1965

Automation! : where it is taking us.

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AUTOMATION! WHERE IS IT TAKING US

by

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A PROBLEM PRESENTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENT FOR THE MASTER OF EDUCATION
DEGREE

UNIVERSITY OF MASSACHUSETTS
August 20, 1965

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INTRODUCTION

In looking over a list of subjects that I considered for this study, I finally chose Automation. It is one invention that is definitely going to effect the lives of everyone on this earth.

From the two or three year old who can push a button on a gumball machine to the man who pushes the button for cigarettes, automation is well known. It is causing more changes in our lives than we had of dreamed.

Even my little niece who attended nursery school came to me all excited to tell me about the "automatic garbage man" who intrigued her no end. She explained in detail how "he drove his truck to the 'loadall', hooked it on, backed up, lifted it over his head and dumped everything into his truck. Then he put it back on the ground. He never got out of his truck once. He just pushed buttons."

After consulting numerous books on automation I felt like a child trying to open all his gifts at once.

It is everywhere. The big question or questions are, "Automation, where is it taking us? Is it friend or foe? Many of the places to which it has already taken us, man has never been before, far out into space, deeper into the earth, and the ocean. I am sure there is hardly a home in our country that has not some evidence of its presence in it. Nearly everything bought in our super markets is automatically wrapped or packaged.

It is now my task to find highlights of its career. There was a TV play called "This is Your Life". You are on stage, Automation. Where do we go from here?

I am sure I will need a computer to assemble even a very short span of your life up to date. You are like a will-o-the-wisp, changing constantly.

First things first. Automation, you have been on the way a long, long time, maybe since the first cave-man made a club to get his dinner. Would not Gallileo and da Vinci be happy to see some of your work! At last the dreamy scientists have come into their own. They are the top men on the totem pole today.

Vannevar Bush in Fortune Magazine said, Scientists were considered long hair idealists, likely to wear one black shoe and one tan. Some days they ate two lunches and some days none. Their thoughts were on mundane things. Then came the A bomb! Now scientists are regarded as supermen. They can do anything if given enough money. If America wants to put a man on the moon, which is really a tough engineering job, just gather enough scientists, pour in the money, and the man will get there. He may even get back."

(Dr. V. Bush, Hon. Bd. Ch. M.I.T. Fortune Magazine 5/65 P. 116)

A RESEARCH STUDY

AUTOMATION - WHERE ARE YOU TAKING US

At sometime or other in our lives, we have tossed a stone into the water and watched the circles grow ever and ever wider ending at the shore. I wonder just when or where the stone was cast that sent automation into the far corners of the earth.

"Automation describes both the use of machines which regulate themselves and the process of making machines automatic. The word automation is also used to describe an attitude toward production. Just as the machinery of mechanization freed human workers from much of the physical labors of production, the machinery of automation frees humans from much of the mental labor involved in guiding and controlling the machines."

Some of the observers consider automation so important that they have called it the Second Industrial Revolution. The reason being that automation not only increases the productive capacity of factories, as did the first Industrial Revolution, but also changes the relationship of man to his machines.

The basic difference between an ordinary machine and the self-regulating machine of automation is the feed-back. The most familiar one is the thermostat which I shall discuss later. Machinery being used to achieve automation may be divided into four general types.

1.) Automatically controlled machines, i.e., lathes and milling machines.
2.) Automatic material-handling systems, which carry products or parts of products from one machine to another.
3.) Automatic control systems, which are used in chemical and oil-refining processes.
4.) Automatic information-handling machines such as computers.

Computers are machines which can solve mathematical and logical problems. These machines may be mechanical, electrical or electronic. Electronic computers are known as data-processing machines..

There are two major types of computers: Analog and digital.

Each receives information from punched cards, perforated tapes or magnetic tapes. The machines may use the information to solve mathematical or logical problems. They might also perform tedious clerical tasks or control industrial processes.

The Analog is essentially a measuring device. It is called an analog computer because it creates physical situations which are analogous to mathematical problems. The slide rule, which expresses numerical relationships, as distances between points, is a simple example.

The digital computer is used for complicated problems, and where speed is important. Instead of measuring, the digital computer counts. It can solve any problem that can be stated numerically. A simple example of the digital computer is the abacus or an adding machine.

For many years automatic machines have been in use in factories to speed production and save labor. For instance, bottles are made, filled, sealed and labeled by automatic machines.

Electronic devices which are applied to machines

often duplicate certain functions of the human senses - "sight, hearing, and may be supplied by a microphone and feeling by piezoelectric crystals." Computers can keep inventory records, compute sales figures, handle payroll accounts, prepare income tax data and make time studies. Some can even translate languages. They have given railroads and airlines a work-saving system for handling seat reservations..

Many major airlines in the U.3. use electronic computer systems to handle seat reservations automatically. It is almost unbelieveable to follow the processes.

Factory automation is made up largely of automatically controlled production machines and transfer macnines or material-handling devices. This is much used in the automobile industry, often being referred to as the Detroit Automation. The Ford Motor Company, in particular, has pioneered the use of automatic controls in automobile manufacturing and assembly. They are reputed to have coined the term "automation" in 1946. The Ford engine plant processes complete engine blocks with automation. In 14.6 minutes, rough cylinder blocks go through

a series of 530 automatic operations and come out as a finished product.

A key unit in the system is a toolomotor (tool controlled board). It looks like a big switch board. It tells an operator when to replace worn tools in the engine block line. A light flashes the moment a tool needs changing. The tool can be replaced without halting production.

Some of the truest examples of automation are found in the oil and chemical processing industries. Oil refining and chemical manufacture were among the first industries to use self regulating systems. Here, feedback control devices regulate continuous flow of raw materials through automatic equipment, so that the finished product flows from the plant in an uninterrupted stream. There is no doubt about it, automation has brought us a long way from the back breaking days that started at six and ended at six.

International Business Machine Corporation (IBM) was the first to put out calculating machines in 1944. They rented them for some years, but now they may be

bought - for a price!

In 1961, the Department of Labor created an Office of Automation and Manpower.

CYBERNETICS

Cybernetics is an introduction to a new scientific development. It comes from the Greek meaning "helmsman" and refers not only to ship steering devices and other automatic machines, but also to living control devices built into the brain.

'Norbert Weiner, who wrote a book, "Cybernetics" was a child prodigy who received a doctorate degree from Harvard University at age 18 and went on to be one of the most creative and widely read scientists of our times. Weiner coined the word nearly a generation ago to identify a new field that was just beginning to take shape, the broad study of all control systems, artificial or natural, man-made and begotten. In introducing this field, he served as unofficial spokesman for a highly original group of thinkers whose leaders included fellow mathematicians John von Neumann of the Institute of Advanced Study in Princeton, Claude Shannon of the Bell Telephone Laboratory, Julian Bigelow, an engineer associated with von Neumann at the Institute and Warren McCulloch, a leading brain investigator at the University of Illinois Medical School.

The book on Cybernetics is essentially a phil-

osophical dissertation on the technology of the future, which is the technology of robots. Weiner and his colleagues were the first to recognize that in a basic sense, the age of brute force has reached a peak. For all the publicity, the release of atomic energy marks the end, not the beginning of an era. From here in, for better or worse, the accent will be more and more on automatic processes, on control and communications rather than power. It all seemed to start quite innocently with the invention of simple instruments to detect light, heat, sound, electricity, and so on. But the robot was on the prowl nearby. Engineers built detectors which, within limits, operate on their own.

Perhaps the most familiar of such instruments was the thermostat of home heating units which registers room temperature at a given moment, compares it with the preset level, and then corrects for any deviation by relaying appropriate information back to the furnace. Thus a bit of the world is held constant for our convenience. Cybernetics discusses the thermostat to illustrate a principle which applies whenever the aim is to maintain stability in the face of continual and unpredictable change. Furthermore, it predicts mathematical techniques for the design of far more complex senses systems.

Today, these techniques have become so familiar that the chief danger against which one must guard is that the book may seem trite and commonplace.

The gadgetry of the space age calls for many robot sense organs. But it also calls for something more. These devices, like the sense organs, constructed by nature, require sophisticated systems to analyze information streaming in from the outside world. This means brains of a sort. The kind that becomes available with the development of electronic computers. An inter-planetary vehicle designed to steer by starlight must have a telescopic eye, which not only passively detects distant radiation but also remains fixed on the star no matter how the vehicle yaws and pitches and rolls. Furthermore, if the rocket begins to drift off course, the information must be flashed to a unit which "knows all" about present conditions in relation to ultimate destination and can send deviation correcting signals to steering mechanisms. Only computers can perform such duties and they are at work everywhere. Miniature computers operate in satellites and rockets which are themselves tracted and controlled with the aid of large earth bound computers. The nation's radar

defenses involve other tracking devices capable of predicting the courses of enemy planes and missiles (as well as probable escape tactics) and destroying the targets by releasing self-guided counter-missiles. There are some pioneers of a strange new breed automaton. They combine brain and sense organs in an essentially unique way. As such they represent a high point in the continuing evolution of machines.

The first industrial revolution, the revolution of the "dark satanic mill" was the devaluation of the human arm by the competition of machinery. There is no rate of pay at which a U. S. pick and shovel laborer can live which is low enough to compete with the work of a steam shovel as an excavator. The modern industrial revolution is similarly bound to devalue the human brain at least in its simpler routine decisions.

About a generation ago, the 18,000-tube affair known as ENIAC (Electronic Numerical Integrator and Computer) worked satisfactorily for its day but broke down frequently. Today, its descendants include several thousand larger-scale computers supplemented by an army of tens

of thousands of smaller machines, and this demand still outruns the supply by a wide margin. They are serving as indispensable thinking aids in our efforts to cope with the complexities of a world that is getting increasingly more complicated all the time, and the design of even more ingenious devices is currently at an advanced stage.

'Cybernetics: Or Control and Communication in Animal and the Machine. By Norbert Weiner. The M.I.T. Press, Cambridge, Mass. Review in N.Y. Times 5/18/65 Rev. by John Pfeiffer.'

The computer, like the train, has yet to be exploited fully. The education of computers represents a continuing challenge, not only to engineers, but also to neurophysiologists and psychologists concerned with the workings of the brain. With such developments, the second industrial revolution is already underway. Wiener was its most articulate prophet. Weiner noted that the means for internal control and communication in an animal, such as its nervous system, were similar to those in a machine. He also realized that biologists who studied animals, and engineers who designed automatic control equipment, did not usually know each others field of work.

He proposed that control and communications in both fields be studied together as the science of Cybernetics.

An important part of cybernetics is the study of the feed-back. If the path of the guided missile is not what it is supposed to be, or if the body temperature of a man is too high or too low, information concerning the error is fed back to the controlling device which then acts to correct the error.

In Columbus, Ohio, at a Presbyterian Conference, May 20, 1965, a warning was issued that computers may be a bigger threat to religion than the devil. Continuous concern with persons is the only thing that will preserve technological society from manipulating people and over-riding personality," declared Reverend John Coventry Smith of New York .

Impact - It Creates Unemployment

At the U. S. Industries, Inc., conference, John I.Snyder, Chairman of the U. S. Industries, Inc., which, among other things, manufactures machinery:

"By its very nature," Mr. Snyder said, "Automation creates unemployment. If it did not, it would have no purpose. Human labor is more expensive, and often less efficient than machine labor. Automation is a labor saving device; that is, it saves human labor. But looked at from the other end of the equation, it destroys the opportunity for human work. Mr. Snyder viewed these facts as they pertain to education in two lights; the necessity of retraining certain groups of people displaced by automation and the possible application of education itself.

In the first point, Mr. Snyder said that his own firm is cooperating with International Associations of Machinists - has established a foundation, financed by a portion of sales revenues and leave royalties from U.S. Industries automated equipment, to study sociological problems caused by automation. Many of the people displaced by automation, perhaps as many as 50%, said Mr. Snyder in answer to a question, are not retrainable, since they are functionally illiterate, are in the 40 - 60 age

group and cannot be relocated easily.

Regarding the application of automation to education, he said that the history of the last 10 years and more, especially the last 3 or 4 years, has indicated the direction which change will take. These recent developments included "the electronic invasion of the classroom," TV films, tapes and recording machines, plus means of storing and retrieving information electronically, the uses of programmed instruction whether presented in book form or via teaching machines.

"As in industry, we are at the very beginning of the automated revolution in the classroom."

Most of the hardware in the schools - the amount has increased dramatically in recent years - is relatively simple. The very complex machines which combine the many means of storing and retrieving information and of presenting it visually or orally on request are mostly experimental or are designed to do very specialized jobs in industry. But all of them constantly offer us the opportunity to learn more about what is possible in this field. The impact of the automated revolution on the printed word,

Mr. Snyder said, will be decided in terms of "who can contribute most effectively to better teaching of children in a world that is constantly demanding more knowledge and skill from its citizens." "This issue," he declared" will be decided in terms of two problems: the need for more research into how learning actually takes place and the problem of obsolescence. Upon research into the learning process depends the attainment of the optimum combination of educational media, used in the right combination with each other to produce optimum learning. Pitted against this need for research is the continuing problem of obsolescence, in school plan, school material and school personnel.

For a decade and a half, schools have been short of teachers and books, classrooms are short of everything but students. In the years ahead, we need not only better education but more of it. The burgeoning of our contemporary world is fast eliminating the kind of jobs that, in the past, have been available to the poorly educated. It is forcing industry to demand a higher level of knowledge and skill from all its employers. It is creating a need for a constantly growing number of highly trained people. We can no longer <u>not</u> afford to educate well and everyone who is capable of learning. It is the

under-educated who make up the hard core of the unemployed. It is those who lack the basic education skills who cannot be retrained when their jobs are eliminated by automation. Education is the only means by which we can prevent a repetition of the problems we are finding so difficult to solve today."

Plagued by a continuing shortage of executives, U. S. business depends as never before on the output of the nation's business schools, and cares more than ever about the kind of training they provide.

At a meeting held in Manhattan recently, of the 113 accredited by the American Association of Collegiate Schools of Business, the deans all agreed that they are changing rapidly in response to new pressures.

"We are no longer training students for their first jobs, said Dean Courtney Brown of Columbia Business School, "we are trying to develop business minds with adaptability, perception and convictions."

Even Harvard, the most prestigious of all, has overhauled its whole curriculum. They will graduate the first class, taught under the new scheme, next month. They

want to be innovation-minded, and psychology-conscious by the onrush of technology.

Dean Courtney Brown of Columbia School of Business
Time Magazine, May 7, 1965.

THE UNEMPLOYMENT PROBLEM - IS IT A MYTH?

Most of us are in agreement that automation has relieved us from many of the tensions that are common when man is doing certain kinds of work.

What about the unskilled or semi-skilled or the unadaptable type who cannot adjust to changes? Where does this group fit into the picture of things? Will they join the ranks of the unemployed indefinitely? Will it encourage certain ones to join the welfare ranks, rather than try to change?

It seems to me that anyone who needs a job can get one. You may not get the one of your choice, but one is there.

The greatest threat of automation seems to be the fear of unemployment. The report from Washington, D.C. says that 3.7 millions are labeled unemployed as of March 1, 1965. U. S. News and World Report claims this to be a myth. They break it up thus - 20% of all jobless are married women and in most cases have husbands working.

Nearly one tenth are teenage girls often living at home and want part time work. One eighth are teenage

boys working part time, living at home.

Married men with families account for less than 10% of the jobless. Of these, most have been out of work less than 15 weeks, and are collecting unemployment compensation.

"Hard Core" of the unemployed men...135,000 married men with families have been out longer than six months.

U. S. NEWS AND WORLD REPORT made a check on this report and found some interesting facts.

In Chicago, an agency reported: Employers are crying for unskilled help in factories, restaurants and filling stations, paying up to $80.00 a week, but some say, "Why work for $80 when we can get $60 on the dole!

A New York job expert said, "The kids today want glamour jobs. They would rather not take routine jobs either. And those that are hired want to be executives overnight..

Older people are choosey too. The West Virginia

coal miners who received $40.00 a day refused to take any other type of work. Some economists raise this point: Minimum-wage laws put pressure on employers to hold down hiring teenagers and other unskilled workers..

(U. S. News and World Report - March 1965 P. 80)

EFFECT OF AUTOMATION ON UNIONS

In the beginning of the machine age, the Luddites went around England burning down factories in hopes of retaining their jobs. Again, at this time, we find differences of opinion regarding the effects on industry.

It is interesting to note that James R. Stern in the "Annals of American Academy" or A New Day in Unionism, says, "Automation adversely affects unions by changing the nature of work and reducing the solidarity of the work group.

Strikes become more difficult to conduct because automation facilitates continued operation by non-bargaining personnel, organizational efforts are retarded by the changes in occupational characteristics, number and location of jobs, the various sectors of economy. Union power is reduced by the erosion of the bargaining unit caused by the creation of technical jobs outside of the traditional unit. Automation enables corporations to extend the boundaries across industrial lines, while political considerations, presently prevent the union from revising their structure to match the increased corporate

power of the bargaining table.

However, solidarity may be rebuilt upon common interests or the establishment of nationally recognized training programs for the new technical operations. Declining effectiveness of thinkers may be offset by increasing effectiveness of political activity to achieve union goals. Automation operation seemed to give rise to individual problems rather than group problems. In an automated factory there is a lower population density. The worker has a lonely life and misses the opportunity for conversation with his fellow-workers. Job satisfaction must be measured against the loss of companionship and group spirit. It may also weaken the foundation on which industry was built. There is still considerable disagreement over whether automation raises skill levels.

James R. Bright "Does Automation Raise Skill Levels?" Harvard Business Review, July, August 1958.

Working conditions differ between automation and non-automation jobs, maybe air conditioning or an entire new building make a difference. As working conditions improve, it lessens the needs for union action on the plant

floor. Automation jobs are not problem free but the problems are not like the same old ones.

END OR A NEW DAY IN UNIONISM James R. Stern in Annals of American Academy Social Science, November, 1963. Ph. D. Madison, Wisconsin.

Automated society is a wealthy society that can generate sufficient output to provide the employed worker with increased living standards at a rate well within the expectation of the average union member. The issue or primary factor in disputes today is worker insecurity.

The fear of replacement by machine is decidedly a serious psychological deterrent to strike.

In the previous decade, the employed white collar worker equalled and exceded the employers of blue collar worker. In 1950, there were 21.6 million white collar workers and 24.3 million blue collar workers. By 1960, there were 28.7 million white collar workers and 26.9 million blue collar workers (Chapter 3 of the Manpower Report of the President, March 1963, Washington, D.C.)

It appears that each transition, be its results

good or bad, presents problems. Not only the young but all ages must keep themselves well-informed.

James R. Stern, Annals of American Academy of Social Science November, 1963, Ph. D. Madison, Wisconsin.

AUTOMATION FUNDS AND DISPLACED WORKERS

This is a very comprehensive study of some of the plans of the unions to eliminate some problems caused by automation. I will, therefore, sum up a few of its purposes.

1. Automatic Fund is a device established by management and labor...
2. To which money is contributed because of changes in equipment methods or plants which result in great output per man hour...
3. From which money is disbursed, for the purposes of sharing the gains of such changes with the retained employees and/or providing for like equities and needs of displaced and/or for studying the best means of accomplishing these purposes.

Some of the unions are United Workers of America Welfare and Retirement Fund, The Music Performance Trust Fund, West Coast Longshore Mechanization and Modernization Fund, the Armour Foundation Fund and others.

Thomas Kennedy - Automation Fund and Displaced Workers
Harvard University Division of Research, Graduate School of Business.

THE IMPACT OF TECHNOLOGY

President Kennedy, at a press conference on February 15, 1962, said, "The major domestic challenges of the Sixties is to maintain full employment at a time when automation is replacing men." He said, "It is a fact that we have to find in over a ten year period 25,000 new jobs every week to take care of those displaced by machines and those who are coming into the labor market."

The American Assembly took place May 3,-6, 1962, in a national meeting at Arden House, on Harriman (N.Y.) Campus of Columbia University to provide actual information as to the impact of automation on technological change. Views are by individual authors.

Automation on Technological Change

For most of human history, until recently, inventions were largely autonomous, dependent upon isolated individuals. As Professor Sumner Schlicter said, "Only such powerful drives as love of ones fellow-man or the thirst for fame or glory or an insatiable curiosity can explain the willingness to risk life or limb to make a desired discovery or to demonstrate that an invention would work. The history of medicine and aviation is full of such heroic efforts to make discoveries. Since the

chance was remote that these would-be inventors could achieve success, conserns were unwilling to put resources at the disposal of researchers, and only a few more or less fanatical spirits were willing to devote their lives to technological research.

> Economic Growth in the U. S., Its History, Problems and Prospects. Louisiana State University Press 1961 (John T. Dunlop Ed.)

But in the last few decades, there have been many industries in private business willing to furnish resources devoted to inventions. These sums have averaged over 10 billion dollars a year in two decades. This accumulation of knowledge and improvements of methods of investigation has eventually made it possible to apply the economic calculus to research and to establish the new industry of discovery. The essential point of this being that the cost, the chance of success, and the value of the results can be estimated with sufficient accuracy so that it can be decoded in a more or less intelligent fashion.

(1) How much money an enterprise may advantageously put into its research department and (2) Whether contracts

for research may be made with outside agencies with a reasonable chance that money will have been well spent.

IMPACTS OF TECHNOLOGICAL CHANGE

The effects of technological change have been a matter of controversy since the early day of the Industrial Revolution. In part, this diversity of views reflected the fact that technological change often had different effects on various groups in the community. The displaced cottage weaver and the new factory loom fixer or the independent cobbler and the shoe factory owner saw the process differently. As a matter of fact, it has varied from period to period, and the effects in a period of high employment are likely to arouse reactions different from those in periods of already severe unemployment. These are things that contribute to a different analysis of the affects of technological change and different valuations of stability or change, security or progress, and individual or social costs and benefits. Computers and transfer machines are new but many of the issues they raise are old. It is hardly necessary to waste words on the power of technology to effect society.

American Assembly, Columbia University
Automation and Technology P. 2-3
John T. Dunlop, Ed. Prentice-Hall, Inc..

The question is no longer what technology will make of man, but what man can still accomplish in the face of his technology. And it is not the potential of nuclear warfare which thus tilts the scales. At least in the Western World, where the typical landscape is industrial, where human life is sustained by the ceaseless operation of enormous technological apparatus, where mechanical contrivances have penetrated into the smallest interstices of private life, it is not mere rhetoric to ask if things are not all ready in the saddle riding Man.

The political and idealogical agonies of our age are not without parallel in the past - what gives it a modern character is above all the technological attributes of the situation to which they now apply. The conduct of peace as well as war, the most routine flow of economic process, at every instance must cope with the magnifying presence of a gigantic and dynamic "Technological foundation for contemporary life. Remember we are only entering upon the age of technological predominance. Science is only emerging from its infancy. It has been said that of all the scientists of whom civilization has any knowlege, 90% of them are living today. Industrial technology is new, - half of all the research and development in the

history of the U.S. have been made in 10 years. Hence, the curve of the technological revolution continues to rise nearly vertically beneath our feet."

Robert L. Heilbroner - Impact of Technology - Automation and Technological Change - American Assembly Pages 7-9, He wrote The Making of Economic Society.

What will be the ultimate impact of change in shape of our environment? To what extent will technology reorder society as it reorders nature. There are many and will be many more widely spread impacts to face. Adam Smith in his "Wealth of Nations" sets the stage for an integration of technological and economic growth. "What," Smith asks, "is the fundamental principle which underlies the disparities among the wealth of nations?" His answer, "It is the division of labor," as a consequence of which some nations achieve "the great multiplication of the productions of all the different arts," which occasions, in a well governed society, that universal opulence which extends to the lowest ranks of the people." But what in turn determines the degree to which labor can be divided and specialized? The growing extent of the market makes possible the introduction of labor specializing technology and this technology, by attracting labor in turn helps the

market to grow - and to give yet another impetus to this reciprocal mechanism, "as the operations of each workman are gradually reduced to a greater degree of simplicity, a variety of new machines come to be invented for facilitating and abridging these operations." Thus technological advance is not only conceived as a basic source of economic progress, but one which is continually refreshed and replenished by the consequences of progress itself. On the momentum of this scientific floodtide we have ridden down to the present day. The doubts concerning the adequacy of technological opportunities have been stilled. But now, curiously, we find ourselves confronting an old issue in a new guise. Now the problem is not with the volume of investment inherent in technological advance but with the volume of employment which technologically dynamic economy can offer.

THE SOCIAL ISSUE

Among the impacts of technology is the one that touches on the social effects of it. It would be best to sift two themes which have interested social observers. They are: What does the machine "do" to the man who attends it?" and -What does the progressive addition of machinery "do" to the institutions of society which contain it?

The man whose whole life is spent in performing a few simple operations, of which the effects too, are perhaps always the same, has no occasion to exert his understanding, or to exercise his invention. He naturally loses, therefore, the habit of such exertion, and generally becomes as stupid and ignorant as a human being can become. His dexterity, therefore, seems to be acquired at the expense of his intellectual and social virtues. Thus as a man is de-personalized of being anonymous as against remaining ones self, is, psychologically more disturbing than the boredom or the tension derived for mechanically paced work. However, technology can also be a force which literates men from "de-humanizing" toil-- that is, a force which opens vistas of leisure time and which brings new and challenging work demands into a life experience which was formerly brutal and coarse. It would seem that technology has operated as a large scale agent of social amelioration over the long time-scale of history. You will note that this secular ameliorative aspect of technological change as viewed by critical sociologists has very few enthusiasts. It has been suggested that workers on such machines be given a general education. It is, nonetheless, bad that he should be treated as a machine all day long. He must become an organ of society, and in the expert discharge of his con-

stricted but useful task, he will find the most meaningful bond to his fellow men. Hence the remedy is not to abandon specialization. It is to flesh it out with meaning, to give the worker the ability to see his small task as a part of a larger whole.

It is not clear as to how this integration of task and meaning is to take place. There are two critical points. The first is that the "impact" of technology cannot be considered as residing in the machine, but in the social uses of it. And the second is that industrial technology has at least a potential function in providing social solidarity.

Robert Heilbroner - Automation and Technology

Prentice- Hall, Inc. Page 17

Adam Smith in "Wealth of Nations."

Durkheim: Sociologist - American Assembly

Automation and Technology Pages 18-19

What are the changes ahead? What jobs will be here in 1975? What ones will be obsolete? Another great fear of automation is obsolescence. We are coming to a shorter work week - (already the electricians in New York are on a 35 hour week) -longer vacations over the year are predicted.

One concern is retiring men at 55 on full pension in order to train younger men to replace them. It is not too early to prepare for the changes that lie ahead.

One thing is certain. All professions and occupations will be rocked by one great factor - change. It will be more drastic than ever in history. This is a view shared by authorities on business, industry and education and government interviewed in a survey by Joseph P. Blank for TRUE MAGAZINE, June, 1965.

To have a job, the right job in 1975 - now is the time to think about it. If you are a liberal arts major in college, unliberalize yourself and concentrate on a specialty. If you are a thirty-two year old accountant in a department store, look behind you - that shadow is a job-stealing machine. Look two floors up to the executive offices. They are the best for you. If you're a

forty-five year old inspector in a plant, see if you can take a course in operation of a computer.

Automated machines are eliminating many jobs each week. The impact of these devices is profound, says Dr. Grant Venn, in his book, "Man, Education, and Work."

Automatic elevators in New York have recently displaced 40,000 elevator operators in New York City alone. Ponderous mechanical cotton pickers have, in the last four years, reduced farm jobs in lush Tular County in California from 25,000 to 17,000. Thirty thousand packing-house workers have been automated out of their jobs in the past few years. Enormous machines have helped to reduce employment in coal fields from 415,000 in 1950 to 136,000 in 1962.

The blue collared semi-skilled worker and office workers including the lower executive class are effected. Where we go in this depends upon our skills. According to Professor Charles Killingworth of Michigan State University, "The fundamental effects of automation on the labor market is to twist the pattern of demand - that is, it pushes down the demand for workers with little training while pushing up the demand for workers with large amounts of training. U. S. Department of Labor, in its Office, Manpower, Auto-

mation and Training, has made this projection: "The fast-- est growing occupations during the next decade will be the professional and technical positions - especially engineers, scientists and technicians - and among the white collar clerical and sales occupations."

The next best prospects, predicts the office, are wages and salary employment in service industries (mainly trade, science, finance, state and local government) which may increase 30% during the next decade. The "service" jobs, of course, include policemen, in local government, barbers, advertising copywriters and home appliance repair- men in private industry.

That's a broad picture. Top Dog in all business and industries is the executive, the man who can handle men as well as business problems. There is a scarcity of execu- tive talent now. And the shortage will increase as we approach 1975. Executive recruiter E. A. Butler said, "There are not enough quality executives to go around. Business and industry have tried to make up for the short- age by resorting to committees, and too many committees are top heavy with committees. Therefore, business is a gamble, not a science. Committees want to turn respon- sibility for a gamble over to a talented man who can think

independently, make a clear decision, act, and understand the implications of his action. Such men are in demand and can practically name their own salaries." An education no longer ends with a graduate degree. To improve the skills, a top executive of many companies such as I.B.M., U. S. Steel, Texas Tidewater Oil and B. F. Boodrich are sending men to M.I.T. for ten week Programs for Senior Executives at approximately three thousand dollars per man.

The "back to school movement" will involve more and more career-minded men in the years ahead, especially engineers who, aside from teachers, are the largest professional group in the nation. We employ about 950,000 engineers and the need before 1975 will be 400,000 more. A most interesting fact is to find that because you are an engineer, you necessarily do not have it made.

New knowledge and new problems are accumulated at fantastic speed. The threat, and an awesome one it is, is obsolescence and no other field is suffering so intensely from it. Obsolescence in engineering simply means the death of the usefulness of certain knowledge. A. C.. Monteith, Vice President of Westinghouse Electric, estimates that half the knowledge of today's engineers will be obsolete in ten years, and turning the coin, half of what

he will need to know in ten years is not available to him today.

Ironically, this cause of Obsolescence is success. Each time engineers solve a problem, they put themselves out of a job. Then they have to master a new or related specialty.

The only answer to obsolescence according to Dean Gordon S. Brown of M.I.T. is re-education. Industry and government will have to send their best technical people back to college periodically for advanced training.

The problem of obsolescence is not going to touch the scientists too much. Both government and private authorities agree that these specialists are going to ride a boom in status, income and demand. There will be a crying need for many more mathematicians, physicists and astronomers than can be turned out by the universities. Moreover, our ever growing drive to get the answer to, "What is Life?" will open new careers to biologists, biophysicists and biochemists. Arnold Grobman, director of the Biological Sciences Curriculum Study, a national group, revanping the teaching of these subjects, antici-

pates increased opportunities in biological research, including investigations in pressing medical and agricultural problems as well as fundamental questions of a more basic nature.

The decade ahead holds good promise for chemists. People in business see a rosy future. If you are in college or on the way to it, consider the opportunities. More chemical engineers will be needed to design and maintain plants in the highly automated chemical and petroleum industries. Expanded research will require more chemists in plastics, drugs, paints, agriculture and medicine as well as missiles in spacecraft, atomic energy, pulp and paper, electronics and oceanography.

Physicians and dentists will thrive. Shortages in these fields will grow more acute because of the shortage of medical and dental schools. New drugs, new techniques, and more extensive use of medical assistants will enable doctors to heal more patients. By 1975, we will probably refer to "my doctor, the computer" because it will be able to diagnose and recommend courses of treatment.

"Accounting was found a poor cousin among professions after World War II, but has since come up and looks

good. Income in this field has jumped 35% in the last five years. The senior partners of the 'Big Eight' accounting firms in New York City earn over $70,000 a year. If they are good, they have a great chance of success. Accountants have been made Presidents of Ford Motor, Chrysler, General Motor, General Electric, T.W.A. and I.B.M.

Let us consider banking. They will save money by the use of computers. The Chase Manhattan in New York City knocked 1000 jobs out in one year with machines. If you combire banking skill with knowing how to meet people, you will be in.

The insurance office jobs will be gobbled up by computers. But insurance companies need salesmen, actuaries, attorneys and investment experts.

As more people earn more money and work fewer hours, opportunities will blossom in "culture" business. Not only will we need more teachers in all the arts, but we will need more art business men too. McNeil Lowry of the Ford Foundation states, "The Foundation believes that the shortage of competent administrators is inhibiting the development of artistic groups." All levels of culture, from musical organizations to museums are avidly searching

for skilled administrators. Good careers in 1975 are available in practically every field of activity and it is not difficult to make sure you choose one that suits you. With more leisure time the market is open for hotel managers, travel agencies, chefs, athletic directors, sport instructors. If you have the personality, go into business for yourself. In whatever you decide to do, face the reality that the future belongs to the "knowledge" people, those who have developed skills through education, training and experience. The fact that you have a job is no guarantee that the job will exist in five or ten years. Our fast changing economy is eliminating job security. The unions will try to protect their working members but they cannot prolong and perpetuate unneeded jobs. Secretary of Labor, Willard Wirtz, says, "A job no longer is something most people can reasonably expect to have or to perform the rest of their lives. In this era of accelerated change, a man's job is also the uncertain product of an unpredictable but almost certain change."

There is only one answer to a better job. Move up to it. The Manpower Report of the President said,"The direction of employment demand is clearly for workers with more education and greater skill. The great obstacles are apathy and ignorance of coming changes.

One corporation official said, "We offered three thousand people slated for unemployment with us, night courses for retraining or to lead to better jobs - only about twenty men responded. Many of the big companies are already doing what they can to retrain their workers. As one executive said, "Stay on the escalator moving up to new jobs. You will find you have passed many who stepped off."

A Survey Conducted by Joseph P. Blank
for TRU MAGAZINE, June, 1965

IS LEISURE TIME A PROBLEM?

Leisure time is a side effect of automation, which has its own problem to be solved.

As Ralph Lazarus says, "Let us suppose, as many well-informed people believe, that the most important product of what is now being called the Second Industrial Revolution will turn out to be time - oceans of it. You may call it leisure time, idle time, unwanted time, depending on your personal outlook on life. In any case, it is a commodity we in this country are not presently prepared to consume in the bounteous quantities in which it is going to be presented to us by the new factory and office systems being dreamed up in our automatic laboratories.

We do not know, of course, how the increase in free time will be divided up among our occupations. The presumption is, that labor will be the first to receive free time, and that it will then move upward and sideways in an unpredictable and erratic way. We do not know either in what kind of packages we will decide to wrap the time. We may continue to use the old devices of a shorter work day and workweeks, more and longer holidays and vacations, later school years and earlier retirement. But none of these, for one reason or another, seems adequate to bail us

out of the ocean of free time with which we will be inundated.

Therefore, we must use our imagination to devise new approaches to taking time off from regular jobs. The one that seems to open the most attractive horizons is the sabbatical year program established in America by Harvard University of eighty years ago, to give professors a year off for study, rest, and renewal. If we adopted that plan for the rest of the population, what would most of us do with it? Would we loaf, play or indulge our passing fancies? Few of us would make a success of "hedonism". Many things would make it hard for us, mostly ourselves. Much of the meaning of modern life has been built around work, and we seem to fear emptiness in our lives more than we do sudden annihilation.

So we will start to hunt, not just for occupations to fill time but for commitments that will bring deeper rewards. All around us are mountains of unfinished business. For example, how much time and energy would it take to beautify our central cities? To abolish our slums? Hartford Connecticut is doing a tremendous job in renovating a slum area. A committee of about 2,400 volunteers are

working on cultural programs for all.

The speed of change and the complexity of knowledge will require us to extend formal education throughout our lives in order to keep up with the demands of new and old occupations. There is also need to reorient education in earlier years so that its emphasis will be broadened to preparation for living rather than concentrating mainly on preparation for earning a living. This is a profound change that will take at least a few decades to achieve.

Now is the time to plan for the leisure hours. Maybe this may be what we need most - the planning to do things with our families, try to enjoy being with them - travel together, help to make our children culturally conscious, and follow President and Mrs. Johnson's urge to beautify our beautiful America.

National Education Association Journal 5/65
Guest Editor, Ralph Lazarus, President, Federated Department Stores, Inc. Cincinnati, Ohio.

PLAN YOUR LEISURE TIME

Wise and careful use of leisure can be both healthy and relaxing.

When did we first hear that "All work and no play makes Jack a dull boy?"

Setting aside time for recreation is becoming increasingly important in leading a healthful and productive life.

For most people, the natural result of modern conveniences and increased automation is a sedentary existence. The National Recreation Association annually sponsors National Recreation Month each June to alert America to the need for wise use of leisure time. Special events of interest to all age groups are planned by recreational departments, civic groups, citizens organizations and other recreation minded agencies across the country.

Modern society has become what someone has called "flip flopped." The executive now works long hours instead of the laborer. Yet like everyone else, physicians, executives and other professional people need the refreshment

that enjoyable recreation offers. Leisure time can be used to regain a healthy balance of suitable physical activity and relaxation, whether through a trip to the opera or an hour or two of quiet fishing. The ability to "lose oneself" in recreation provides personal fulfillment and relief from life's tensions.

Recreation is personal, to be satisfying, the hobbies and other activities chosen should be meaningful to the individual. What may be enjoyable to one person may be boring to another. Fortunately, a wide variety of opportunities is available, and every person should be able to find some that bring satisfaction. Interesting family activities, another important but often missing part of modern life, can evolve from personal recreation interests. Whatever a person may choose as hobbies, some physical recreation should be included daily. The health benefits from suitable physical activity, such as weight control, relief from stress and a sense of well-being, are now well established. On the other hand, the potential ill-effects of prolonged inactivity, such as obesity, loss of movement capacity, cannot be considered helpful for enjoyable living.

The broad benefits attributed to recreation are not automatic outcomes. Every activity carries some risk

whether from the nature of the activity itself or from the demands upon the participant.

Our national survey shows 1,600 disabling golf injuries in 1962. Most of these were sustained by persons struck by golf balls. However, heat prostration accounted for 10%, over-exertion another 7%. Golfers should respect the safeguards that judgment and conditioning will offer.

To capitalize on recreational opportunities:

1. Learn your capabilities and liabilities through periodic medical exams and plan your activities accordingly.
2. Practice habits of healthful living faithfully, in order to have the ability to do effectively the things you want to do.
3. Understand the risks involved in your activities of choice and the preventive methods to be followed.

[Daily News, Springfield, Massachusetts
May 24, 1965
Leisure Time Can Be Both Healthful and Relaxing.]

WHAT DO THE EXPERTS SAY ABOUT EFFECTS OF AUTOMATION?

What do the experts say about automation's effect? Automation will make more jobs. U. S. Economic strength depends on raising our rate of innovation. American business men find themselves competing more and more with foreign industry.

Other nations are challenging United States superiority in this vital area.

Versatility and flexibility are the keys to technological growth. You can plan a development but you cannot plan a discovery. Dr. O. M. Baker, Vice President for Research in Bell Laboratories: "The Telstar satellite was based entirely on what we already knew, as was the Mercury Project to put a man in orbit, Dr. Baker emphasizes, but they were not based on knowledge that we planned to find or hoped to find, as are some similar military programs. You cannot plan to discover certain knowledge, no matter how much money you spend, but some of the federal people haven't learned it yet!

2. Frank K. McCune, Vice President of Foreign Services, General Electric, said that most of our high standard of living and social benefits including shorter

work weeks and high wages are due to advancing technology.

John W. Kendrick, Professor of Economics at George Washington University says, "It has generally been the industries with the fastest rates of technological advance that have increased employment more than average."

Frank McCune, Vice President of General Electric said much of the concern over technological change centers on how one of its facets - automation - effects jobs. But the job dislocation resulting from automation is only a part of the broad sweep of technological progress which creates more and better jobs.

Dr. Richard Nelson, Rand Corporation Economics, says, "People who panic over automation just have not done their homework, such as examining the studies that have been made or productivity and its effect on employment. Those who predict a crisis see only that increases in productivity-output per worker, might result in fewer and fewer people producing the same amount of goods.

This does not make even good economic sense.

(Nation"s Business - June, 1963 -Volume 51 #6)

They overlook the fact that our growing rate of productivity is much more likely to result in a higher output, by the same or a greater number of workers.

As productivity rises, costs and prices fall relative to income. Demand is sensitive to falling prices so that the total output is forced up. This increase in output generates necessity to buy it in the market place.

Dr. Nelson believes that another aspect of the debate over technological progress - the fear that it will drastically reduce demend for less skilled workers and boost demand for higher skilled workers is greatly over emphasized. Take the development of the transistor, a dramatic advance. In the early stages, the people involved in the production process were largely physicists and engineers. But as production was studied and became routine, the specialists reduced it to the point where less skilled people could be trained to do it. By focusing on the first stage of a new product process, educational demands for the workers are likely to be overstated. The growth of the chemical industry provides a good illustration. During the past ten years, the industry's investment in research and development, exclusive of government funds, went up 167%. More than 500 new chemical products were launched each year.

Employment increased 10% of average weekly wages, production workers showed a 57% boost.

Dr. Jesse Werner, President of General Aniline and Film Corporation says that technological breakthroughs have brought new business and new services. If we still made some of our products in the old-fashioned way, they would cost too much to buy. When we found process relatively highly automated we initially use fewer people. But as we produce a better quality product at a lower cost, we attract more customers and our employment goes back up. In addition, our increased production provides more jobs in the industries that package and distribute them.

The computer itself is providing jobs for a growing corps of office workers who are required to operate processing machines.

Although growth of technology has a total effect of creating more jobs, it causes dislocation within the labor force as more highly skilled people are needed."

All possible encouragements should be given to the social sciences to work out ways to minimize such problems.

Dr. Balt, Associate Director For Research of the National Science Foundation says, "Once we have established certain basic scientific knowledge, we can predict to some degree what technology will grow out of it and do a better job of anticipating the problems it will bring.

D. Simon Rame, Chief of the Board, Thompson Rame Woodridge, Inc., expresses the most striking challenge ahead. "The mass extension of the human intellect by electronics will be technology's crowning achievement. In every intellectual activity in business, profession and in education, we will see a greater intelligence focussed on every problem through new partnership of man and machine."

HAIL AUTOMATION! HAIL PEACE!

Two fears are stalking America. One is fear of automation. The other is fear of peace." They are twin fears born of foreboding over possible economic paralysis and loss of jobs. These fears are disfiguring the American future. They give opportunity the face of disaster.

Has there been ever a human society on this planet that has not dreamed of a realizable utopia? In almost every case, these utopias have had two things in common, peace and plenty. In such a favored state a man would be freed of drudgery. He would be able to develop his most powerful and valuable resources, the human brain. He would regard education as the greatest of all adventures, for one exciting search would lead to another. He would come to appreciate the difference between concept of things and the absence of unremitting and exhausting physical labor would lead not to boredom but to all sorts of useful and satisfying activity. And peace would not be a land and time of nothingness but a place and period for bringing a nation's potential to a full life. All these hopes, misty and unattainable in the past, are now a tangible prospect. Confronted by these promises of man being able to make of this planet a good earch, banishing incurable diseases, nourishing the body with vital foods, building

schools by the thousands, not only for youth but for all ages, many Americans seem to be reacting as though they had just been handed a sentence of doom. They hear the word automation and immediately spew out the number of jobs that would be lost in this or that industry. Or mention peace and immediately they think of plants being shut down and salaries shut off. Peace and automation do not have to mean the end of the world. They can mean the beginning of a better one. This kind of hysterical thinking can lead on the one hand to economic stagnation and on the other the perpetuation of arms spiral that could end in war. What is really to be feared, therefore, is not the onset of innovation but the flight of the collapse of the moral obligation. The effects of automation embrace virtually all aspects of the national economy. Some experts contend whether a decade or so of automation could take over half the tasks now performed by more than half the national work force. But this, by itself, need not produce widespread deprivation or destitution. It will not reduce production of the things people need. It can increase them. Instead of bemoaning automation, we ought to be directing our attention to the shortage of imagination and intelligence that stands in the way of the fuller life that is now clearly attainable. It is not too soon to be studying and planning how to keep the greatest pot-

ential asset in the nation's history from disintegrating into a liability. It may mean that such study will indicate a three or even two day work week for many Americans will be a practical and desirable development. What happens when people have maximum freedom? We must look to education, to our individual and national purposes, and to the preciousness we attach to human life and the possibilities inside it waiting to be released.

I think this is an excellent article by Mr. Cousins. He has covered all the worthwhile things that any right-thinking American would desire for himself, his family and his country. I say, All Hail, Mr. Cousins!

Norman Cousins, Editor of Saturday Review
January 18, 1964

GALLOPING AUTOMATION

Walter Wingo has a report in Science News Letter, November 16, 1964, page 310. He calls the electronic computer the workhorse of the technological and scientific age which seems to have limitless fields in which to roam.

Fifteen years ago, computer makers were in the same position as F. B. Morse, who, upon inventing the telegraph sent out the message "What hath God wrought." Not knowing exactly what they had, computer men talked more confidently about the physical qualities of the big new toy and their uncanny ability to retain information, the amazing number of computations in each second, their electronic pulse rate. Today, archeologists are using computers in attempts to reconstruct ancient civilization, biochemists use them to determine the structure of protein molecules; aeronautical engineers use them to test-fly experimental airplanes that need never to be built. A Stanford California University Professor, studying how people learn, taught a computer to hold an upright broom held in the palm of a mechanical hand.

Many computers have the capacity to store within their memory cores the contents of all the books in the library of Congress. Just picture reference libraries of

the future that may have no books. The information-seeker can drop a card containing a question and out will come the answer. Such a library would be called a "total system".

The Labor Department uses Robots to answer questions of newsmen regarding releases.

BELL TELEPHONE SYSTEM - BIGGEST USER

TOPICS -New England Telephone - Vomume 58 #6 May and June

Our world is growing up to computers, up to machine language. So says Bell Telephone System. Data transmission is so rapid that the Bell System forecasters expect that data communications in the near future may equal voice communications.

Today, business facts and figures are no longer an arm's length away. And no matter how fast they are processed, they may be out of date "by the time they have been received at the home office. It helps business to respond quickly - to change,to growth, to new operations."

Albert C. Palmer, after attending a seminar at Cooperstown, N.Y. said, "I felt that the curtains of the future had been opened and that I had previewed some of the tremendous changes the computer age will effect on our business and our lives.

Properly applied, they should provide management unprecedented means of assembling the vast information required in running a sound business. The days ahead promise much that is stimulating and challenging as we

harness and control the vast potential of the computer age."

Interesting Sidelights From the Bell System

Page 50 TOPICS

Fifty years ago when the first transcontinental route was placed in service, it took 23 minutes to complete a call between San Francisco and New York. Today, it takes 43 seconds. In 1915, a call between San Francisco and New York cost $20.70 for 3 minutes. The average was three calls a day. Now it is 30,000 calls a day, cost @$2.25 in the daytime and $1.00 after 9 P.M.

Computer Music Research TOPICS Page 50

Music IV developed by Dr. M. V. Mathews, Director of Research Laboratory of Bell Laboratories, is currently playing a major role in musical research at Princeton University in New Jersey.

With the help of Music IV, researchers are able to produce musical tones not readily obtainable with conventional musical instruments. Music IV computer program allows users to write on an I.B.M. punch card musical notes which they want the computer to play through loud speakers. With the assistance of Dr. Mathews, program researchers

hope to learn more about the patterns or rhythms and timbre which are of great interest to contemporary composers. This project was initiated one year ago and is presently continuing under a Rockefeller Foundation grant.

Page 20 Picturephone Service

The Bell System is now operating in Chicago, New York and Washington. A customer can call 3 minutes for $27.00. Customers make Picturephone appointments by calling the center. They make all arrangements with the person to be called. When the customer arrives at the Picturephone Center at the booth, an attendant helps him place his call. Touch Tone dialing speeds his connection and a built-in speakerphone provides hands free talking and viewing. The customer sees as well as hears the party he calls.

Volume 58 #6 Page 15 TOPICS

Theodore L. Simis, Assistant Vice President of A.T. and T's Marketing Department, at a seminar of executives to discuss the exploration of a phenomenon said that of all inventions that may have the most profound effect in human destiny, computers have been steadily extending man's brain power to unbelievable capacities by ingesting and processing knowledge with fantastic accuracy and speed.

Computers are accomplishing tasks that would take the human mechanisms centuries to do.

He explains the whys of it in this way. "Perhaps no other industry or institution in the United States has been or will be as deeply affected by the computer revolution than the Bell Systems. One reason is the increasing use of computer and information systems by our customers and their needs for moving data over our network. Another is the growth and change taking place in our own business. To continue to progress, we must keep up with the times.

THE EXCITING ERA AHEAD!

It is at this time impossible to estimate the number of changes in our way of life and living by the year 2000. Since this is the age of the computer, I will repeat the prediction by Vice President Albert J. Gracia of the Goodyear Tire and Rubber Company in Columbus, Ohio.

The electronic computer will be as much a part of the American middle class home in the year 2000 as the kitchen sink is today. The "control" center will keep budgets, plan menus, and appointments, help the family to arrive at a policy decision, also help Junior with his High School homework. The thirty five years between now and 2000 are going to be momentous ones. He suggested that durable and fashionable clothing will be made of paper with inexpensive adhesive seams. Great progress will be made in the field of medicine, and materials which will be able to reproduce themselves may be developed.

(Columbus, Ohio) United Press 6/65. Mr. Gracia told 200 High School Seniors: "You have a more exciting period of advance ahead of you than man has yet ever experienced."

Exploring the Pace and Potential of the Future is

an exciting concept. Dr. Isaac Asimor, Associate Professor of biochemistry at Boston Iniversity School of Medicine, who claims he has no private "spy glass" to the future; However, he has made some lively and preceptive glimpses in the "World of 1990" for the Diners Club Magazine, 1965.

"There are now 3 billion people on this planet. What will the situation be in 1990, assuming that we avoid a thermo nuclear war? It undoubtedly will increase 60% more.

An obvious consequence is an appreciation of the necessity of conserving the planet"s resources - not out of idealism, but out of sheer self-love. Air is inexhaustible, but to be useful, it must be clean. That presents the problem of polluted air.

Water, too, is inexhaustible, but fresh water is not. Already, we have felt the squeeze for the need of fresh water. It seems that by 2000, some invention will be discovered to desalinize the ocean. That will be expensive. The fight against water polution will become strenuous.

The greatist problem for the average man will be

the pressures on soil and living space. This is no easy solution. People cannot all be crowded into the cities - plainly the direction must be down, not up. People might have to become adapted to the advantages or disadvantages it would present. Underground temperature changes are minor so there would be less problem of cooling in summer and heating in winter.

The north eastern seaboard of the United States will be in effect one large city of 40 million.

Transportation will be a difficult solution.

Subway trains will become increasingly automated.

Between cities, the decline of the railroad will have produced trucks and buses of unprecedented size and sorts. Use of helicopters will increase - there will be a ground vehicle that will come into its own. It will run on jets of compressed air rather than on wheels, will not require highways but will be able to move along dirt roads with ease.

The push is toward an extreme of mechanization and automation. This will affect the housewife from shopping

through final consumption. We are so gadget conscious. Supermarkets will have coded lists to be checked off. In minutes, the housewife will collect her items. More and more will the use of muscle or routine use of the brain vanish due to use of computers. Education will feature mathematics and science more and more. Such items as binary arithmetic and computer languages will be taught from the earliest grades. Personalized education and the detailed teacher - student contact - will tend to restrict itself to two classes of children - the retarded and the very bright.

The changes that will be taking place between now and 1990 will convince people that "trends cannot be allowed to continue blindly, but must be deliberately channeled."

All of this makes one pause and dwell on thoughts of tomorrow - two words seem to hum like the wheels of a train - change - speed - change - speed.

DO WE STILL HAVE PROBLEMS?

We have summed up some of our accomplishments due in great measure to automation.

It has been a changing world and although change has been constant since time began, never has it made the pace that it has set for us, at this period.

Much of the brutality that was taken for granted in doing a day's work to provide a living for one's family has been removed.

Did we ever dream, in the early 1900's that a poor man would own his own car? Or that he might have leisure time to enjoy it with his family!

Automation's impact is all about us. It is true many of us were apprehensive concerning unemployment but the high rate of production seemed to offset that problem to a great degree.

Yes, we have problems, but they are ever present everywhere. We, in the United States, are fortunate not to have the wide-spread starvation and disease and such, that are so prevalent in other countries.

What, in essence, are the problems we face after a century or so of scientific and technological development. Let us name a few.

1. The avoidance of war.
2. The maintenance of a free society.
3. The spreadings of the benefits of these technological advances to all people: to all classes in this country, eventually to the people of all nations.
4. The avoidance of suffering, distress, broken lives and injustice which result from the adjustment to new conditions resulting from technical advance -- e.g., unemployment, class and race discrimination, local disruption and caused by changing industrial or agricultural patterns.
5. The regulation in the public interest of evils which result from the selfishness of those who manage the large and powerful agencies which modern society finds necessary - big business, big labor unions, and big government.
6. The creation of an education system which will enable people everywhere to understand the changing world in which they live and better adapt themselves to it - and thus lead happier, more meaningful and more fruitful lives.

There are many more problems related to technical advance: to reduce the inequities and dangers resulting from past developments; and to open the way to future advances. It is this positive endeavor that needs further emphasis. For when it is successful, it will often reduce the nagative problems and also bring about new human benefits.

Lee A. DuBridge, President of The California Institute of Technology, and a Director of Radar Research at M.I.T. The American Assembly, Columbia University, Prentice-Hall, Englewood Cliffs, New Jersey "Automation and Technological Change." Pages 33 - 34.

HOW CAN WE PLAN FOR THE FUTURE

Since the world needs to grow up to a technological measuring-stick, it behooves the individual who wants to survive to plan his place in the sun, if that is what he wants, and do it very soon.

High on the list of preparation for all of us to my way of thinking, is learning to accept and to become adapted to change. There is no longer what we smugly described as "job security". Therefore, if your job comes under the obsolete category, it means change for you and many more.

The people who are now employed have this problem. If they are willing to make the adjustment, their employers will make every effort to retrain them.

It would appear that our whole educational system needs to expand much faster than it is. I know it costs money and a lot of it. However, in an era heavily dependent for future advance in human welfare on scientific and engineering research, we need great numbers of highly talented and thoroughly educated men and women.

We should start in our primary and secondary

schools to lay the groundwork for the future ahead. This is where high talent in every field needs to be discovered, encouraged, and challenged. This too, is where all types and levels of abilities and interests should be recognized and guided. For one research engineer may be needed to develop a new automation device for industry; but a dozen competent technicians must be available to keep it working.

Improve attention to individual aptitudes and talents, guiding the academically gifted to college preparation, the manually or technically gifted to technical high schools, or institutes, greatly expand the technical institutes or technical training in high school or junior college to provide broad education for technicians, mechanics, and other highly skilled trades, with emphasis on versatility of skills.

Expand training courses in industry to develop suitable skills for the modern industrial worker, and retain opportunities for displaced workers.

Eliminate racial and other discrimination in all the educational systems.

Expand the graduate and professional schools to

meet the needs for scientists, engineers, doctors, psychologists, social scientists, teachers, and other professional personnel.

These changes will, as I have said, cost money. It may be that new methods of financing education will have to be evolved. But the economic and social benefits to be attained are enormous--well worth the added cost. Man is still the master of the machine. A better educated man can be a better master.

Scientific and technological knowledge and it's applications, new security, new comforts, new dignity within the reach of human beings. They have brought in sight the day of elimination of most kinds of unskilled hand labor--and have thus elevated the status and the dignity of the workingman - if he is suitably educated to perform more skilled and more interesting tasks. They have also increased the need for and social importance of the highly talented and the well educated - the teachers, scientists, engineers, doctors, lawyers and industrial managers. Our educational system and our social political institution and practices face great challenge in helping us - and all the world - meet these new opportunities.

Dr. Lee A. DuBridge, President, California Institute of Technology and Director of Radar Research at M.I.T. American Assembly, Columbia University, Prentice-Hall, "Automation and Technological Change."

AUTOMATION - A FAST CHANGING WORLD

Automation is an off-shoot or a continuation of the machine age. Once civilization became accustomed to less arduous ways of doing work, it was a natural sequence to invent more innovations. The more the better.

Silas Bent, in his account called "Machine - Genie or Juggernaut" in 1930, says, "Never a child with growing pains was more self-conscious or more uncomfortable than this United States as it approached the full stature of its industrial dynasty. On every side, we hear the plaint: the man is a Frankenstein and he has created a monster which will destroy him. Civilization is about to commit suicide. The evils of our age are dinned into our ears with the percussion of a steel riveter. We were told it was strident, materialistic and soulless. This was in the heat of the Industrial Revolution which dates back to Arkwright and his spinning machine in 1764 and Watt and his steam engine about the same time."

But progress continued with mighty automation coming to the helm. We are, for the most part, happy at the trend. It seems apparent that we never could have made the strides in space travel without it.

Again, there are the doubters with apprehensive feelings that we are about to commit suicide, racing to outer space. Or will the dreaded thermonuclear war bring its horrors upon us? What amazing changes may come from the bottom of the seas? Or worse still, can the mighty computers take over and make us do <u>their</u> bidding?

We shall just wait and see. We have no spy glass that sees into the future. We must bear in mind that science, too, has come a long way in delineating the probable nature of the universe that surrounds us, of the physical world in which we live, of our own structure, our physical and chemical nature. It even enters into the mechanism by which the brain itself operates. Then it comes to the question of consciousness and free will - and there it stops. No longer can science prove or bear evidence. Those who base their personal philosophies on their religion upon science are left, beyond that point without support. They end where they began except that the framework, the background against which they ponder is far more elaborate, far more probable, than was the evidence when the ancient shepherd guided his flock toward the setting sun, and wondered why he was there and where he was going.

Science proves nothing absolutely. On the most

vital questions, it does not even produce evidence.

FORTUNE MAGAZINE May 19, 1965 Page 172

Vannevar Bush - Science Pauses

Honorable Chairman of the Board at Massachusetts Institute of Technology

MIGHTY COMPUTER!

Automation seems to have the speed of a thoroughbred race horse. Over night new innovations appear.

At the recent Computer Conference in San Francisco Civic Auditorium, businessmen tried their hand at playing blackjack with a computer, but they inevitably lost, for the machine has not only broken the bank at Las Vegas in a test, but also outwitted comptrollers and architects in performing such practically profitable jobs as laying out real estate sub-divisions. Dozens of other whirring and flashing machines demonstrated how they simulate Gemini space flights, balance million-dollar corporate ledgers in a split second, or tap out frighteningly human messages - "Oh, that tickles"--in response to a tap on the keyboard. Programmers claim they can do any job that can be defined.

United States industry is eagerly putting them to the test. An electronic computer runs crewless auxillary locomotives on long Louisville - Nashville freight trains. The New York Stock Exchange is installing a computer system that can answer brokers questions, keep track of floor transactions at each trading post and feed quotations to the ticker at the rate of 16 million shares a day. Long Island's Maxson Electronics Company plans next month to

link 5000 hotels, travel bureaus and car-rental outlets in a computerized reservation network.

This year government and business will spend a record two billion dollars for electronic data-processing machines ranging from $90,000 small ones to $5,500,000 machines capable of 2,500,000 calculations a second. So broad is the variety of computer users that there are more than a thousand programming "languages."

I could go on and recount many more new uses for the computers. At the San Francisco meeting, General Motors demonstrated how one of it's computers, built by I. B.M. helps engineers create automotive design. An engineer feeds instructions and preliminary drawings to the machine which then produces a line drawing of a car or its components on a TV - like console. The machine can also "read" and store up lines from engineerings, communicate back and forth with the operator, and turn out permanent drawings.

Though some managers have lost their jobs to computers, higher echelon men will not be replaced but will simply be oriented to accommodate the machine. At companies such as Lockheed and Westinghouse, young executives are trained in computerized management in night school courses

that are a cross between the Pentagon's war games and Monopoly. In the growing dialogue between man and machine, the man who controls the computer has a huge amount of influence in the company.

TIME MAGAZINE November 6, 1964

WHO HAS THE ANSWERS?

After going far afield to trace the results of automation and finding the pace growing faster, it seems logical to pause to ask again, "Where is it going from here? Is it friend or foe?"

It is hard to predict where it will eventually go but after the success of our brave astronauts plus the experiments with Telstar, Comsat and Early Bird, it is safe to say that we are going"up and at 'em", maybe we will reach the noon soon.

Who can tell what might happen on one of those trips? So little is known about that outpost far out there. In readers' Digest, May, 1964, is an article on the newly discovered quasi-stellar radio sources. They are as massive as one million suns, one hundred times brighter than our entire galaxy--what produces them is an enigma. One is perhaps ten billion light years away. Not having a scientific mind would it be idiotic to assume that some disturbance "out there" could have an appalling effect on our world? I hope not.

Automation has proved a friend in many ways--relinquishing to a great degree, the brutality of labor,

work for all, a time for leisure - a goal that all might try to attain. Is there a fly in the ointment? Possibly. What would happen if the machine took over the work of the brain? Are we then going to be dullards? Or what if the "master" of the machine is power happy? Are we sure the machine can be controlled?

Could this be an instrument that might launch a thermo-nuclear war? Those push buttons are so easy to use- Herman Kahn, who is physicist and mathematician, Director of Hudson Institute, specializing in long-range policy research on national security was asked,"Will there be a nuclear war in ten years where the United States might lose one hundred and fifty million lives?" He answered, "Chances are relatively small. There are currently no active areas of contention between Russia and the United States that are worth going to war over. There are few nations anywhere that are pushing very hard.

There are only two big nations which have real unsolved problems. Germany has one of unification; China has a compulsion to show that it is a great power.

The Germans are cautious in part, because they have no real power now. The Chinese, like the Russians, tend

to be cautious people almost any time. They are not romantic about war, in the feudal tradition of romance.

Therefore, without trying to be too complacent, let us go along with an optimistic viewpoint and hope all is well with the world."

It is a comforting thought to dwell on this prediction and to add the hope that it will come true.

Herman Kahn, Author of a new book, "Escalation: Metaphors and Scenarios.

Director Hudson Institute

Readers' Digest, May, 1964.

CONCLUSION

As I predicted, in the beginning, I could go on ad infinitum and still tell of the wonders that automation has brought to us.

I began by asking a question, then many questions. Some are answered, some predicted but some, no one can answer, only the future knows--like the song "Que Sera?"

I did not follow any sequential plan or set out to prove anything. Perhaps I did want to match the "for Automation" and "against Automation" and why. The "for" tipped the scales heavily.

It was a challenging and satisfying topic. I learned much while working on it. Automation has given us an exciting life but much more is yet to come. We have not heard the last of it!

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