very considerable difficulty seems to lurk in the offing. If arable land continues to diminish in extent beyond possibility of recovery, our chances of survival diminish correspondingly. Here we have an example of typical and unpredictable secondary effects, effects which in corn and cotton agriculture do not reveal themselves except after 30 years of experience. It is again impossible, therefore, to say whether technical progress is in essence good or bad.

We are launched into a world of an astonishing degree of complexity; at every step we let loose new problems and raise new difficulties. We succeed progressively in solving these difficulties, but only in such a way that when one has been resolved we are confronted by another. Such is the progress of technology in our society. All I have been able to do is to give a few fragmentary examples. What would be necessary in order to comprehend the problem in its entirety is a systematic and detailed study of all these points.