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Data processing machines and you: [pattern speech]

American Institute of Certified Public Accountants

NOTE: This speech is intended for delivery before college accounting students. It could be adapted for some others as well. It may be used as it is, or as a source of material to be reworked so that the user feels comfortable about it. Illustrative cases from your own experience will help to give it color, and -- as you relate them yourself -- will no doubt communicate conviction.

DATA PROCESSING MACHINES AND YOU

My subject today reminds me of a story:

A blind man stood on the curb at a busy intersection. "Could I take your arm to cross the street?" he asked someone.

"Certainly," a friendly voice replied.

There was some pulling and hauling as they crossed, and one driver shouted, "Watch the light!"

But they made it, and Friendly Voice said, "Thank you."

"What are you thanking me for?" asked the blind man.

"For helping me across the street," answered Friendly Voice. "Didn't you realize I'm blind?"

Anyone talking to anybody else about the future of data processing takes the risk of being compared to a blind man leading the blind. For who can see what data processing equipment will be doing in the year 2000, when the men in this room are well along in their accounting careers? I make no claim that I see that far ahead.

Attempts to automate the processing of data are very old. Witness for example the abacus, which is still used in the Soviet Union and in Japan. This device is believed to have originated in the Near East at least 2000 years ago. But this is hardly a machine as the term is understood today. Blaise Pascal, the French philosopher, built a machine that could add and subtract in 1642. It looks like a Swiss music box and is full of clockmaker's wheels and cogs. Burroughs built the first recognizable ancestor of the present-day adding machine in 1892.

However, we have seen a greatly stepped-up pace in the growth of data processing for some thirty years. Along with this growth, some new phrases have come into our language. "Automatic data processing" -- ADP -- means simply the automation of manual data processing. Hands plus equipment do more than one job at the same time. "Electronic data processing" -- EDP -- indicates this automation through the use of electronic equipment. In general, the significant thing about EDP is the enormous increase in speed. In the past decade, we have heard a great deal about "integrated data processing" -- IDP. By this is meant the most streamlined and automatic flow of data that is practicable inside a particular business, with recognition of the inter-relationship of all administrative activities. ADP, EDP, and IDP are not three different things. They are closely related in concept and in physical characteristics, and they are developing concurrently.

Since 1960, there appears to have been an increasing number of "on-line-real-time" installations. In this kind of system the delay in recording data and in making it available is very substantially reduced by combining data processing, decentralized input and output, and communications. Airlines have such installations for handling reservations.

Accountants have been involved in all this development, and we naturally have a number of questions in mind:

Are we now headed toward integrated data processing, perhaps with on-line-real-time systems, for all leading businesses? Or, through the use of data processing centers, for practically all businesses, large or small? If so, when will this happen? In ten years? Twenty-five? Fifty? To put many questions in a nutshell -- to what degree and how fast?

Although speculations are exciting -- and good exercise as long as we recognize them as speculations -- I shall avoid them in this talk. I shall discuss what is now happening that <u>seems</u> to have implications for your futures and mine.

But while seeing the trees we should not lose sight of the forest. The age of the computer is not just a big thing to accountants; it will bring about major changes in society. Already some thoughtful people are talking about a Second Industrial Revolution. The use of the word "Second" implies that the First Industrial Revolution, which began in the Nineteenth Century and lasted until World War II, gave us the machines that made human and animal muscles uneconomic in very many kinds

of work. John Henry, the hero of the old folk song, died when he lost a race with a steam drill. At the same moment, employment at swinging thirty-pound hammers also gave up the ghost. During the Second Industrial Revolution, which is just beginning, a lot of routine mental work, as well as more physical work, will be taken over by the machines.

College men are naturally interested in what this does to career opportunities. One recent estimate presented to a Senate labor subcommittee was that some 2 million people a year lose their jobs as a result of automation. 1/ Forty thousand a week! At the same time, some people are getting new positions and some new kinds of positions. But these are different people -- people with technical, managerial, and professional skills. You can see the effect of this in the "help wanted" sections of any metropolitan newspaper. Note the need for people in kinds of work related to data processing; note the need for accountants and auditors.

This change in the character of the work force needed in the United States was predicted by the Labor Department during the 1950's. 2/ They calculated that there would be an increase of 18% in the total work force of the United States during the 1960's. But they figured that the number of technical, managerial, and professional people would increase 40%. If professional accountancy continues to grow at the same rate as in the past, there will be about 100% more CPAs in 1970 than there were in 1960.

It seems evident that some people will ride the electronic wave of the future; others will be drowned.

Accountants will be in a good position to ride it. I would like to submit that the age of the computer has dawned because there are several sets of people who have uses for computers. If computers did not meet a need, they would be exercises in pure science, and nobody here would have heard about them.

Computers meet the needs of accountancy because they make feasible kinds of analyses that accountants have wanted to make for some time, analyses that for most businesses have been too expensive in the past. The scientific management that to many businessmen has been a catch phrase or a dream is becoming possible or even necessary.

Electronic installations often reduce accounting costs -- if we understand by this, quite properly, comparison of costs for equivalent work. As it happens, the work done is often increased when electronic installations are made. In brief, management can get either the same information for less money or more information for the same money.

As some companies acquire promptly, through using computers, the kind of sophisticated accounting data and reports that are needed for the most rational kind of management, other companies <u>should</u> do the same in order to remain competitive.

This is in general what I see for the next decade. The picture becomes even more interesting as one considers specifics.

In long historic development, accounting was first simple record keeping; second, with the development of financial statements showing results of operations for a period as one integrated whole, accounting became a method for planning, operation and control -- in short, management; and third, with the organization of limited companies and corporations, the conception of accountability and the need for independent auditing developed. Accounting today serves all three functions. Automatic and electronic data processing and the on-line-real-time system are having an impact on all three functions.

What is happening to record keeping is dramatic and visible even to the non-technical public. Here are some situations reported in newspapers and magazines:

Item: During the past year or so, on-line-real-time systems were installed in at least three banks. All functions of the banks' business were included in the system -- savings accounts, mortgages, Christmas club and school accounts, payday savings, payroll, general ledger, cost accounting, and trust operations. 3/

Item: A gas company recently acquired a computer, capable of adding 16,000 five-digit figures in a second, for processing meter readings into completed bills and making up-to-the-minute statistics available to management. This computer also handled accounting for 20,000 items -- from gas

jets to 36-inch pipeline -- which the company needed for its operation; payroll accounting for about 4,000 employees; accounting for appliances sold by the company; and preparation of dividend checks and proxy notices. 4/

Item: A number of New York brokerage houses have installed computers to handle the bulk of the paper work connected with trades. There have been dramatic reductions in the amount of manual effort. 5/

Of course, these are only random examples of what I am talking about. I'm sure you have all seen similar reports in the newspapers or magazines. But I would like to stress that for every newsworthy event like these there are hundreds or indeed thousands of daily unreported occurrences in which the impact of machines upon traditional ways of keeping records is felt.

A recent article in The Journal of Accountancy illuminates this quiet revolution. 6/ In this article an individual CPA practitioner describes his first year's experience using punched tape. The practitioner had begun his practice with a few write-up clients, all very small businesses. In order to serve them better, he found he needed either to hire a new junior or buy a $1700 machine for punching tape, which he could then send to a processing center. After carefully weighing the pros and cons, this practitioner chose the machine and a year later felt very happy about his decision. (There are implications in this regarding the work of junior accountants that I'll talk about later.) In general, this practitioner reported that

handing his client the financial statements no longer marked the end of the engagement; rather it gave him an opportunity, which he now had the time to grab, of discussing such matters as the client's profits, his operating ratios and percentages, trends, possible income tax liability, cash flow, working capital, and inventory. His write-up clients became audit and management service clients; his whole practice was upgraded. In sum, this CPA estimated that with the machine he had been able to telescope about 10 years of normal growth for an individual practitioner into one year.

There is another conclusion to be drawn from this CPA's experience: he found an economic advantage in mechanizing the summarizing process in record keeping even for very small operations -- retail stores, restaurants, and a dentist's office, for example. If one pioneer CPA finds this, other accountants will no doubt make the same discovery. In the long run, very few companies that now need only one or two bookkeepers will need one in the future. Just as laundromats now process the family wash, electronic centers may come to process the bookkeeping of small businesses.

In larger operations, more complex machines tend to take even more routine work away from people. There are desk-sized machines for about $10,000 capable of handling a variety of accounting problems automatically, but not too many problems at one time. These are used by many

medium-sized businesses for such tasks as making out billing records and inventories; and calculating taxes, customers' accounts, commissions, and current balances.

Some big businesses with decentralized operations use smaller computers, up to the $100,000 size, in some rare instances by the dozen. Making a choice between a number of small computers and one big one is sometimes difficult. With a number of small computers, offices in the field complete summaries which they send to regional or central headquarters as often as necessary. If there is no time pressure, punched tape can be mailed to headquarters, saving the cost of a data communications network. The centralized system with one big computer relies on such a network, but has the advantage of providing top management with information more rapidly. 7/

An example of a big centralized system is one that was recently installed for a power company with 720,000 customers and with 1,125,000 meters spread over 20,000 square miles. The computer takes care of billing, payroll for about 6,000 employees, cash posting, and meter order procedures. The ease with which such a system produces some kinds of results leads some people, even in management, to underestimate the long and arduous work needed for installation. This underestimation may be encouraged by machine manufacturers' sales efforts. Understandably, their advertising talks about "a mere flick of the switch" producing management reports and a variety of accounting records. "Unattended" performance is mentioned. Speed in helping manage-

ment control operations is stressed. However, in this power company, conversion to this happy state of affairs from a system handled by eleven centers using varied methods took over three years. The work was handled by a committee of men expert in the various kinds of knowledge that was needed; ultimately, they became known as the Accounting Methods and Procedures Department. This was a typical experience in making a large installation. 8/

A committee of English experts, visiting the United States in 1960 to study our data processing installations, had one serious criticism of American methods. In their opinion, in the initial study of the system to be used, there was too much concentration on the selection of equipment and not enough concentration on the design of the system itself. 9/

There may well have been mitigating circumstances regarding what the English experts felt was overconcern about the equipment. Since the equipment was a new thing, purchasers were naturally concerned whether it would work; they were worried about wide variations in the capabilities of different kinds of equipment; and the very rapidity of technological change forced close attention to kind of equipment purchased. However, the English experts were certainly correct in stating that there has been a need for more concentration on the design of the system itself.

In the situations I have mentioned, which I believe are representative of the trend, I see three kinds of changes in record keeping: there are fewer people doing routine clerical work; there is probably more centralization of clerical work; and there is probably less emphasis on the historical type of ledger and more emphasis on records showing current balances and transactions for limited periods of time. Accountants should participate in all these changes.

After these changes in record keeping have been brought about, what is the effect on management? Let's illustrate with experiences of a couple of prominent accountants now in management.

My first illustration is Gerald Lloyd Phillippe, president of General Electric. When Mr. Phillippe goes to work on the fifth working day of a month, he finds on his desk a complete financial statement for all of the company's over one hundred operating units. When he first went to work for GE in 1933 as a traveling auditor, it took almost a full month to get even a summary of financial information on the president's desk. Of course, part of the reason for the change has been electronic data processing.

My second illustration involves Lynn A. Townsend, president of Chrysler Corporation. Chrysler became one of the first companies to automate its parts inventory control procedures through a computer application. From inventory records

and through automation the company was able to get the exact figures on the average life of every part in its automobiles. This made it possible for Chrysler to announce its well-known five-year or 50,000-mile warranty, which presumably has been a useful sales tool.

CPAs in particular have been aware that data processing is making or helping to make changes in the ways management functions. Here are some of the trends that have been observed:

One: Information tends to be produced for more levels of management. With electronics the factors that are significant just to specific managers are isolated -- or "personalized", to use an increasingly common word. The lower cost of clerical analysis and reanalysis is making this possible.

Two: Accounting departments tend to become "intelligence units." By this I mean that they are responsible not only for internal information, but also for such external information as market conditions, competitor actions, economic trends, inventory prices and so on. Some of this information is obtained through statistical sampling. Electronics facilitates the systematic correlation of internal and external information.

Three: There is a visible trend toward "management by exception." Perhaps because electronic systems must be founded upon exact definitions of norms, there is a greater understanding in management of what constitutes an "exception." Thus there can be much greater efficiency in directing management's

attention to the exceptional situations that need attention.

Four: There is greater use of simulation and model building. While these techniques have been known for some time, the data to be handled is sometimes so voluminous that research in the operation is simply not feasible without a computer. For example, in making a model of a large machine shop, it was necessary to obtain mathematical formulae representing such factors as the probability of obtaining new work, the probable mix of machining time, the probabilities of breakdowns and other delays, and the time required to move parts from one machine to the next. All these factors were programed into the computer. While it would have been theoretically possible to work the problem out without a computer, doing so would be neither cheap enough nor fast enough for most managements.

Five: The financial executive, through control of the intelligence unit -- traditionally called the accounting department -- and with a computer at his disposal, is in a better position to make suggestions to operating executives. The kind of thing that may be done is dramatized by our story about Chrysler Corporation's use of a computer and analysis of inventory as basis for a sales policy. Some constructive policies in all departments of a business can flow from analysis of factors which only the financial executive with a computer is able to make. 10/

As we look at businesses today with electronic data processing, we can see that a tremendous amount of the work that leads to printed financial statements, and also processes of decision-making that conform to programed directives, are disappearing inside black boxes. This raises a further interesting question: how can stockholders know what's going on? and how about creditors and other "third parties" with a legitimate claim to information? In a word, what's happening to independent auditing? Confronted with black boxes, how does an independent auditor ascertain whether financial statements fairly present financial condition?

I think that most CPAs who audit clients with highly mechanized systems are in agreement that independent auditing will be helped. One past president of the American Institute of Certified Public Accountants has said this: with the pick and shovel work of auditing taken over by machines, auditing will become as commonplace as breathing. He believes that no bank loan will be obtainable without audit, and that virtually all companies will be registered by the SEC. 11/

Other CPAs feel that we are a long way from this happy state of affairs in auditing. And some point out that auditing will become more difficult. Certainly, the auditor of the future should know some things that the auditor of the past didn't have to know.

This is illustrated by a decision auditors have been forced to make during the past ten years: should they "leap frog" the computer -- that is, make it print out information they need so that they could audit as usual? or -- on the other hand -- should they audit "through" the computer, using the characteristics of the machine in order to save time or even to get more information than usual?

There is no doubt a growing body of opinion that auditors should not "leap frog" the computer. In other words, it is not enough for an auditor to know what goes into a computer, assume that what goes on inside the box is reliable, and then accept what comes out as grist for his audit. Actually, what goes on inside the box usually contains provision for quite a number of choices within the wires and diodes. In addition to auditing the output, an auditor must understand these possibilities for choice inside the box.

What an auditor now does with computers suggests that there will be a fascinating future for men in this work, either as internal auditors or as independent CPAs in public practice. Ordinarily, the auditor tests the computer's performance with what is called a "test deck" of cards. These are cards designed by the auditor to describe theoretical situations. Fed into the computer, they challenge it to perform perfectly under every conceivable set of circumstances. With "test decks" an independent CPA may audit through the computer and give his unqualified

opinion that financial statements prepared with the help of the computer fairly present a company's financial condition. Obviously, such a CPA must master the computer's potential, at least as it applies to the financial statements of a particular company.

The auditor of the future should understand enough about programing, machine checks and built-in checks of the program, flow charts and block diagrams so that he can identify program checks, translate what he wants to know into computer language, and design test decks. If he doesn't know these things, he will have to work with a computer expert. Once he has this understanding himself, the auditor of the future will have at his command the equivalent of a whole army of clerks.

The advantages of auditing through a computer are not limited to easy mathematical computation. Just as management uses a computer to manage "by exception", so auditors may audit "by exception." For example, customer's accounts that are outstanding either in terms of too many days or too many dollars may be singled out by computer; or inventory quantities in excess of what is needed for a specified time may be listed.

Of course, auditing will continue to review what people do, just as it has always done. Control of machine usage, and the ability of console operators to "walk through" a particular computation are important audit considerations.

This concludes my very brief survey of what is happening in data processing that seems to me to have significance for future accountants - in record keeping, in management accounting, and in auditing. It raises the question: how can I prepare? I should like to admit that recent trends in data processing raise this question for mature practitioners as well as students. We both face something new and even revolutionary.

Although there is no generally accepted standard of education to prepare for the use of data processing equipment by accountants, certain conclusions about curriculum seem fairly obvious. It seems clear that new accountants will need to know more about statistics, probability, and math. Their knowledge of accounting, of auditing practice, and of management will have to be deeper. It may be that the increased pace in both high schools and colleges will make it possible for students to cover some of this ground relatively early in their formal education. For example, elementary calculus is now covered in many high schools. This should make it easier for students to acquire broader backgrounds in liberal arts, which CPAs seem to agree is desirable.

The perspective for early experience in public practice is this: the junior accountant who does quite routine work while becoming oriented to work for a firm of certified public accountants will quite likely become a rarity. The new graduate will be

expected to take upon himself quite quickly the responsibilities usually assigned at present to the semi-senior or senior.

In order to be prepared for this, and to obtain the additional knowledge required to master the computers, the new accountant will more and more frequently be a man with an advanced degree. Some of this thinking was no doubt behind the American Institute's resolution, through Council action in 1958, that a master's degree, as educational preparation for public accounting work, is preferable to the more traditional baccalaureate.

We practitioners are going back to school too. Among the courses offered by the American Institute's Professional Development Division to Institute members is one two-day course called "An Introduction to Automatic Data Processing." What the course covers may be described as a kind of minimum body of knowledge for CPAs who are just getting into this field. The course covers computer logic, computer language, and the binary system. It also instructs CPAs how to continue study in this field.

You students and we practitioners are all in this together. The future will no doubt contain a lot of surprises for all of us. I wish that we could all get together in ten years and compare notes.

NOTES

1/ John I. Snyder, chairman and president of U. S. Industries, Inc., before a Senate labor subcommittee; quoted in The New York Times, October 4, 1963, p. 1.

2/ U. S. Department of Labor: Manpower -- Challenge of the 1960s.

3/ Teleregister systems for Howard Savings Institutions, Newark, N. J.; Society for Savings, Hartford, Conn.; Union Dime Savings Bank, New York City. These installations are discussed in Electronic Business Systems by Richard E. Sprague, Ronald Press, New York 10.

4/ The Brooklyn Union Gas Company. (IBM news release.)

5/ Dean Witter & Company. (IBM news release.)

6/ For the complete story of this CPA's experience, see "My First Year with Punched Tape Accounting," by Alexander Pintner, Jr., in The Journal of Accountancy, April 1963, p. 49.

7/ For a slightly more detailed treatment of this issue, see Business Week, July 20, 1963, p. 45.

8/ Duke Power Company. The story of this installation is told in more detail in Electrical World, February 5, 1962, p. 42.

9/ Accountancy, November 1960, p. 630.

10/ These five effects of electronic data processing upon management were listed by Arthur B. Toan, Jr., "Data Processing, Accounting, and Business Administration," The Journal of Accountancy, November 1962, p. 43.

11/ J. S. Seidman, "Importance of CPA Will Increase in Electronic Age," in The Office, January 1960, p. 117.

12/ The section of this speech about the impact of computers on auditing owes a great deal to two articles: Virgil F. Blank, "Auditing in the Age of EDP," in Journal of Machine Accounting, July 1961, p. 34; Gregory M. Boni, "Impact of EDP on Auditing," The Journal of Accountancy, September 1963, p. 39.