

THE TRANSFER OF FUNCTIONS FROM MAN TO MACHINE

When he hears about automation, automatic factories, and unmanned manufacture, the worker wonders with a certain anxiety what will be his fate in an industry which is undergoing transformation and whether the trade from which he draws his livelihood today does not risk becoming useless tomorrow and leaving him without work. No doubt he has been told that the machine will never be able to replace man entirely, that there is no danger of unemployment, since new machines create new jobs, and that he will be freed of heavy labor and fatigue, thanks to the automatized factory. But these arguments are not all valid for the man whose job is eliminated or modified and who must find another situation or adapt himself to a different kind of work. It makes no difference if the over-all perspectives are reassuring—they are less so on the individual's level. The economy may continue to experience a cycle of full employment, but the individual may have to face the depressing hunt for a new job or start at the bottom in a different trade.

Translated by Wells F. Chamberlin.

Notes and Discussion

To the problems of reconverting businesses there is thus added the problem of transferring and reclassifying the "liberated" labor force. This problem concerns the entire economy. In our era of accelerated progress, there is no sector of business, no trade, which we can, without deluding ourselves, imagine as being entirely "sheltered" from the consequences of an automatism which is now in the process of becoming generalized. The problem involves, to no less a degree, the individual worker who must try to orient himself toward those studies, trades, and careers in which, when the tendency of technical progress is taken into account, his aptitudes will find employment and his personality will find a way to develop.

Such is the angle from which we propose to examine briefly the problem of transferring man's functions to the machine, its effects on conditions for employment, and certain possibilities for reducing the threat which menaces the individual today.

LONG-TERM OUTLOOK

The economy is really in evolution. We may even say that it is in a permanent state of reversion. The most modern techniques—and we are thinking of automation—are going to be applied and become generalized. We are going to see machines progressively take over the tasks of a great number of qualified and specialized workers. We did say "progressively," for we must not expect to see, as certain alarmists have thought it possible to proclaim, a sudden "unfurling" of automation which would upset the structure of society. Although technically possible right now, so radical a transformation of the world's means of production cannot be effected without the accompaniment of a financial transformation (think of the investments required), an economic transformation (think of markets and distribution facilities), and a social transformation (think of salaries, purchasing power, and ways of life).

Such changes cannot be effected without a profound evolution in people's thinking and a more or less general acceptance, which supposes in turn a revision of the individual's aspirations and motivations. Man would no longer be man if he accepted immediately and without resistance the idea of a change which affects him individually and profoundly in his mode of life. Certainly, he will adapt to the change which automation brings him. That is assured. But it is no less certain that this adaptation will require time—one generation at least, and probably more.

In what direction will this adaptation be made? In all likelihood, it will come about through integration into the more general evolution which is in progress. It has been noted, for example, along with Colin Clark, that, under the domination of mechanization, an important drift of labor had been effected from the primary or agrarian field to the secondary or industrial field and toward the tertiary field, or field of services. Agriculture in Western countries today employs probably no more than 10 per cent of the labor force, as against 70-80 per cent a hundred years ago.

Looking at this closely, we realize that, although this reduction of the agricultural population is due in part to the introduction of improved methods of work, it is essentially the result of a profound change in the way of life of the inhabitants of rural areas, which has entailed a new division of labor. In earlier years the farmer lived off his land. He baked his bread, brewed his beer, spun his wool, cut his wood, and dug marl to improve his soil. He went to market to sell his butter, eggs, fowl, wheat, and the cattle he had raised. Today the farmer no longer goes to market. The baker and brewer deliver bread and beer to him. Industry supplies building materials, fuel, and fertilizers. A co-operative picks up his milk; another co-operative sells his crops. A large number of secondary and tertiary businesses have sprung in this way from agriculture. Freed of a multitude of cares and accessory activities, today's farmer, one might almost say, carries on farming in its pure state.

Shall we someday witness an analogous drift from the secondary phase to the tertiary phase? Shall we see industry carried on in its pure state? This evolution is already being outlined. Do we not already see many examples of it around us? We have electrical distributing companies which are distinct from the producing companies, specialized bureaus for studies and calculations, legal, fiscal, and accounting councils which free industrial firms, sales agencies, export houses, transport firms, advertising agencies. It was reported recently that the oil refineries grouped around the Étang de Berre have thought it profitable, although they belong to different companies, to establish a common maintenance service for their equipment, having the appropriate tools and stock of repair parts.

Toward whatever area of business we may turn we see this tendency toward specialization becoming stronger and developing from day to

Notes and Discussion

day. Why is there this movement? Because the new division of labor allows a better development and a better utilization of particular skills by concentrating the identical operations to be performed. Automation falls in line with this evolution, which, as we can foresee, will become increasingly important. We shall see specialized service networks of more or less independent subcontractors being established around the big production units. The tertiary phase will thus free the secondary phase of a large number of extra activities.

SHORT-TERM OUTLOOK IN INDUSTRY

The evolution will also appear in the immediate future. In the next ten years we shall see—under the stimulus of an accelerated technical knowledge and of automation in particular—a considerable effort at adaptation on the part of a vast majority of businesses, large and small. How will this effort—which, we must emphasize, will be only the first wave of a deeper transformation—be shown? What will its scope be? In what fields will it be particularly noticeable?

1. If we consider the different fields of industry, it is obvious that progress will not be simultaneous or of the same scope within every branch. Mass manufactures of non-personal products, in which the production process is continuous or highly repetitious, lend themselves better than others to the application of automation techniques. On the other hand, unit or occasional manufactures and those in which setup operations must be conducted on the site (shipbuilding, building construction, etc.) appear to lend themselves less well to extensive automatization.

2. If we consider next those businesses which are already heavily automatized or are likely to become so (oil refineries, electric-generating plants, automobile plants, rolling mills, etc.), let us not allow ourselves to be impressed by such terms as “push-button factory” and other expressions which are in style. Let us look at reality. We see that these factories are only elements, fragments of important enterprises, partial installations, and that, alongside of certain automatized production services, we find others which are not automatized. And, above all, there are numerous services, which an important personnel force, which can never be automatized to the same extent: maintenance, sales, accounting, research services, etc. Let us take as an example a mechanical engi-

neering firm. We know that, when an estimate is made in this kind of business, a coefficient in the order of 400–500 per cent is applied to the cost of direct labor in order to account for expenses of all kinds, representing auxilliary activities. Is this not a very significant measure of the current importance of such services?

3. If we consider, finally, those activities which take place inside shops, in which automation has been the object of the most extensive applications, we observe that for certain operations the manual, human solution has been retained in preference to the automatized solution. Of course we might foresee the automatic replacement for a tool which breaks down, the mechanization of certain assembly operations, or even simply the transferring of products from one machine to another. All this is technically feasible, although at a terrific cost in complexity and investment. Consequently, there still remain operations which it is wiser, for seasons of pure return on investment, to carry out by less evolved but more economical methods.

All this means that, in the whole of the evolution which is now under way, we shall see branches of industry, departments or services, and operations which will lend themselves better to developed mechanization, to automation, alongside of a great number of fields, businesses, and workshops where only a partial automatization will be carried out because it will not be profitable to do more. Consequently, in our evaluation of the effects of automation, let us not be impressed by an over-estimation of the relative importance of the numbers who will be directly affected.

OFFICE WORK

People have felt safe in saying that “the race of office workers, like that of the salesclerks, is in the process of disappearing.” As far as office workers are concerned such a prediction seems, at the very least, premature. Employment figures show indeed that, in all countries, in absolute figures as well as in relative importance, the number of administrative personnel in private businesses and in public services has continued to increase. It is true that we do see in certain establishments (banks, insurance companies, public services, etc.) a marked tendency toward the mechanization of jobs of a statistical or accounting nature—bookkeeping, receipting, taking inventory, preparing statements, preparing payroll, controlling stock, etc.

Notes and Discussion

When we analyze the nature of administrative work, we observe that it is essentially a matter of recording and preserving the information, of treating it, and of re-establishing it at the opportune moment in an appropriate form. Such an activity naturally lends itself to simplification and to mechanization. There is always, and this is the important point, at the beginning, a furnishing of information by men, followed by man-made decisions, and, finally, at the end of the process, there are measures which affect men. Office work is therefore essentially the utilization of relations among men and, as such, remains subject to human reactions. It is only the centralized part of this work which can be treated automatically. Automatization will be advantageous when it bears on information concerning large numbers of individuals and when it makes possible analyses which we could not undertake by manual means, namely, in those cases where the volume of information to be treated (or its complexity) is considerable. On the other hand, we do not foresee any practical possibility of treating in a mechanical way relationships which must be individually differentiated. And these are still the most numerous. Total automatization in this area is consequently not a thing of tomorrow, but inevitably it will progress.

CLERKING

As for salesclerks, whose disappearance is also being predicted—because we have seen self-service stores and the use of automatic vending machines developing—this prediction, too, seems premature. Attempts at extensive automatization have not been followed up. The work of salespeople is also an action on people. As the needs and desires of men are extended, and as the means of satisfying them are developed, we are also witnessing the development of buyers' information, of possibilities of choice, and of the service personnel which accompany the sale. Markets are being extended, and classes of consumers who a few years ago appeared to be unreachable, owing perhaps to their more or less primitive way of life or to their distance from the large centers, must be considered as prospects today. Sales could certainly be automatized insofar as mass, non-personal goods, and goods well known to the public are concerned. The action of selling consists essentially in information for the customer concerning the service which the product can give him and, reciprocally, in information for the producer and the distributor about the customer's real needs. Here again it is the principle of informa-

tion which is involved, and we can expect important developments of automatization in this field, thanks to the perfecting of information techniques (advertising, press, radio, television, etc.) which has already been achieved.

But selling is not all there is to distribution. Functions concerning the grouping and selecting of merchandise, keeping it in good condition, maintaining it in stock, and concerning transportation, handling, and delivery, are also part of it, as well as functions concerning the study of markets, distribution networks, credits, and collections. These are all areas in which partial, fragmentary mechanizations can be envisaged but in which, for the moment, we do not yet see any indication of a generalization of the tendency. Again, it is the centralized operations, above all, which will lend themselves to an economical and effective automatization. Now in many cases the service given by offices and stores is so occasional in regard to the consumer, beneficiary, or dependent that the latter cannot think of it as anything other than the individual solution of a personal, special case. And, moreover, he refuses to yield to an automatized routine because this often has the effect of transferring to him a part of the functions which have to be done.

However, we may reasonably expect that in the fields of administration and distribution new subdivisions of labor will be forthcoming, as they have been brought about in agriculture and in industry, and that certain activities thus detached from the present mass of tasks may lend themselves more to automatization. But, here again, total automatization is not for tomorrow.

EFFECTS OF AUTOMATION ON WORKERS

The analysis shows that all this should reassure us to a certain extent. Of course automation will eliminate entire fields of activity, businesses which will be unable to adapt, partial tasks, and, finally, jobs. But has not the same thing been true of all progress throughout history? If we feel today a strong drive in this direction, we must tell ourselves that it will not have, in the immediate future, that character of suddenness and generality which certain people take pleasure in prophesying. Its scope will not be of an extent such that it must terrorize us. Everything appears to indicate that we shall see in the next few years a following-up of the already manifested phenomenon of change in functions—a more pronounced specialization of certain current professions giving birth to

Notes and Discussion

new activities, new trades, new businesses. We shall also see the creation of new products and of new fabrications still unsuspected today.

As those are essentially problems of adaptation, it is particularly important that the search for solutions not be hindered by a priori stands or by blocking of imperative requirements, which can only impede the evolution by removing the necessary fluidity from the factors now working.

RECONVERSION IN THE JOB

From the point of view which concerns us, and in view of the large outlines of this evolution, there is a certain interest in examining step by step the manner in which it affects employment.

1. On the general level there are two main observations: on the one hand, a greater and greater volume of needs, requiring more and more workers (the outlook for a general short supply of labor); on the other, a drift of activities toward the tertiary phase.

2. On the level of business establishments, there is also a two-way motion: on the one hand, a concentration of activities of the same nature in vast production units, favorable to large production in series and to automatization; on the other, the development of numerous satellite enterprises, less important, specializing in order to help the others as suppliers, subcontractors, finishers, distributors, etc.

3. Inside business firms, the double phenomenon again: on the one hand, a reduction of personnel forces occupied in production properly so called; on the other, the growth of services of research, preparation, maintenance, advertising, sales, service, etc.

4. Finally, on the working-site level, again a double aspect: on the one hand, elimination of heavy labor, routine tasks, and tasks of pure repetition; on the other, the utilization of the essential tasks of intelligence, judgment, and decision.

No doubt this schematic chart shows exceptions. The evolution does not appear everywhere, at the same time, or at the same speed. Certain branches of industry are in progress; others have a less favorable outlook. The general pace of the movement appears, however, to be quite sharply defined. On the *quantitative* level, according to fields and to activities, there is a tendency toward increase or decrease of the work-

ing personnel. On the *qualitative* level there is division, simplification, and mechanization of the repetitive tasks and at the same time a more selective specialization for tasks involving decision. There we have the first indication of the distinctions to be made in examining the problems of employment.

TRANSFORMATION OF TRADES

Leaving the general aspects of the evolution and concentrating on the more particular area of production, we pick up other indications. The progressive transformation of human activities and the passing from manual work to automatic work have had the effect of eliminating, in order, physical effort, through the introduction of the machine; mental effort, through the division of labor; and, finally, the effort of will, of decision, by the advent of automatism.

In its broad outlines, the evolution is the following:

1. The artisan, an independent worker who practices a manual trade, must do absolutely everything—establish his program, organize, buy, manufacture, sell, and keep his accounts. He must be fitted for all functions.
2. The worker who plies his trade in a shop with the help of tools or of a multiple-purpose machine does nothing more than fabricate. At the very most, he can still arrange his work in his own way.
3. The operator of a special machine usually is no longer the master of the whole of his work. He has become a “specialized hand.” He can accomplish a certain spread of operations, but most of the factors, and liaison with preceding and following operations, escape him.
4. The specialist in charge of an entirely automatic machine has nothing more than a surveillance responsibility. He obeys a simple command or order: to watch a given dial or a given graphic recorder, to turn a certain wheel in order to correct such and such a deviation, and, in case of emergency, to stop the setup and call in the repair crew.

Thus it is obvious that, as the work becomes specialized, mechanized, automatized, man sees his field of intervention shrinking. Is it not to be feared that by being progressively dispossessed of his functions, with certain of his prerogatives cut away from him, he may soon become incapable of anything but a compartmentalized task, closely confined,

Notes and Discussion

limited to observing a simple work order? We do not think so, but the question is worthy of examination.

FROM THOUGHT TO ACTION

Let us immediately remove one basic worry. In inventing and building machines, have our engineers really transferred human functions to men? On the physical level, yes, undeniably. The machine amplifies our strength and guides or gives precision to our gestures and our movements. But on the psychic level? Is the machine from now on gifted with faculties of attention, preception, memory, choice, and will? No doubt this appears to be so. But suppose we look at it closely; let us analyze any given human activity. Incessantly, thought intervenes to give precision to the intent—the purpose of the work. It intervenes in order to perceive a thousand bits of information, to effect innumerable and careful selections and co-ordinations, to decide finally about the motion to be made—the moment when and the place where it must be made. We are so accustomed to this, so habituated, that we no longer consider all this mental process which leads from thought to action. With the help of habit, our decisions seem to come from nothing other than our subconscious.

But, when we want to have this action reproduced by the machine, we must admit that the machine has no subconscious and that, with it, we cannot leap from the idea to the act. When we try, in order to relieve ourselves of our intervening in the work, to pass from brain to machine, we must concern ourselves with giving the machine organs of control, memory organs, organs of choice and regulation, which will be substituted for our cerebral action. At that moment we have the feeling that we are rebuilding the mental process of our activities with material parts, but in reality all that we can do, through research, is to endow the machine with *physical means*—relays, mechanical devices, and electronic or other devices which will assure an analogous effect and will permit us to obtain a result similar to that of the human will. A dog on a graduated scale will stop a mechanical motion; a precisely profiled cam will determine the successive variations of the behavior of a tool; a spread of perforations or magnetic impressions will assure the calculation of complex algebraic formulas. These performances will sometimes give a convincing impression of intelligent behavior on the part of the machine. But this will never be anything more than an appear-

ance. Certainly the result obtained with the machine's help will generally be superior, in strength or in quality, to human action; but the machine will bring nothing to this action by itself. It has no will of its own, does not think, and can initiate only those steps dictated by the program which man has provided for it.

In bestowing these perfections on the machine, we avoid our need to intervene in order to solve over and over again problems which have already been solved a thousand times, and we spare ourselves additional efforts. We shall have made the machine our slave. It is going to work for us. It is going to free us in certain circumstances from having to specify the goal again each time, from having to make the choice again, and from having to decide the course of action. But it will not be able to direct, to choose and to decide, being aware of its objective, its choice, or its decision. Man therefore does not have to fear being eventually dispossessed by the machine from his noblest faculties. His brain, instead of commanding his muscles, commands other forces and other physical means, but it remains their master.

LOWER JOB QUALIFICATIONS?

Let us return to the worker. It is a fact that man's field of action is shrinking. The complete task of the artisan of former times has been split into fractions, "crumbled," to use Friedmann's expression again, and today's worker carries out only a fragment of it—sometimes a very small one. Has job qualification, formerly of necessity very broad, been raised, or has it dropped with mechanization and automatization?

Here is what they say:

The director of an electrical generating plant tells us: "Present conditions for operating almost fully automatized installations require on the part of personnel a qualification which is incontestably different from that required by the old installations."

And the general manager of an important bakery states: "The only difficulty we experienced in the automatization of our cookie factory was when we had to transform our 'pastry cooks' into 'chemist's assistants'; when we had to indicate to them that a cooking temperature is not taken by opening the oven door and putting one's head inside but by reading the indications shown on the dial of an oven thermometer; and when we had to teach them to carry out precise and constant measurements."

Notes and Discussion

At Chantereine, on the new production line of mirrors, the Compagnie de Saint-Gobain states: "The very rapid evolution during the past thirty years of the glass and mirror industry, the present very technical aspect of manufacture and means of scientific control, have transformed the trade of the glassmaker, who has nothing in common with his former self. The men at Chantereine today are controllers, estimators, electronics experts, mechanics, oven supervisors, operators of tractors or traveling cranes . . . yet the glassmaker's trade has preserved its particular spirit, built upon devotion to the trade and to the sense of teamwork, and has kept its traditions."

These examples, coming from practice, show that it is certainly not quite exact to talk of lowering or of raising the specifications of job functions. What is actually happening is that certain qualities or aptitudes, on which emphasis was placed when the production was being carried out with the use of hand tools or of a multipurpose machine, have lost their relative importance today, now that this work is done by a special machine and will no longer be necessary when an entirely automatic machine is adopted. Reciprocally, as machines are equipped with accessories and with automatic organs which are more and more complex, precise, and delicate, the role of the services which must study and produce these organs, regulate them, and assure their unflinching operation assumes more importance and requires qualities which were not indispensable in the same degree earlier. On the whole, we see then that the personnel forces necessary in different services and the qualifications which are set must change in the move toward automation each time that we pass from one stage to the next, from simple tooling to the manually controlled machine, then to the special machine, and, finally, to the automatic machine. In reality each stage offers employment on different levels of technical knowledge and widens the spread of functions which must intervene.

NEW JOB QUALIFICATIONS

To become aware of that, all we need to do is to observe the types of workers who will be necessary in the automation cycle, in a branch of industry such as mechanical engineering, as well as the qualifications which will be expected of each of them. Without discussing supervisory personnel, and in the area of production alone, we see that various categories of men will be necessary:

1. *Inventors* who will create the automatic machines in laboratories and in research bureaus and who will adapt new discoveries to practice. These men will need to be of scientific mind and endowed with imagination.

2. Next *builders* will be required, capable of transferring the theoretical conceptions to the practice level. They will be mechanics, electronics experts, toolmakers, etc. In a word, they will be doers.

3. Then people capable of *operating* the machines will be needed. As this will be principally a task of surveillance, it will call for attentive minds which possess that capacity termed "expectant attention" but do not need highly developed technical knowledge.

4. There will also be *maintenance men*, capable of detecting the origin of breakdowns, diagnosing trouble, and carrying out adjustments. They will have methodical minds, given to detail, and will be men of sure judgment.

5. And then there will be the *skilled workers*, capable of doing everything that the machine will not have taken over from the workers. They will be masons, plumbers, electricians, painters, carpenters, welders, etc., whose chief activity, when they are faced with unforeseen situations involving small jobs, will be modifying equipment, choosing a proper solution, co-ordinating all its elements, and carrying the work through to a successful conclusion.

At first blush and at present among these different trades it is certainly the operating of machines—reduced essentially to a task of surveillance—which will lend itself to the easiest and most rapid beginning. This tendency is not new. The use of machines is becoming commonplace, and, aided by familiarity, everyone today knows how to use a typewriter, a radio, or a television set and how to drive a car. On the other hand, the other functions of mechanical engineering (invention, construction, maintenance, etc.) will still require for a long time special training and much longer apprenticeship. That is why it could at a certain time be said that job qualifications were going to be lowered for operating machines and raised for other functions.

SHALL WE ADAPT MEN?

No one, it seems, is seriously considering the possibility of reversing the direction of this evolution, of going upstream and suspending technical

Notes and Discussion

progress. Therefore it is necessary that man, the worker, adapt himself to these new conditions. How well this adaptation be effected?

In the past we could observe—in most branches which became industrialized—that, in general, it was not the experienced artisans, possessing to the last degree a fixed manual trade, who were picked to control the machines when these were adopted but rather people having aptitudes and a taste for mechanics, “mechanicians.” Later they gave way to “qualified workers,” then to “specialized workers,” and so on. To illustrate, we may note that the village blacksmith rarely became a garage man—it was his son or his neighbor who acquired the necessary knowledge and equipment for the new trade. In other cases technical progress appeared in a form different from mechanization properly so called, for example, by the substitution of one material for another (molded plastic pieces replacing fabricated metal pieces). The buyer is then often forced to turn to another supplier, so that, from the point of view with which we are concerned, it turns out that the work is transferred from a metal trade to a trade stemming from the chemical industry. It is therefore certainly not the same man who is called upon to adapt himself to the new method of work. In cases of this type, and when technical progress is introduced with a certain reservation, a certain slowness, the substitution is done without any apparent harm. Time facilitates things. The problem is certainly easier to solve.

But, today, the rhythm of progress has accelerated in a prodigious fashion. All industries and all trades are concerned at the same time. Most often the isolated individual cannot readapt himself or find a new job by his own means. Business, on its part, cannot be unaware of the problem or be disinterested in it. It finds itself faced with the alternatives of using the old personnel by trying to adapt them to the new working conditions or of substituting for the former workers new personnel trained in the new methods and of then trying to reclassify the old ones within the actual enterprise or elsewhere. Whether it is adaptation or substitution, the option to be exercised deserves thought, for neither economic calculation nor the social implication can give the right solution by itself. Individual psychological factors must also be taken into account.

PSYCHOLOGICAL FACTORS

It is when we try to transfer a man from one category of work to the next, whether it is up or down, that we trigger a painful reaction in

him and that we give him a feeling of frustration. When we want to intrust a more mechanized task to him than the one he had before, but in which initiative and responsibility are more limited, he feels that he is being downgraded for two reasons. He finds himself before a machine he does not know and on which he must do an apprenticeship (with all the groping and risk of error which that implies)—and, consequently, he has fears of not measuring up. On the other hand, he feels that his professional knowledge, his experience acquired in the former method of work, are no longer useful and are even a handicap for him. When we want to give him a less mechanized job, he also has a feeling of being downgraded. He must take up accessory tasks for which he was assisted by human or by mechanical helpers. Of necessity he finds himself awkward in executing these minor tasks which he has not been trained to do; and, on the other hand, in the work itself, he can no longer show the mastery which he had of the perfected machine. Consequently, no matter how it is done, the sense of downgrading persists.

This is true unless the character of the person involved pushes him to interest himself actively in the utilization of more complicated means of action, to a widening of his field of initiative and responsibility, or to considering as a challenge the need to execute a task with more rudimentary means than those to which he was accustomed. If he is curious about new methods, likes innovations, if he is ambitious, if he considers that he is enriching himself intellectually in training himself in new procedures, everything is perfect. When these psychic conditions are combined in an individual, there is no problem, or it is a simple one. When these conditions do not exist, it is important to cause them to arise through preparation, through the appropriate psychological action, before effecting the planned transfer. However, it seems undeniably simpler, when a worker (for reasons of character or of age) feels some repugnance in facing such a change, to limit ourselves to a lateral transfer, avoiding making the person take a new step on the path to mechanization or automatization.

NEW ORIENTATION

However, it is a good idea not to underestimate the faculties of adaptation in man. Before any decision, we must consider means of helping the worker and of showing him the way by which he will reach those better conditions of life which we promise him under automation.

Notes and Discussion

What can we do for the man whose job, because of technical progress, requires different qualifications from now on? Three things can be done; there are three ways open. We can give him the new training necessary for him to evolve with the trade or with the technique of the branch concerned. We can, if he has the desired qualities of intellect, morale, and character, think in terms of promotion and train him for a job involving greater responsibility. We can also, as we have said, consider lateral changes, or transfers, favoring the utilization of what he has acquired earlier.

Each of these possibilities requires an individual professional orientation test, or, rather, reorientation test; training, based both on the aptitudes of the individual and on the qualifications of the job which are to be met; and, finally, an effort on the individual's part to study and to acquire training in the new functions. The whole of this action of "re-classification"—a word we do not like because it suggests the idea of a mechanical treatment, whereas the problem is first of all a social one, a problem of human mutual aid—suggests certain considerations which will bring us to our conclusion.

1. Having the worker evolve along with the technical evolution of the trade is a solution which is primarily valid for the young. Young workers and future workers must be started off not in today's trades but in those of tomorrow. They must all be instructed and must all continue their learning without interruption, in order to evolve with the technique of their branch of industry. This training is as indispensable as research. Business leaders must keep an eye on it if they do not want in ten or fifteen years to have their personnel making up a team of "oldsters," or workers definitely outmoded.

2. Training for promotion of those who have the necessary stuff for it means the fruitful utilization of the technical acquisition and the experience of the trade and of the men, of their spirit of devotion to their trade, and of the sense of teamwork, to which the directors of Saint-Gobain refer. This is a precious asset which we must take care not to waste or disperse.

3. Carrying out transfers, or lateral changes, is often the advisable solution when men no longer have youth's zeal for learning and do not appear fitted for commanding their companions. Such transfers will be facilitated if we refer not to the trade as a whole but to the factors

of which the qualification for the job is composed: knowledge of the material, knowledge of the machines, knowledge of the procedures, and individual aptitudes.

DIRECTION OF THE EVOLUTION

And this brings us to a final consideration, which is valid for all cases. The evolution of manufacturing assumes constantly different aspects. When we say that one of today's trades no longer has anything in common with that of former times, we mean that its center of gravity has shifted. Yesterday the emphasis was placed on the treatment of the material; today it is carried over to the functioning of the machine.

Automation, in that respect, has sparked a remarkable phenomenon—the control operations of machines have become practically identical in very dissimilar industries. Whether in a cookie factory, a glassworks, or the chemical industries, the operations of feeding, mixing, and of controlling the ovens are made up of analogous elements. They are reduced to the reading of dials, to the detection of deviations, to corrections by turning a wheel. They require identical qualities: vigilant attention, ability to recognize anomalies, cool-headedness, sensitivity in maneuvering, and a sense of responsibility. The pastry cook, the glassmaker, and the chemist of yesterday have all become “controllers, oven operators, tractor and crane operators,” and, as such, they are closely related to the men in the electric-generating plants and in the oil refineries. These trades, which are tomorrow's trades, are found in many branches of industry. They have become “multivalent.” One senses very clearly that men who yesterday were working in steel, glass, or wood are qualifying today as machine operators or special equipment operators and will be qualified tomorrow as planners, estimators, controllers, adjusters, etc. Their functions will no longer be based on the properties of the material or of the machine but on aptitudes and on *human qualities*.

That observation, if it raises many hopes within us, also shows us the way in which the movement will be oriented—this movement of which the present phase has been called “the relieving of man by the machine.” We must say to ourselves that the new work which automation offers us (there is no point in deluding ourselves—automation will not bring us the elimination of work) is opportunity knocking on our door. As Phil Carrol, president of the Society for the Advancement of Management, said recently: “We have no choice. We must prepare for tomor-

Notes and Discussion

row. We must study, study all the time, in order to get where we want to be before the end of the forty short years of active life which are granted us. We have no choice, unless it is that of learning more in order to do our present jobs as well as we can do them, and of learning still more in order to deserve the promotions we want." We shall add only one word to that. We must see to it that others are made to study and made to advance so that they may obtain their share in the progress which life is bringing us today and which it holds in store for us tomorrow.

HUMAN ASPIRATIONS

A final question to serve as conclusion. The worker of today is going to become tomorrow's technician. He is going to learn more, to be started on new techniques, sometimes in order to prepare himself for promotion, but most often simply in order to keep his place on the job. Will extra learning and professional training bring him "joy in work"? In the past, work has been considered too much as something outside life, a test, a curse, a subjugation from which one had to free one's self. We sought to remove physical effort from work, then mental effort, and now we are seeking to eliminate the effort of decision, the effort of will. The man who has almost nothing to say in his work cannot be happy. Since we take from him the satisfaction of "correctly deciding" when faced with new problems, he seeks outside of work what have been called "possibilities of escape." But it is really much more, and we prefer to say that he is seeking "possibilities of expression." What makes the personality of a human being is precisely his individual way of expressing what is in him, what he feels deeply, what he experiences. It is the possibility of re-establishing around himself, in his own way, with his own personal imprint, those events and facts which other men have taught him. Why are sports, automobiles, travel, television, pottering, "do-it-yourself" projects, hobbies, contests, etc., so successful? Because to a certain extent they bring man the chance to satisfy this aspiration for personal expression, or, at the very least, because they provide him with moments of escape which have become necessary to him in the absence of the happiness and the joy he no longer finds in his work. In an individual effort for personal culture he will be able to find once again the possibilities of expression of which he is deprived today. But these possibilities must be shown him, the rudiments of an initia-

tion in the various forms of culture must be given him, in order to allow him to choose those which correspond to his own temperament and which will help him become a complete man again.

And there is the basic problem to which we must finally return. If automatization has stripped the worker of prerogatives which he formerly possessed when he practiced a complete trade, it must in return restore to him his role in the life of the society. The error of the past was not in specializing men in their work—that was a tendency which could not be avoided—but in the specializing and compartmentalizing of their way of life as a function of work. Today's general concern must be to prepare man for all his tasks—not only for his task as worker, through professional training, but also for his task as consumer through education in family and household arts, for his role as an owner of durable goods through training in economics, for his role as citizen through civic and social education, for the exercise of his faculties as a man of culture through training in thought and in the expression of that thought. Worker, consumer, owner, citizen, intellectual—he is still the same man. Every man must be all of these at the same time in order to be fully a man. And we must strive to give each man access to all those aspects of life. Automation, by the effort it requires, by the wealth which it can give, and by the leisure it promises man, is the only chance which society has to bring about this sane relocation of values. It is important that society not allow the opportunity to escape.