# The Computer Revolution And Christian Faith

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Advances in technology have had and will continue to have a profound impact on society. The historical aspect of this statement may be verified by even the most casual survey of the consequences of the technological advances which brought about the Industrial Revolution. The steam engine, the railroads, the power loom, etc. gave society a totally new environment – a changed outlook on life. An industrialized society develops, among other things, a sense of time, a sense of material progress, and the tendency toward urbanization.

More recent technological advances, of which perhaps foremost is the electronic computer, have the capacity to change society much more rapidly and profoundly than the machines of the Industrial Revolution. This is because "they deal with the stuff of which society is made – information and its communication."[1]

What is the electronic computer, the machine which has been described by the American Federation of Information Processing Societies as a tool "whose liberating potential for mankind is greater than that of any other invention in our history"?[2] Does it "think," or is it simply an overgrown calculator?

The computer is an information-processing system.

The computer accepts information from its environment

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1. John Diebold, *Man and the Computer* (New York: Frederick A. Praeger, Inc., 1969), p. 4.
2. American Federation of Information Societies, quoted in Gloria Kirshner (ed.), "The Computer Revolution," *The Teacher's Guide to the 21st Century*, (Sept. 24, 1967), p. 1.

> through its input devices; it combines this information, according to the rules of the program stored in its memory, with information that is also stored in its memory, and it sends information back to its environment through its output devices.[3]

This is not unlike the functioning of the human brain, which also accepts inputs, processes input information with stored information, and can return the results to the environment.

Interestingly, the French Christian philosopher, mathematician, and physicist, Blaise Pascal, made the first entry in the history of the modern electronic computer when he invented a mechanical adder in the 17th century. While theoretical advances were made in the intervening years, it was not until World War II that the first digital computers were built. It has been twenty years since the beginning of commercial manufacturing of electronic computers, and in that short time the industry has risen to the position of third largest in the United States. "Industry prophets" agree that it is only a question of time until the computer industry attains first place.[4] Furthermore, after only twenty years computers are well into what is called their "third generation," and the fourth generation is actually beginning to appear.

In the 1940's computer speeds were measured in seconds. Today the nanosecond (one billionth of a second) is the common unit of reference. A nanosecond is to a second as a second is to thirty years!

The early computers were made with huge vacuum tubes. Today it is not possible to observe the details of circuity with the naked eye. Fifty thousand third-generation transistors can be placed in a thimble.[5] This trend toward miniaturization is not only for the convenience of compactness for the computer user, but also to reduce the distances electrons must travel in the circuits. After all, electrons travel at the rate of 186,000 miles per second, but that is not quite a foot per nanosecond!

Every four years the cost of computing power has been reduced by a

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3. Dennis Flanagan (ed.), *Information* (San Francisco: W. H. Freeman, 1966), p. 1.
4. Paul Armer, *The Individual: His Privacy, Self-Image, and Obsolescence,* presented to the Committee on Science and Astronautics, U. S. House of Representatives, (Jan. 28, 1970), p. 10.
5. *IBM System/360 System Summary* (New York: IBM Corporation, 1968), p. 5.

factor of ten, and this trend is continuing.[6] This has made the use of computers feasible for a large number of applications and makes more believable the predictions of a computer in every home, at least from the standpoint of cost. By the end of 1972 there will be 100,000 computer installations in the United States; there were less than 1,000 in 1956.[7]

The computer, with rare exception, does what it is told (programmed) to do. (The difficulties one may encounter with, for example, a computerized billing system are a consequence of the difficulties human beings have in determining exactly what the computer should be instructed to do.) The term "computer" is commonly meant to designate a machine which can accomplish any number of tasks, depending on the program which is selected and stored within it.

A computer can be instructed to do such things as "read" input data which has been previously recorded (e.g., a punched card, the pencil markings on a special test answer form, special characters on a bank check, a set of magnetic "marks" on a reel of tape) or which is currently being generated (e.g., radar signals, electrocardiograms); it can be told to store input information internally or externally for future reference, to perform arithmetic calculations, to perform character manipulations such as an alphabetic ordering or scanning a sentence for a particular word, and to compare items of information and use the results of the comparison to determine which set of subsequent instructions to select for further processing; it can "write" information through a variety of output devices (e.g., a printer, a card punch, a magnetic tape drive, a typewriter terminal hundreds of miles away, a cathode ray tube similar to a television screen). A particularly interesting use of computers is known as "computer graphics," which refers to the ability of the computer to accept line drawings or graphs as input as well as create the "graphics" and produce them as output.

One of the most important developments in computer technology is known as "time-sharing." Many remote terminals may be connected to a single large central computer by means of communication lines. Users at these terminals may instruct the computer, enter data, and receive responses from the computer. Because of the relatively high speed of the computer when compared with the speed of the termianl, each user feels that he

6. Armer, *op. cit.*, p. 2.
7. Diebold, *op. cit.*, p. 8.

has the complete attention of the central computer. Messages may also be sent from one terminal to another. In fact, the main function of the central computer may be to interchange these messages. Computers, therefore, are very closely related to communications; in fact, modern sophisticated communications systems are actually computers.[8]

The human being cannot compete with the computer in accuracy, speed, or capacity for the purposes of computing, correlating, and retrieving information. Consequently, tasks which could never have been accomplished in a reasonable length of time by a reasonable number of humans are being accomplished through the use of the computer. Ideally, the human being is freed from routine and time-consuming tasks which may better be performed by information-processing machines to concentrate his efforts at more creative tasks and those which require intuition and judgement. "The uniqueness and promise of information processing is that it is a tool for increasing his understanding and control of the physical and psychological factors that have the greatest effect upon his existence."[9]

Current applications of computers include the checking of income tax returns, chemical analysis of smog, the space program (which could hardly exist without computers), control of city traffic lights, and airline and hotel reservation systems. A computer may be used for writing concordances, text editing, and text analysis. The Dead Sea Scrolls were catalogued in proper sequence with the aid of a computer. Computers have analyzed, composed, and produced music. In the field of medicine, computers are monitoring patient data in intensive care facilities and aiding doctors with diagnoses. The computer can be used to simulate a proposed new system for industry or business, or it can simulate a biological or chemical process.

There is much improvement to be made in educational uses of computers, particularly in the elementary and secondary schools. They have already proved themselves very useful and even superior to human teachers where drill and repetition are required. What is lacking is sufficient understanding of the teaching-learning process and adequate sophistication in the programming of computers so that creativity on the part of

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8. Armer, *op. cit.*, p. 1.
9. Isaac Auerbach, "The Impact of Information Processing on Society," Automation Series, *The Voice of America Forum Lectures.*

the student may be cultivated. Current programs seldom permit the student to be other than passive. Patrick Suppes predicts that "in a few more years millions of school children will have access to what Philip of Macedon's son Alexander enjoyed as a royal prerogative: the personal services of a tutor as well-informed and responsive as Aristotle."[10]

John McCarthy, in considering future uses of computers, describes the following:

> No stretching of the demonstrated technology is required to envision computer consoles installed in every home and connected to public-utility computers through the telephone system. The console might consist of a typewriter keyboard and a television screen that can display text and pictures. Each subscriber will have his private file space in the computer that he can consult and alter at any time. Given the availability of such equipment, it is impossible to recite more than a small fraction of the uses to which enterprising consumers will put it . . . .
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> Everyone will have better access to the Library of Congress than the librarian himself now has. Any page will be immediately accessible . . . .
>
> The system will serve as each person's external memory, with his messages in and out kept nicely filed and reminders displayed at designated times.
>
> Full reports on current events, whether baseball scores, the smog index in Los Angeles, . . . will be available for the asking.
>
> Income tax returns will be automatically prepared on the basis of continuous, cumulative annual records of income, deductions, contributions, and expenses.
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> With the requisite sensors and effectors installed in the household the public-utility information system will shut the windows when it rains . . . .[11]

When one considers the powerful capabilities of the computer, he must surely be concerned that the power be used for the good of mankind. It is not difficult to recall the anti-Utopian descriptions of Orwell's

10. Flanagan, *op. cit.*, p. 157.
11. Flanagan, *op. cit.*, pp. 11-12.

1984 or Huxley's *Brave New World.* While the computer's potential for good exceeds one's imagination, misuse of the computer does indeed threaten the safety and integrity of the individual.

An immediately obvious problem is the threat of unemployment posed by automation. While job-opportunity patterns have changed and will continue to do so, there is room for argument about the total effect on unemployment caused by automation. The threat to the employment picture remains, however, and the hope is that intelligent and realistic planning and control can direct the course of the computer revolution so that an unemployment crisis can be avoided. This planning must include education and retraining with the objective of helping the individual to find a meaningful role in the world of automation.[12]

There are other problems related to unemployment. The use of leisure time is one which has been widely discussed. Alienation of workers from their work in computer-dominated plants could present increasing psychological problems, perhaps resulting in alcoholism and dope addiction.[13]

The creation of a national information file or "data bank" is a topic which may come more frequently to the public's attention. Computers make it possible to collect in one file all the medical, employment, educational, security, tax, and credit information about every citizen. Existing large files such as credit files have been abused; it requires little imagination to foresee misuses of a national information file. The privacy of the individual is obviously threatened by such misuse. However, the enforcement of appropriate legislation resulting from questions of the centralized file could be used to eliminate current misuses of existing files.

Some of the most significant and interesting questions are being asked in the area of cybernetics, which involves

> the comparative study of communication and control in the brain and nervous system of organisms and in mechanical-electrical systems. Study of the brain and nervous system has yielded insights that are valuable in the development of mechanical-electrical control systems, and, conversely, the study of such systems has yielded insights into the physiology

12. Robert MacBride, *The Automated State* (Philadelphia: Chilton Book Co., 1967), pp. 19-34.
13. Kirshner, *op. cit.*, p. 4.

> and neurology of organisms. Man was nudged from the center of the universe by Copernicus; Darwin drew man's physical nature within the natural evolutionary process; man's unique claim to rationality was greatly reduced by Freud; and now, it seems, man is nothing but a highly complex communication-control system. Indeed, man is already excelled by the machine in some of the simpler, more routine tasks. What does the future hold?[14]

Cyberneticians, it would seem, tread on sacred ground.

Norbert Wiener, the late mathematician and cybernetician, warned us of certain points in cybernetics which impinge on religion, particularly in his book, *God and Golem, Inc.*[15] The cybernetic points he cites are machines which learn, machines which reproduce themselves, and the coordination of machines and man. Wiener acknowledged the superiority of man at this stage in the art of cybernetics.

Let us here examine only the first of these three issues. The development of learning machines comes in the study of artificial intelligence. The classic example of a learning machine is that of a computer which is programmed so that it learns, or appears to learn, to play the game of checkers. The program provides a correct understanding of the rules of checkers, a method for analyzing potential moves, and a memory for recording the results of previous efforts. At first the machine is easy to beat, but after several hours of practice its game improves so that it is able to win consistently. To this example Marvin Minsky adds others, including a program for taking the section of a college-entrance examination which has to do with the recognition of analogies between geometric figures. Admitting the weaknesses in current results in the development of artificial intelligence, he concludes:

> It is reasonable, I suppose, to be unconvinced by our examples and to be skeptical about whether machines will ever be intelligent. It is unreasonable, however, to think machines could become *nearly* as intelligent as we are and then stop, or to suppose we will always be able to compete with them in

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14. Harold E. Hatt, *Cybernetics and the Image of Man* (Nashville: Abingdon Press, 1968), p. 9.
15. Norbert Wiener, *God and Golem, Inc.* (Cambridge, Mass.: The M.I.T. Press, 1964).

> wit or wisdom. Whether or not we could retain some sort of control of the machines, assuming that we would want to, the nature of our activities and aspirations would be changed utterly by the presence on earth of intellectually superior beings.[16]

Moral, ethical, social, political, theological questions are posed by current and potential uses of technological advances. The direction our society follows will be determined by those who ask and answer the questions. In addition to questions of a theological nature, such as those regarding the image of man, it must be the intelligent concern of Christianity that the appropriate questions be asked in time, and that the answers which follow be those which would result in the betterment of the human individual and his society.

Thomas J. Watson, Jr., Chairman of the Board of the IBM Corporation, made these observations at a recent conference on computers and society at Oberlin College:

> . . . the computer and other technological devices in our time, I believe, are hurrying us all towards . . . a moment of truth, which will force us to look at ourselves square in the face as never before . . . we cannot get the answers from technology or systems analysis or gimmicks or data processing . . . the computer is an instrument – not an instrument of good or evil, of uplift or destruction, of promise or doom; just an instrument, period. It has no purpose. It has no soul . . . it has always been and always must remain the motivation of the human being which determines progress or regression, not the tools he uses . . .
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> Everything hangs on the answer we give to one key question: what will this advance of technology produce, not in the world of gadgets and offices and satellites without, but in the world of heart and mind and conscience and soul within?[17]

The Christian faith holds *the* answer to Mr. Watson's question. Will this answer be effectively communicated to a society undergoing the computer revolution?

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16. Flanagan, *op. cit.*, p. 211.
17. "Computer and Society," *The IBM Magazine*, (Feb. 27, 1970), II, VIII, 8.