AUTOMATION:

THE RETREATING CATASTROPHE

*By Yale Brozen**

Amateur social scientists such as Norbert Wiener (a professional mathematician) predicted, in 1949, that we faced "a decade or more of ruin and despair" from the wholesale unemployment which would occur in the 1950's. Cybernation and automation were going to abolish jobs at an unprecedented rate. The prediction was reaffirmed by a parade of witnesses in the mid-1950's before a Congressional committee investigating automation. Yet, the "decade or more of ruin and despair" from the unemployment that was going to be caused by automation appears to have been postponed by at least 17 years. Nevertheless, we still have doom criers who say that this consequence of automation will be appearing in the near future.

The Ad Hoc Committee on the Triple Revolution has issued a Manifesto (March 1964) which declares that the advent of complex computers and self-regulating machines introduces an historical break in the evolution of social processes. "A new era of production has begun. Its principles of organization are as different from those of the industrial era as those of the industrial era were different from the agricultural." The new machines introduce an era of unlimited productive capacity. The new machines are displacing people in droves from manufacturing and agriculture and will soon displace them from

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the service industries. Men cannot compete with these machines. Poverty is expanding and it has become impossible to achieve full employment.

Judgement Day is coming. Despite the fact that the predictions of its coming have been constantly disappointed, it will be upon us soon, you sinners, so repent while there is still time.

These predictions of wholesale unemployment seem to be repeated at shorter intervals as more of such predictions fail to materialize. In the late 1700's, machines such as the loom and the spinning jenny were about to bring the end of the world upon us. Edward Baines, the historian, writing in 1834, made the following comment about these predictions:

"At the accession of George III (1760), the manufacture of cotton supported hardly more than 40,000 persons; but since machines have been invented by means of which one worker can produce as much yarn as 200 or 300 persons could at that time, and one person can print as much material as could 100 persons at that time, 1,500,000 or 37 times as many as formerly can now earn their bread...

"Any yet there are still many, even scholars and members of Parliament, who are so ignorant or so blinded by prejudice as to raise a pathetic lament over the increase and spread of the manufacturing system... there are persons who regard it as a great disaster when they hear that 150,000 persons in our spinning works now produce as much yarn as could hardly be spun with the little handwheel by 40,000,000."

In the 1870's and 1880's, the spread of mechanization showed that the end was in sight. David Ames Wells, writing on Recent Economic Changes in 1889, reported that:

"The power to excavate earth, or to excavate and blast rock, is from five to ten times as great as it was when operations for the construction of the Suez Canal were commenced, in 1859-'60. The machinery sent to the Isthmus of Panama, for the excavation of the canal at that point, was computed by engineers as capable of performing the labor of half a million of men.

"The displacement of muscular labor in some of the cotton mills of the United States, within the last ten years, by improved machinery, has been from thirty-

three to fifty percent, and the average work of one operative, working one year, in the best mills of the United States, will now, according to Mr. Atkinson, supply the annual wants of 1,600 fully clothed Chinese, or 3,000 partially clothed East Indians. In 1840 an operative in the cotton mills of Rhode Island, working thirteen to fourteen hours a day, turned off 9,600 yards of standard sheeting in a year; in 1886 the operative in the same mill made about 30,000 yards, working ten hours a day. In 1840 the wages were $176 a year; in 1886 the wages were $285 a year.

"The United States census returns for 1880 report a very large increase in the amount of coal and copper produced during the ten previous years in this country, with a very large comparative diminution in the number of hands employed in these two great mining industries; in anthracite coal the increase in the number of hands employed having been 33.2 percent, as compared with an increase of product of 82.7; while in the case of copper the ratios were 15.8 and 70.8, respectively. For such results, the use of cheaper and more powerful blasting agents (dynamite), and of the steam drill, furnish an explanation. And, in the way of further illustration, it may be stated that a carload of coal, in the principal mining districts of the United States, can now (1889) be mined, hoisted, screened, cleaned, and loaded in one half of the time that it required ten years previously.

"The report of the United States Commissioner of Labor for 1886 furnishes the following additional illutrations:

"In the manufacture of agricultural implements, six hundred men now do the work that, fifteen or twenty years ago, would have required 2,145 men-a displacement of 1,545.

"The manufacture of boots and shoes offers some very wonderful facts in this connection. In one large and long-established manufactory the proprietors testify that it would require five hundred persons, working by hand processes, to make as many womens' boots and shoes as a hundred persons now make with the aid of machinery-a displacement of eighty per cent.

"Another firm, engaged in the manufacture of children's shoes, states that the introduction of new machinery within the past thirty years has displaced about six times the amount of hand-labor required, and that the cost of the product has been reduced one half.

"On another grade of goods, the facts collected by the agents of the bureau show that one man can now do the work which twenty years ago required ten men.

"In the manufacture of flour there has been a displacement of nearly three fourths of the manual labor necessary to produce the same product. In the manufacture of furniture, from one half to three fourths only of the old number of persons is now required. In the manufacture of wallpaper, the best evidence puts the displacement in the proportion of one hundred to one. In the manufacture of metals and metallic goods, long-established firms testify that machinery has decreased manual labor 33 1/3 per cent.

"In 1845 the boot and shoe makers of Massachusetts made an average production, under the then existing conditions of manufacturing, of 1.52 pairs of boots for each working day. In 1885 each employee in the State made on an average 4.2 pairs daily, while at the present time in Lynn and Haverhill the daily average of each person is seven pairs per day, showing an increase in the power of production in forty years of four hundred per cent."

In the early 1900's electrification meant that the end was at hand. Then in the 1930's, the heavens cracked and the deluge descended because, it was said, there was too little technological change, a reversal of the earlier stand. But we are now back at the old stand again. Technology is about to engulf us. Job opportunities are about to be swallowed up, once again, by technological change, which we now call automation and cybernation.

Frankly, I am puzzled by this increasingly repeated belief in a judgement day which is constantly postponed. I am especially puzzled in view of facts which demonstrate that, if ever a judgement day threatened, it is farther in the future than ever. More jobs exist today than ever existed at any time in our history. The number of jobs has grown, not declined or even remained static. More jobs are vacant and more employers are searching for additional help than at any time in our recent history. And this is not because there is a greater gap between the skills required to fill jobs and the skills possessed by those seeking jobs. There are more people at work today filling jobs than at any time in our history. Not only are more people at work than ever, but the proportion of those aged 18 to 64 who are at work has been growing. The population in the 18 to 64 age bracket has increased at a 0.9% per year rate since 1947. Total civilian em-

ployment has increased even faster, mounting at a 1.3% per year rate since 1947. The growth rate in number of civilians employed is 40% faster than the growth rate of population in the age brackets that furnishes most of the available tenants for jobs. Yet the Ad Hoc Committee blandly states that the labor force participation rate is declining because people are losing jobs. They tell us that the unemployment figures do not tell the actual unemployment because they do not include those who have withdrawn from the market because they have found the quest for jobs to be hopeless.

Where do we find this spectre of declining job opportunities with which the doom criers are constantly trying to haunt us? The major place where we find it is among Negro teen-agers. After the statutory minimum wage rate was increased to $1.00 an hour in 1956, the unemployment rate among this group leaped to 18% of those who would like to have jobs (from a range of 7 to 13% in the preceding decade). After the statutory minimum wage was raised to $1.15 in 1961, the unemployment rate among this group jumped to 21%. With the further increase in the statutory minimum wage rate to $1.25 in 1963, the unemployment rate in this group rose further to 24%.

Now a proposal is before Congress to increase again the statutory minimum to $1.40 next year and then to $1.60 and to extend further the number of jobs covered by this wage law. We seem to be intent on forcing more and more teenagers into unemployment. We seem to be eager to foreclose the opportunities to learn a skill and become productive enough to be worth employing at wage rates well in excess of the statutory minimum in the later years of life.

A major part of our education is obtained while at work. We are foreclosing educational opportunities by these successive increases in the statutory minimum wage rate. We pushed the statutory minimum wage up by 212% from 1949 to 1963 in a period when the average wage of all employees rose less than 80%. It is no wonder that unskilled, inexperienced workers are finding it difficult to land jobs.

The inability of a major number of teen-agers to find jobs is hardly attributable to automation. The arbitrary price set by law that employers must pay must take the major share of the blame for the lack of employment opportunities for this group.

Mass unemployment, or even a minor amount of un-

employment, has not been caused by automation. We are closer to a mass shortage of employees in the 20 to 64 year age bracket than we are to a shortage of jobs.

Since 1949, when alarms were sounded about the expected effect of automation, the number of people at work has increased by 14 million and the number of jobs by 16 million. At the same time, the average hourly compensation of factory employees has increased from $1.90 (measured in 1965 dollars) to $2.90. This is a 55% increase in real terms (i.e., measured in dollars of constant purchasing power). If the demand for employees had been depressed by automation, we would have seen a drop in the real wage, not a 55% rise, particularly in view of the rising size of the labor force.

This is not a pronouncement that no person ever lost a job because of automation. I am saying that the number of unemployed persons has not increased because of automation. Automation has created more jobs than it has destroyed. Unemployment has dropped because of it, although there are some people among the unemployed who would not have been there if there had been no automation. But there are a great many more people among those employed because of automation than are among the unemployed because of automation. Although automation has displaced some employees, the total number unemployed is smaller today than it would have been without automation, given the present wage structure.

Most of the unemployment of those 20 years of age and over is the normal unemployment that we will always have with us because of the constant shifting among jobs. People voluntarily quit jobs in very large numbers in order to seek better jobs. Normally, six million or more persons a year do this. During the period in which they are choosing among the jobs available, they are classed as unemployed and seeking work. They are not unemployed because of economic disaster, however. They are unemployed because they are taking time to canvass the market and choose among alternative openings or because they are doing some work at home and are not counted among the employed even though they are employed. If they average two months between the time they quit one job and the time they start a new one chosen from among the many openings available, the average unemployment appearing in the statistics from this one source would be over one million.

Automation does result in a redeployment of the work force. This, however, is an old story in America. A

hundred years ago, there was no automobile industry, no aircraft industry, no electric generating industry, no camera or film industry, no motor boat industry, no radio and television industry, no telephone industry, ect. Today, these are all very substantial industries employing large number of people. Without a redeployment of the work force, these industries would not be in existence. Automation-caused redeployment is simply another facet of the redeployment of labor which has been a constant fact in American life.

Why Is Automation Alarming?

In the face of this data, why do some cry that doomsday is coming? What is it about automation that causes alarm? Why is it that workers asked about their attitude toward mechanization feel no threat, yet appear frightened when asked about their feelings toward automation?

The hallmarks of automation, to distinguish it from simple mechanization or automatic methods, are its sensing, feed-back, and self-adjusting characteristics. Because it senses changing requirements and adjusts without human intervention, it presumably does away with the need for human attendants or human labor. This is very fearful indeed to those who depend upon jobs for their livelihood.

Fear of automation can be traced to four sources. One is based upon the assumption that there is a fixed amount of goods, which buyers want. Any new method which enables us to turn out more goods per man-hour will, it is believed, enable us to turn out the fixed amount of goods and services with fewer men. If a man helped by an automatic machine can produce twice as many widgets per hour as he formerly did, then, presumably, only half as many hours of work will be available for each man to do. If work weeks are not shortened, only half as many jobs could, it is asserted, be provided in these circumstances. The President of the United States used this sort of logic when he said "that approximately 1.8 million persons holding jobs are replaced every year by machines."

The second source of fear springs from the idea that automation or cybernation is something more than the latest stage in the long evolution of technology. Automation is said to be so different in degree that it is profoundly different in its effect. Automated machines controlled by computers do not simply augment muscle power as previous machines did. They replace and out-

perform human intelligence. In the future, machines will not only run machines; they will repair machines, program production, run governments and even rule men. Union leaders will collect no dues and business will have no customers because, presumably, there will be no production workers required. Human beings will, it is believed, be made as obsolete by these machines as horses were by the tractor and the automobile.

The third source of fear lies in the fact that we are much more aware of the people displaced by automation and concerned about them than we are of the other unemployed. Among the three million unemployed are several thousand persons laid off because their skills are not usable by concerns installing automated processes to replace previously used technology. Presumably, possessing only obsolete skills there are no job opportunities open to them. Others who are laid off or who are among the unemployed because they have voluntarily quit their jobs are less worrisome because their skills are not obsolete and they will have new jobs in a few weeks.

A fourth source of fear is the high incidence of joblessness among the unskilled. It is felt that the unskilled are unemployed because automated production reduces the demand for unskilled workers. Any increases in the demand for labor occurring because of automation are believed to be concentrated on highly skilled workers.

Is The Alarm Justified?

Let us analyze these presumptions which make automation so fearful to some. First, is there a fixed amount of work to be done? Does an improvement in technology which enables us to do a fixed lump of work with fewer men mean there will be fewer jobs?

In terms of a very recent type of automation, the use of electronic data processing equipment, a United States Department of Labor study of large firms which introduced such equipment concluded that: despite the reduction in labor requirements for the tasks performed by the computers, total employment of the offices as a whole rose. Over the four years from December 1953 to December 1957, total office employment at 17 offices studied increased an average of 7 percent. The experience of these offices suggests the possibility of expanding employment in new areas of office activity to handle in-

formation which had previously been uneconomical to acquire.[1]

This experience of increasing office employment despite reduced labor requirements per unit of outputs is a specific instance of what has been going on generally in our economy. From 1919 to 1962, man-hours required per unit of output in the American economy dropped by 67 percent, yet total number of jobs rose from 42 million to 68 million. The tripling of output per man-hour did not reduce the number of jobs by two-thirds as those who believe in a fixed amount of work available would predict.

One group which subscribes to the fixed lump of work philosophy has pointed to the 1960-65 annual rise in output per man-hour of 3.6 percent with alarm. It has said that this exceeds the long term average annual rise of 2.4 percent from 1909 to 1963 and the average annual postwar rise of 3.0 percent. This, it has said, indicates that the pace of technological change is accelerating and will create a great unemployment problem.

The more rapid rise of output per man-hour from 1960 to 1965 was accompanied by an increase in the number of civilian jobs from 67 million to 72 million--an increase of 5 million. An even more rapid rate of increase in output per man-hour from 1949 to 1953, amounting to 4.0 percent per year, was accompanied by increase in civilian jobs from 59 million to 62 million. On the other hand, a slowed rate of increase in output per man-hour from 1953 to 1954, when output per man-hour rose by only 1.8 percent, well below the long run average rise of 2.4 percent, was accompanied by a drop in employment from 62 million to 61 million. "It is noteworthy that while many Americans worry about the loss of jobs due to technological change, the much more rapid increase in productivity abroad has been accompanied by a great reduction, not an increase, in unemployment."[2] It would seem that a more rapid rise in output per man-hour should be welcomed as a means of creating jobs more

1. U. S. Bureau of Labor Statistics, ADJUSTMENT TO THE INTRODUCTION OF OFFICE AUTOMATION, Bulletin NO. 1276 (Washington: U. S. Government Printing Office, 1960) p. 4.
2. R. N. Cooper, "International Aspects," AUTOMATION AND TECHNOLOGICAL CHANGE, edited by J. T. Dunlop (Englewood Cliffs: Prentice-Hall, 1962), p. 148.

rapidly than they can be destroyed by other factors at work in our economy.[3]

The primary effect of automation and increased output per man-hour is not a reduction in the number of jobs available. Rather, it makes it possible for us to do many things which otherwise could not and would not be done. Automation enables us to earn larger incomes and lead fuller lives. It will, in the future, literally make it possible to travel to the moon. It saves lives through the aid it gives doctors. By controlling traffic signals in response to traffic flows and reducing traffic congestion, it adds hours to the free time of commuters every week. It helps scientists, with the aid of high-speed data processing, to develop new knowledge that otherwise would not be available in our lifetimes. We are increasing the scale of educational activities because mechanization, automation, cybernation, or whatever we choose to call our new technology, makes it possible to do more than we could formerly. With the coming of automation, men are able to do more and have more. Both sublime and mundane activities are being enlarged and the number of jobs has grown as a consequence, not declined.

The second source of fear--the idea that automation is something more than the latest stage in the long evolution of technology--the idea that it is so different in degree that it is profoundly different in effect--is an equally specious hobgoblin. The first thing to be said is that automation is not a new phenomenon.

Although we may grant that automation differs from other kinds of technology, we should not blind ourselves to history to the point of saying it is completely new. Perhaps the earliest automated device was the pressure cooker invented by Denis Papin in 1680. He originated a pressure control which is still one of the most widely used regulators. Despite this automated device, and others

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3. A study by S. Fabricant for the pre-war period found that "trends in unit labor requirements have been negatively correlated with trends in man-hour employment in different industries" (that is, decreases in hours of labor per unit of product--increases in output per man-hour--have been correlated with increased employment while increases in hours of labor per unit of proudct have been correlated with a decline in employment). EMPLOYMENT IN MANUFACTURING, 1899-1939 (New York: National Bureau of Economic Research, 1942).

such as thermostatic oven controls, cooks are still extensively employed and housewives still find it necessary to devote time to their kitchen work. Although homemakers may spend less time in the kitchen, this has simply freed them to do more of other kinds of work, such as better educating their children and decorating their homes.

During the eighteenth century, several types of automatic regulators were applied to windmills. An automatic, card-programmed loom was devised by Jacquard over 150 years ago. An automatic flour mill was built in 1741. Eighteenth century steam engines were controlled by governors which had sensing, feed-back, and resetting characteristics which are the hallmark of automation. Automation has been increasingly applied over the last two centuries, yet employment has risen continually.

If automation is so remarkably different in degree than previous technological change, it should show in the data on productivity. I have said above that output per man-hour has risen in the last five years at a 3.6% annual rate. If automation is doing such profoundly different things to us, that rate, then, should be a markedly higher rate of increase than ever before experienced. Yet, in contrast, output per man-hour in manufacturing in the post World War I decade rose at a 5.0% per year rate--a rate which has not been matched in any ten year period you want to pick since World War II. If automation is such a profound leap in technology, it has yet to manifest itself as such in economically significant terms.

As to the third source of fear--the fear that our skills will be made obsolete much more rapidly because of automation and we will lose our jobs for that reason and, with obsolete skills, be unable to find any other job--there is simply no evidence that workers are becoming unemployed in greater numbers for this reason and are unable to find other jobs because their skills are obsolete. The only group which has suffered a significant increase in the incidence of unemployment are teen-agers seeking their first job. I have already indicated that this is a consequence of man-made legislation--the stupendous increase in the minimum wage rates set by statutes passed by Congress and state legislatures.

When skill requirements on jobs change, most of the affected employees are retrained by their employers for new jobs. The average production worker in General Motors is retrained six times in ten years. The average

airline spends $100,000 per pilot over a pilot's career retraining him for flying new aircraft as old aircraft are phased out and replaced. Industry in general is spending well over $20 billion a year on employee training and retraining.

The U. S. Bureau of Labor Statistics studied the experience of twenty major firms converting to electronic accounting and found that only one employee of the 2,800 employees involved was laid off. In seven companies installing automation equipment which were intensively studied by the Stanford Research Institute, not one employee was laid off. When the South Chicago Works of U. S. Steel was replaced by an automated mill, of the 1,346 employees involved, only one was laid off.

Automation has resulted in the re-deployment of the work force--not in discarding obsolete men for whom there is no further use. I said earlier that this is an old story. The extent of the redeployment which has occurred may startle many readers.

Only a century ago, fifty out of every one hundred workers toiled on farms producing the nation's supply of food and fiber. Only two or three out of every one hundred workers were producing educational, medical, recreational, and other services which contribute to a richer, fuller, healthier life. Today, the number of workers in these life-enriching occupations is relatively five times as great. Those toiling on farms have been reduced to one-seventh their former number. They now direct machines instead of using animal power and their own muscles. The quality of life has been improved and brute toil has been reduced because technology has increased our incomes to the point where we can afford these services and these machines.

Most of this redeployment occurred before we ever heard of automation, much less had any effects produced by it.

The fourth source of fear of automation apparently springs from the high incidence of joblessness among the unskilled. Some of the doom criers tell us the unskilled are unemployed because automation has reduced the demand for unskilled workers even though it may, in some instances they grudgingly admit, increase the demand for skilled workers.

If the unskilled were the victims of automation, we should expect a steadily growing volume of unemployed

among the unskilled as the economy becomes increasingly automated. Instead, we find, for example, that the age group 14 to 17 "had particularly severe declines (in employment) from 1950 to 1951, 1955 through 1957, and 1960 to 1961. These declines in employment for this group coincide with Federal increases in minimum wages and the extension of coverage." After the surge in teen-age unemployment coinciding with the last increase in the minimum wage rate in 1963, the unemployment rate has started dropping. If we believe that automation causes unemployment among the unskilled, the unemployment rate in this group should have continued to rise.

There is abundant evidence that the increased unemployment among the unskilled is a result of the rise in the statutory minimum wage rate and extension of the number of jobs covered by the statutory minimum. There is now a large literature which displays the data establishing this fact.

The evidence available concerning the effects of automation leads to these conclusions:

1. If no technological change had occurred in the past decade, the number of civilian jobs available and occupied could have grown as it has from 63 million to 72 million only at the price of restricting increases in wage rates.

2. The technological change of the last decade has increased the average employee's earnings by $400 per year compared to what they would be if there had been no automation.

3. Automation increased the number of jobs available at the 1955 wage level by 20 million. Since only 9 million additional people have joined the work force and become available to fill jobs, there would be a shortage of 11 million workers today if wage rates had not increased. The increase in wage rates has reduced the demand for labor to the point where there are few shortages of most types of labor.

4. The overly large increase in the wage rate for the unskilled as a result of minimum wage legislation, has destroyed so many jobs for these people that we have a surplus of unskilled teen-agers for filling unskilled jobs in some sections of the country. This surplus is not a result of automation but of over-pricing.

5. Automation and other forces such as the growth in the stock of capital are doing a major job in alleviating poverty. If we define poverty in terms of a $3000 per year family income measured in 1962 dollars, the incidence of poverty has fallen from 32% of all family units in 1947 to 18% in 1964 and to approximately 15% today. The declarations of the Ad Hoc Committee on the Triple Revolution that there is an increasingly large disadvantaged group in our society, that there is a growing permanently depressed class, and that poverty is worsening simply do not square with the facts.

6. Instead of being alarmed about growing automation, we ought to be cheering it on. The catastrophe that doom criers constantly threaten us with has retreated into such a dim future that we simply cannot take their pronouncements seriously.

Let us have more automation, more mechanical slaves to work for us, and stop wasting our time and dwelling on the threat of hobgoblins which exist only in the imaginations of those who refuse to look about them at what is going on in the economy.