The Social Problems of Automation

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During this conference a considerable number of discussions will be presented on the subject of computer design. Such computer conferences have been conducted for seven or eight years. The computer industry can be reckoned to be about ten years of age. During this time, a large number of computers, data processors, and other descendents of computers have been produced. Because of the time span over which the early machines have been in operation, and because of the rather large and increasing numbers of these machines that are now being produced and used, it is reasonable to say that the world has now felt a considerable cumulative effect from the work these machines have performed.

How have these machines been of help? A very broad and overlapping classification can point to three major areas of activity:

1. Science and Engineering. Computers have proven to be unusually powerful tools wherever computation and numerical analysis are employed. The speed or economy of these machines have made it possible to perform computations and analyses which were formerly infeasible. The total effect of the application of computers undergoes an enormous amplification, because of the great variety of scientific and engineering fields in which computation contributes, and because of the never-ending application of scientific and engineering discoveries. Our everyday life is affected in a multitude of ways.

2. Military Control Mechanisms. A considerable fraction of the computer design effort over the past 10 years has been aimed at the incorporation of these devices in weapons of warfare. They are being increasingly applied where men or other equipment are proving to be too slow, too large, too weak, too inaccurate, or too unreliable. The military work can be measured in terms of more powerful weapons and greater military strength. As usual, the techniques evolving from military effort find wide and useful application in nonmilitary fields.

3. Business Data Processing and Industrial Control. The capabilities of computer-type equipment are applicable to the performance of business processes such as financial accounting, sales forecasts, inventory control, study of alternate plans of action, etc. Furthermore, computer equipment is finding increasing application in the control of complex industrial processes. In this role, the computer is beginning to play an important part in the continuing industrial revolution. This revolution has been characterized by increasing replacement or augmenting of men's muscles, starting with the mechanization of simple, repetitive, manual tasks and moving to more and more powerful and complex mechanisms. In contrast to the mechanization of manual tasks, the computer can perform some of the types of activities that men perform mentally. This simple fact lies behind the ability of the computer to replace men in control of functions. Again, simple and repetitive mental or information-processing tasks are among the first to be mechanized, and more complex controls are on the way. They are likely to be used where they outperform men in terms of speed, accuracy, or operating costs. The modest progress to date in this area indicates that the total effect of such applications is going to be extensive.

What has been the over-all effect of the work these machines have done? Is it good or bad? How has it affected everyday life, health, politics, work, education, and leisure? Are new problems being created, or are old problems being compounded, or is this computer activity all for the good? These are the questions asked of our opening session speakers. Are there any social problems associated with automation? If so, what are they, and what is the proper way to meet them?

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The Social Consequences of Automation

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A comprehensive analysis of the impact of automation upon society would consider every sector of the social process. In the process of social interaction man pursues "value outcomes" through institutional practices utilizing resources. He pursues knowledge (enlightenment), political power, and various other value outcomes.

Enlightenment Outcomes

The development of computers has evolved a formidable instrument of enlightenment. Whether this potentiality is realized in practice depends upon many factors, of which one is the recognition of what can be done. An enlightened opinion on any problem of policy is a complex matter contingent upon the performing of five intellectual tasks: the clarification of goals, the perception of trend in the degree to which goals have been achieved, the analysis of the factors that condition trends, the projection of future developments (if policies continue unaltered), and the invention and evaluation of alternative policies.

Automation technique can be of enormous help in performing these intellectual tasks for every problem of public policy. There is no reason why working models of social history and of the future should not be part of the ordinary equipment of educational institutions and of institutions of civic decision. The entire social process can be portrayed in alternative models which show such estimated consequences as the following: the effect of at least two levels of expenditure upon arms; the consequences of cutting the hours of work over a given period to 6, 4, and 2 hours a day; the consequences of making available at various rates a cheap oral contraceptive to the populations of specified countries; the effects of altering the residential arrangements of the population in centers.

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and subcenters of various size and location; the results of lengthening the life span during assumed periods of 10, 20, or more years, or even of abolishing death.

If every neighborhood, city, region, private association, and organ of government is to have continuing access to clarified information new institutions must be devised to supplement our present channels of public information. For instance, a means of popular instruction that has been applied to astronomy can be extended to the field of public opinion and decision making. The author refers to the possibility of a social planetarium. The social planetarium will enable visitors to rehearse the past and to foresee the future. Alternative policies relating to economic progress and stabilization, for example, can be presented step by step. In this way the meaning of alternative courses of action can be grasped by most of the population, not only by a specialized few. Competing interpretations can be candidly set forth in presentations approved by competent specialists so that the viewer-participant can arrive at a well-disciplined estimate of the likelihood of one or another outcome. Computing instruments are indispensable to the processing of vast bodies of data pertinent to the needs of social planetaria.

One advantage of automation technique is that it permits more exact appraisals to be made of the functioning of courts, administrative commissions, and other organs of decision. It is probably feasible to translate the routines of some modern logics into machine routine; this would mean that it is feasible to program the tax code or any other system of allegedly logical prescriptions for machine handling. The effort to do so will disclose many removable ambiguities. It will also make it practicable to test the strength of other-than-logical factors in bringing about decisions by pitting machine models built to function logically against contemporary and historical agencies.

Political Outcomes

Previously the discussion was about the possible impact of automation upon an enlightened view of puzzling and controversial issues. This also has great significance for the survival of popular government, which, as political philosophers and political scientists have pointed out, depends upon an informed public. Now consider the direct impact of automation upon political power.

The obvious and basic point will be emphasized that no technical operation or program is introduced into a social vacuum. Nor does automation, per se, have "inherent" collective consequences. Factors in the context determine the aggregate effect by affecting the location, timing, and scale of the operation or program.

At first glance automation would appear to constitute a landmark in the historical processes that favor democratic forms of government. The machine does at last become the slave and give free time to free men for the consideration of public business. But since the effect of more leisure depends upon many factors in the social context besides leisure, it cannot be safely concluded that the sequence from automation, leisure to democracy is certain. Concern for public affairs and willingness to take an active part in civic life depend upon the perspectives of those concerned. There is evidence, though not definitive, that as modern Americans have more leisure they vote less often in elections and they expect pressure groups, executives, political party machines, the press, and public officials to look after the common good. Those who concern themselves with the distinctive specialties of modern times, such as science and engineering, are not as a rule conspicuous among the active leaders of community policy at local, state, national, and international levels. Evidently there is an assumption that public affairs is a specialty and that civic judgment has no peculiar opportunities or obligations.

In the intricate web of modern life, to civilize is to specialize. But a governing process is needed that continually clarifies the goals of the whole community and appraises the degree in which current trends coincide with these value objectives, or diverge therefrom. An exercise of judgment is called for in which the individual acts as a whole person, not merely as an engineer, the head of a family, the alumnus of a college, a raiser of orchids, a member of a social fraternity, a man of international travel, or as one who plays a hundred other roles. The civic process is the governing process in which, ideally, contradictions and tensions are resolved in a common plan of purpose and method.

If democratic forms are to be kept vital, styles of life must be developed which take advantage of the leisure time that automation can afford. During basic training in the educational system some familiarity should be acquired with the decision-making process of society, and of the place of individuals and organizations within it. During the early phases of intensive professional education and practice, it is probable that one will become too specialized to play a significant civic role. But this phase may typically pass into a stage of professional growth at which one becomes an administrator of research or moves to general management. If one remains at the research level, one's development typically becomes more routine and less absorbing of the whole energy of the personality, leaving more margin for other concerns, including civic affairs. Even when most acutely preoccupied professionally, one usually belongs to professional and other associations which are equipped with staffs and committees. By supporting associational activities which are directed to public issues one may contribute somewhat effectively to civic life.

In these days, one cannot afford to overlook the world of politics. Does the advent of automation promise to intensify the world crisis or not? The fundamental fact in the global arena is the expectation of violence, which is the assumption that wars, though not necessarily global wars, are probable. Given the expectation of violence, the powers in world politics group themselves in opposing coalitions for defense and offense. Contemporary world politics conform approximately to a bipolar pattern in which the United States and Russia are dominant. In this setting, the continued growth of science and technology has contributed to an armament race of unprecedented danger. Automation speeds up the tempo of whatever it touches; and it is touching the preparation of arms and the conduct of mutual surveillance. Hence, automation speeds up the crisis and accentuates the bipolar antagonisms of world politics.

Will this result necessarily continue? There is evidence that automation technique makes it easier now than in the past to install modern technology anywhere on the globe. The question is whether the United States will supply enough investment capital to countries in the non-Soviet world to take advantage of this opportunity to develop strong allies; or whether we will undertake only enough examples of superior technology abroad to provoke resentment that the United States has not done more. The top and middle leaders of the former colonial peoples are especially sensitive to this situation. Moreover, it cannot be taken for granted that automation will be installed by managers.
who use policies relating to labor, public, and governmental relations which will keep difficulties at a minimum.

Is it likely that the middle powers (like Great Britain, France, or West Germany) will be able to improve their political position in relation to the United States and Russia, as they make fuller use of automation? Or will the strong grow stronger as the automation revolution proceeds? The author invites expert judgments here. This is a crucial area for joint estimates by physical scientists and engineers, and political scientists. The tentative expectation is that bipolarity will be sharpened and that the balance of power will not revert to the pattern of the last century, which was dominated by relations among a few great powers.

Perhaps it is easier to predict that, as automation advances, centralization will continue in the handling of all instruments of national policy, whether military, economic, diplomatic, or ideological. The necessity for comprehensive and instantaneous information, coupled with the need of operational co-ordination, are factors that further centralize control.

The trend to centralize is also a trend to governamentalize. The cost and scale of military preparation favor the spread of this influence from national departments of defense throughout the whole economy. The new instruments of automatic operation, in this context, give hands as well as eyes and ears to official directives.

An examination of the newer technology discloses a remarkable impact upon the unit of effective military action. The most complex weapons and weapon centers are supervised and tended by rather small teams. Infiltration and surprise depend upon small, agile units; and sabotage and espionage networks call for such structures. With the increased use of automation, components of the total machine become vulnerable to the well-placed few.

Automation has an important psychological effect by reducing emotionality in combat preparations or activities. The machine intervenes between fighters; the destruction of a target is a result of a number of complex and impersonal sequences. In a sense modern war and war preparation are always cold and impersonal.

Cutting down on emotionality puts the emphasis upon intellectual appeals either to maintain or to undermine the dependability of personnel in sensitive positions. The ideological instrument of world politics is made more important, since it may be used to reach the key individuals in man-machine combinations.

In all likelihood, owing to pressures for social conformity, automation is having and will have large repercussions upon respect for individuality. Modern technology has developed a repertory of devices capable of penetrating barriers of privacy. Some of these relate to behavior such as the recording microphone or concealed photography; others refer to the inner life (narcosis-inducing devices, lie detection polygraph machines, etc.). Although traditional regard for freedom from snooping has erected many safeguards against arbitrary police investigation, these barriers are already dissolving in the name of security and loyalty inquiries, and of "moral" or "job" pressure to submit voluntarily to deception tests. In the past, the efficiency of police networks suffered from shortage of personnel. The installation of automatically monitored surveillance instruments makes it possible to penetrate the remaining barriers to privacy, and to redouble the pressures toward cautious conformity, not only to lawful prescriptions but to the informal prescriptions laid down by "Mrs. Grundy." The potentiality exists of monitoring not only prisons, schools, offices, plants, barracks, training, and recreational fields, but of surveying traffic flows, etc.

Limits to this process may be wanted in order to maintain areas of individual privacy and freedom. If so, it will be necessary to stop drifting and take the positive step of drawing up, adopting, and administering codes of freedom. Otherwise, the world will be comfortable only for people who have no unconventional impulses, no unpretty habits, no objectionable behaviors of any kind, no novel conceptions of rectitude. Man will be approaching the time when he automizes himself into conformity, into seeming rectitude. Paradoxically, a license to be unobserved for awhile may become one of the principal rewards of meritorious conformity.

Affection Outcomes

Another important set of social outcomes relates to affection, not only in the sense of intimacy and friendship, but of emotional identification with such social units as the "Nation State." Automation requires the long-term trend to continue, which increases the amount of invested capital per producer. It is often said that this has brought about the dwarfing of the individual by skyscrapers, giant power plants, and such.

To some extent men proudly identify the primary ego, which is relatively puny, with gigantic achievements of the kind. At the same time, however, many careful investigators allege that our large-scale modern society alienates many millions of its members. Attachments are slowly withdrawn from the larger and more inclusive entities to smaller and more compassable units. Presumably, this alienation affects the United States, Great Britain, and all of the older industrial nations more than it does, for example, the Soviet world. Where technological progress is relatively new, fewer elements in the population are disenchedanted with its results in terms of art, morality, or other values of their kind.

Well-Being Outcomes

In a related vein are some questions about how mental and physical well-being is connected with technology. One sequence runs from the technological environment to an impact upon affection (alienation) or rectitude (rigid conformity), which has already been mentioned. Do the pressures of alienation or conformity in turn affect the psychosomatic equilibrium of individuals? Is the demand for tranquilizing drugs, for instance, to be interpreted as a symptom of cumulative stress whose origin is partly in the technological environment which automation intensifies? Can any significant part of the rising incidence of neurosis, of "acting out," and of other psychiatric disorders be attributed to the same set of factors?

Skill Outcomes

To offset whatever adverse effects there may be in terms of well-being, the effect of less drudgery per day upon human creativity can be weighed. If in fact, the hours of compulsory or semivoluntary work are cut down, perhaps human abilities will seek creative outlets on a hitherto unimagined scale. Undoubtedly this will give rise to problems. The ungifted, for example, are problems. But some of those who appear devoid of wit and talent are victims of our current inability to perceive new talent potentials for new and contributory modes of expression.

Respect Outcomes

A brief word about respect outcomes. Scientists and engineers are today en-
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American industry appears to be moving into a period of technological change which staggering the imagination. While a layman may have read a great deal about the new automated processes, and may have had considerable actual experience with the practical impact of automation, it is difficult to visualize fully the changes which are taking place.

Americans are fascinated with the new technology, and are a people who always have been entranced by mechanics, by science, and by the wonders which can be accomplished by machines and instruments. Americans are inclined to glorify mechanical, technical, and scientific progress. But the current revolutionary change in technology has reached a point that is sometimes frightening. In the past technical progress has come about by relatively easy stages. Each new invention affected only a limited segment of industry and economy. Each new machine represented only one step forward on an old process. Mechanical programs did not jump overnight from hand shovels to 10-cubic-yard earth-moving machines, but instead moved by easy stages over a period of decades. Each of us, as amateur mechanics, could 'savor and enjoy the step-by-step changes in the machinery we loved to watch in operation.

Now, automation has brought about the expectation of overnight revolution in the way we apply energy and build things. The change not only threatens to be abrupt, it also is so great as to outrun the imagination. Laymen have to some degree lost their capacity to enjoy watching change as spectators, and are hard put to understand the new devices which are coming into factories and offices.

We continue to admire, indeed, we continue to virtually worship, the scientists who create the fantastic new methods and machines. Yet we are filled with apprehension, for there is a vague and uncertain feeling that these scientists are so engrossed with the almost supernatural nature of their instruments that they have forgotten the natural needs of mankind. The author does not make the charge that the scientists have forgotten the people; only that many people have a feeling of apprehension. At times the trade union movement shares that apprehension when we see the industrial applications in certain cases. I am sure the scientists are just as interested as I am in dispelling this apprehension and creating a climate in which the layman can trust the scientists, and the scientists can feel that they are working solely for the welfare of people.

Panel discussions such as the one which produced this group of papers certainly contribute to a better understanding between those gentlemen who are working electronic marvels and the laymen who are amazed by it all. Discussions like this can serve to provide us with mutual education and perhaps a better understanding.

Speaking as a representative of organized labor, I can assure you that labor does not oppose automation as such. We are wholeheartedly in favor of the application of better, faster, easier, and cheaper methods of performing work, so long as these methods are applied with due consideration of the needs of the people. My only thesis is that the technology of man must always serve people; people must never be made the slaves of technology.

Organized labor has no doubt that in the long range automation will benefit the human race. Anything which increases the production of goods and services for the use of people, and anything which reduces human toil, ultimately will bring about a more pleasant life. Labor does not want to return to a past era of hard manual labor with picks, shovels, and other hand tools. Mechanical progress already has relieved labor of much of its unpleasantness and we certainly do not want to stand in the way of technological progress which will relieve us of still more toil.

This is our long-range view. In the short range, labor resistance will be found from time to time in the application of new automated processes which bring hardship to individual workers and groups of workers who are displaced by new equipment, with resultant personal and family dislocations. Whenever new equipment is applied under circumstances which take into consideration first the welfare of the people concerned and secondly the question of mechanical efficiency, there will be no substantial resistance from labor. But whenever new equipment is installed purely on the basis of production efficiency and without regard for the human beings who suffer thereby, resistance and resentment will be built up.

All changes in our way of doing things, whether these changes be economic, administrative, or technological, should be made on the basis of what will best serve the people. Labor believes that industrial planning should start

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