

From Computer Operators to Operating Systems:

The Hidden Costs of Business Computing

Nathan Ensmenger
University of Pennsylvania

Unlocking the Computer's Profit Potential

A MCKINSEY STUDY

"The rule is, jam tomorrow and jam yesterday, but never jam today."

The Red Queen's rule for Looking Glass Land fairly sums up the effort of many companies to wring profits from the computer. Yet this study suggests that "jam today" might be plentiful, if management would reshape its old strategies to fit its new opportunities.

IN TERMS OF technical achievement, the computer revolution in U.S. business is outrunning expectations. In terms of economic payoff on new applications, it is rapidly losing momentum. Such is the evidence of a recent study by McKinsey & Company of computer systems management in 36 major companies.

From a profit standpoint, our findings indicate, computer efforts in all but a few exceptional companies are in real, if often unacknowledged, trouble. Faster, costlier, more sophisticated hardware; larger and increasingly costly computer staffs; increasingly complex and ingenious applications: these are in evidence everywhere. Less and less in evidence, as these new applications proliferate, are profitable results.

Most large companies have successfully mechanized the bulk of their routine clerical and accounting procedures, and many have moved out into operating ap-

plications. Yet with few exceptions their mounting computer expenditures are no longer matched by rising economic returns.

What has gone wrong? The answer, our findings suggest, lies in a failure to adapt to new conditions. The rules of the game have been changing, but management's strategies have not. A look at current computer development efforts shows that the prime objective of many is still the reduction of general and administrative expenses. Yet for most companies this is an area of fast-diminishing returns. It is high time for a change of course in the computer development effort, many senior executives are beginning to recognize. "How can I keep on justifying major computer expenditures when I can't show

This article is a condensation of the Research Report to Management published earlier this year under the same title.

"After buying or leasing some 60,000 computers during the past fifteen years, businessmen are less and less able to state with assurance that it's all worth it."

Computers Can't Solve Everything
Fortune Magazine (1969)

Determining Computer Service Operating Costs

JOHN P. CARROLL

IN BANKING there has been great emphasis placed on the summarization of accounting data for the purpose of reporting to regulatory authorities. As a result, the emphasis has been an historical approach rather than a managerial approach to record keeping.

Unfortunately, records kept from a conventional financial statement approach do not usually provide the data required for developing cost data, or data for determining product line profitability, or data for managerial control and decision making.

This does not mean that the accounting system cannot serve all of these purposes. What it does mean is that the accounting system must be designed so that it serves all of these purposes. This, of course, is the "integrated" systems approach.

Integrated System

The key to an integrated accounting system is the "building block" approach—the data have to be broken down in small enough pieces that they can be channeled into several different uses and at the same time provide the degree of detail to satisfy the most stringent requirements. Since product cost would normally require the greatest degree of detail, an integrated accounting system would be strongly influenced by the product cost requirements.

Within this industry there is a tremendous variety of products and a corresponding requirement for cost data. The clerical requirements of maintaining such a cost system could be overwhelming. With the use of EDP, however, the development of an integrated accounting system does become feasible.

Costs have different characteristics, and it is not only possible, but useful for managerial purposes to develop the breakdown of costs into

The author, recently appointed controller of Kirkeby, Natus Corp., was manager of management services with the New York accounting firm of Touche, Ross, Bailey & Smart when this article was prepared for BANKING.

"stand-by" and "variable" components. Our firm does not accept the philosophy that costs per se may be classified into two clear-cut groups: Fixed and variable. Rather, most costs have an element of variability and also a stand-by or fixed complement. This is one of the major elements of what we call "profitability accounting."

Profitability accounting advocates determination of the incurrence of cost, account by account, at all volume levels and the use of this data as a basis for the budgetary control of overhead. On this basis, only that cost which remains under conditions of significant reduction in activity is termed fixed or stand-by. All increments of cost over and above that level are in the variable category.

Stand-by Costs

The effect is that stand-by cost is the same absolute amount at all volume levels. To unitize it in product cost would require the assumption of a volume level and would freeze the cost at the assumed volume point. Profitability accounting regards this as objectionable for purposes of many managerial decisions which must be made in connection with product pricing, volume considerations, and make-or-buy determinations. It suggests rather that an incremental cost approach be taken in which stand-by cost is entirely eliminated from unit product cost and is assessed directly to the total product line as such.

In profitability accounting there is

another important category of cost. This is called "programed" cost. It is a cost that varies in accordance with a management decision, and therefore it cannot be controlled by the techniques described for variable and stand-by costs. Good examples of this type of cost are research and development cost and advertising expense.

Major Types of Cost

Let us now consider the major types of expense associated with computer installation and operations.

First, let's look at some of the pre-decision costs—the research and development type costs that have to be incurred before a decision can be made—for example, the computer feasibility study or the market research associated with a particular service or product. These would be classified as programed cost, and would be included in product line costs based on a specific management decision. These costs can be amortized over a period of time, over a specific number of units of production, or management might decide to charge these costs off in the period incurred as part of general development expenditures.

Regardless of management's decision as to when and how these expenses should be written off, it is important that these costs be properly segregated and accumulated on a project basis. Only in this way can proper control be exercised over the project during its active life. Data then become available to assist in making similar decisions in the future. Ideally, a budget would have been established at the beginning of the project and actual expenses compared with budget on a monthly basis as the project progresses.

There are certain other so-called one-time costs associated with the



OPERATIONS BULLETIN

EQUIPMENT - SYSTEMS - FACILITIES - PRODUCTS - METHODS - BUILDINGS

WELTON BECKET AND ASSOCIATES, ARCHITECTS AND ENGINEERS

Banking in the round is encouraged by the completely circular design of this new Los Angeles branch of the Security First National Bank. The central platform for officers surrounds a sand-sculptured column and is beneath a big canopy of lights

The Costs of Computerized Banking

JAMES A. O'BRIEN

Dr. O'Brien is Assistant Professor of Finance in the Division of Business and Industry, Eastern Washington State College.

HAS the use of computer systems increased or reduced bank operating costs? The answer to this question can be furnished by considering how computer processing affected particular cost categories of several large and small banks analyzed in a recent study. These categories are: (1) Conversion cost; (2) equipment cost; (3) personnel cost; and (4) EDP cost.

• *Conversion cost:* The cost of converting from non-computer methods to electronic data processing includes the one-time costs arising from initial programming

and systems design, additional supplies, and the additional personnel or overtime required to prepare for and monitor the actual conversion. This definition of conversion cost excludes the purchase cost of computer equipment and the cost of building facilities because this cost is reflected in the depreciation costs included in the operating costs of EDP.

The small banks in the study had comparatively small conversion costs for demand deposit accounting because they all used off-premises EDP arrangements with either a correspondent bank or an EDP service bureau. These arrangements required no outlays for programming and systems design or for special supervisory conversion personnel. The conversion period did require some additional personnel but, in most cases, the work was done

"The computer has had little impact on most companies' key operating and management problems."

Unlocking the Computer's Profit Potential
McKinsey & Company, 1968

ECONOMICS

of the Digital Computer

Costs - Uses - Speed - Scale

By Richard F. Clippinger

This article is based on wide experience in the application of high-speed automatic computers to the solution of scientific, engineering, and operations research problems, and on extensive consideration of the use of computers in business and industry. It should be stressed, however, that many of the applications discussed in this article do not belong to the category of examples which have already been worked through to completion.

Thus the conclusions set forth here represent extrapolations from a broad base of experience into the future. The author — who is Chief, Computing Services Section, Raytheon Manufacturing Company — would have preferred to wait three to five years and then draw conclusions from accomplished facts, but there has been substantial demand for a more specific prediction of fields and methods of application and detailed requirements of personnel and cost. It is hoped that these objectives are met in this article, even though there is risk of oversimplification and consequent misinterpretation.

For example, the reader may be startled at the magnitude of effort required to realize

the *full* potential of the automatic computer. He is urged therefore to observe how large this potential is and to bear in mind that a *modest* expenditure will suffice to get started on a paying basis.

— *The Editors*

As businessmen consider the implications of the phenomenal developments in data-processing equipment in the light of their own requirements, they are likely to ask themselves:

- ☛ What records and problems do I have to which a digital computer can be advantageously applied?
- ☛ Will a digital computer lower my cost?
- ☛ Should I set up my own installation, or should I farm out my problems to a computing center?
- ☛ What scale of operation fits my company?

Various aspects of the use of computers have been discussed in recent issues of this magazine.¹ I shall try to provide a rounded picture here, but with more attention on what has not been covered — particularly the potential uses and costs for the company which has not had

¹ See John A. Higgins and Joseph S. Glickauf, "Electronics Down to Earth," HBR, March-April 1954, p. 97; and Roddy F. Osborn, "GE and UNIVAC: Harnessing the High-Speed Computer," HBR, July-August 1954, p. 99.

**"Electronic data processing is
the biggest ripoff that has
been perpetrated on business,
industry, and government over
the past 20 years"**

**EDP - A 20 Year Ripoff!
Infosystems (1974)**

Wanted: 500,000 Men to

By Stanley L. Englehardt

IF YOU know how to "talk to computers," chances are you've got it made. If you don't, you may be missing out on a great job opportunity.

People who talk to computers are called programmers. They instruct data-processing machines on how to perform specific jobs. Today there are about 40,000 of these specialists at work. In six years, experts say, 500,000 more will be needed. Many will require a

bachelor's, master's, or even doctor's degree. But close to 50 percent will move into this new profession with only high-school diplomas.

Here's why there's such a tremendous demand for programmers.

Computers are really very stupid multimillion-dollar collections of wires and transistors. Plug one in and it does nothing. Yell at it, curse, kick it—and still it remains mute. The reason: no instructions.

But once *people* write instructions,

You don't have to be a college man to get a good job in computer programming—today even high-school grads are stepping into excellent jobs with big futures

Feed Computers

the computer becomes a marvelous tool. It can tell the exact moment at which an astronaut should fire his retrorockets, or identify an obscure disease and prescribe a course of treatment. It can keep watch over huge inventories and write reorders when the stock gets low. Computers can prepare your paycheck, update accounts-receivable files—even print out past-due notices when you're late in paying bills.

Thousands of new computers are installed each year to do these jobs. Each

one must be programmed before it can start processing. This means anywhere from 1 to 100 people sitting down to figure out every possible step in a particular operation. These steps are translated into machine language, punched into cards, and fed into the computer. There they are stored for use during the solution of a problem.

Do you have what it takes to be a programmer?

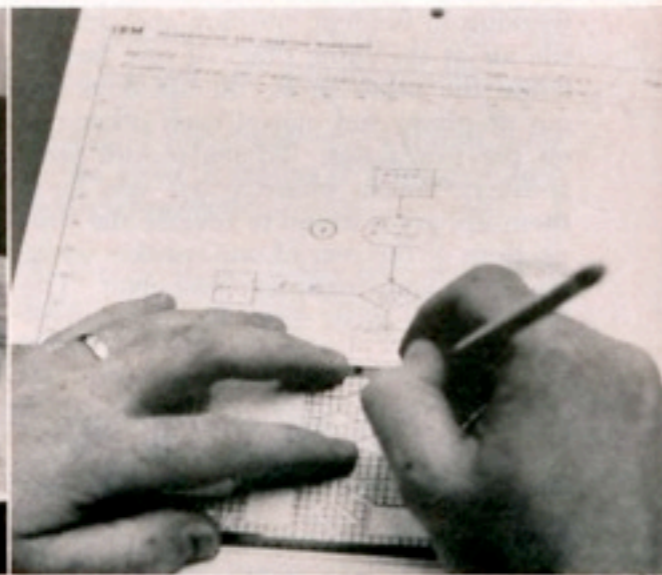
Education is important, but most important is a quick mind, with the ability

The computer programmer's daily work



1 From his boss, a systems analyst, the programmer receives his assignment to work out a program for one section of a job planned on a flow chart.

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2 First step: Draw a block diagram showing basic data-handling and logic operations computer must perform. Standard symbols are used in the diagram.

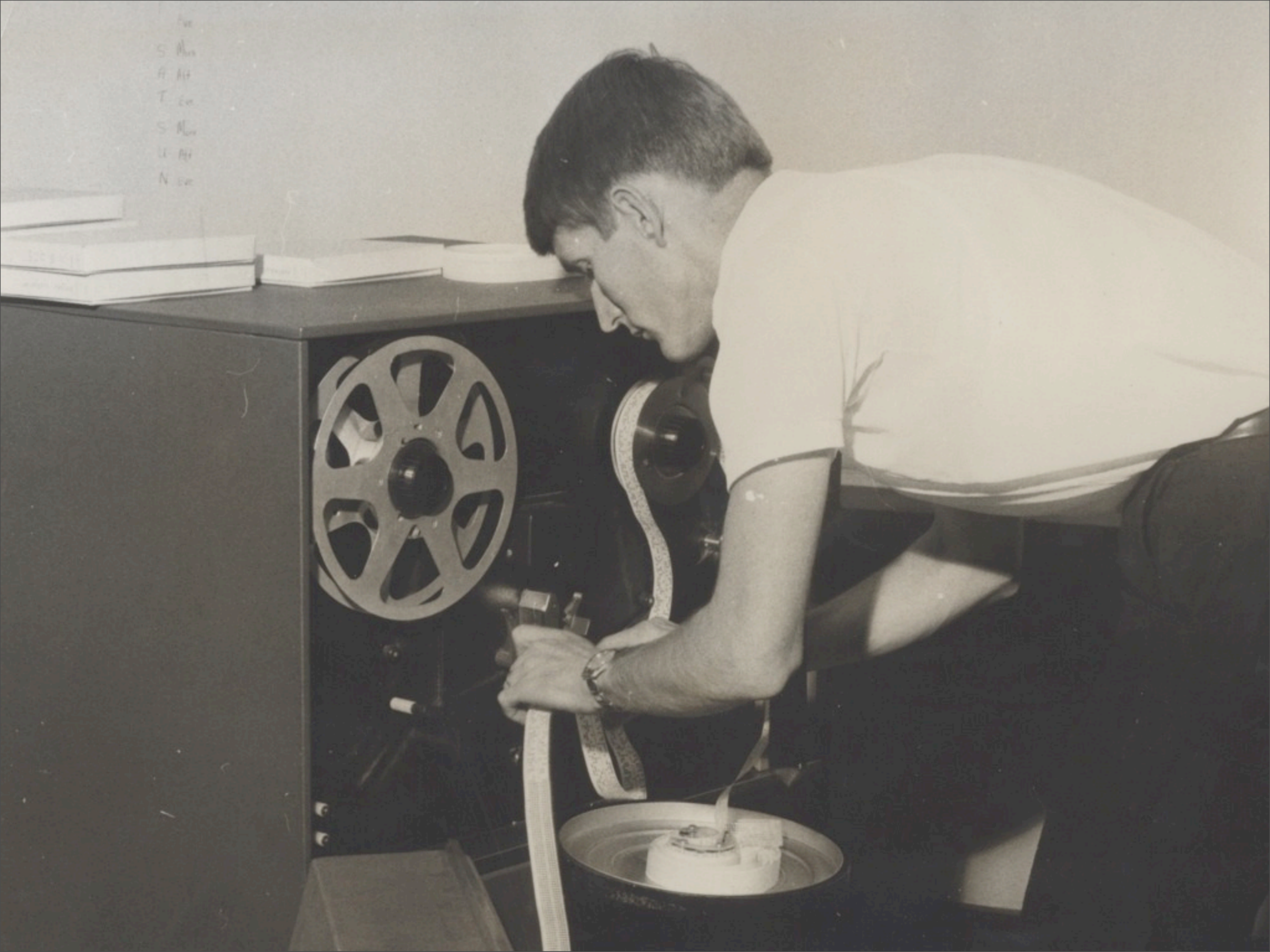


3 Consulting a special dictionary, programmer spells out instructions in a "programming language"—a code describing standard sequences of machine operations.



4 Coded instructions, now punched into cards, are fed into a computer, which automatically translates steps into precise instructions it can follow.





Fr
S Mon
Th
T Fri
S Mon
Th
N Fri

male

female

300000

225000

150000

75000

0

Supervisor

Analyst

Programmer

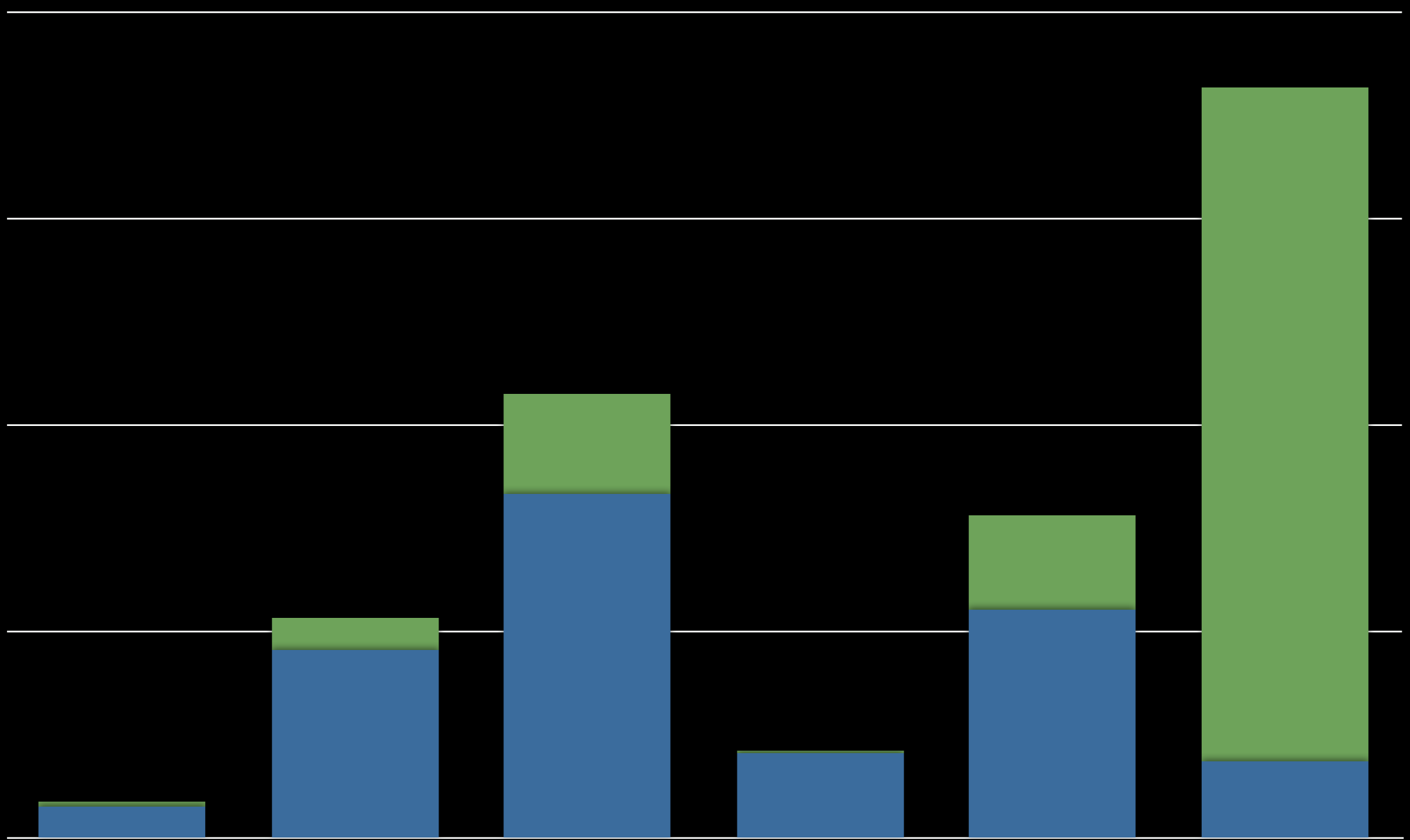
Technician

Computer

Keypunch



Operators



male

female

300000

225000

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Supervisor

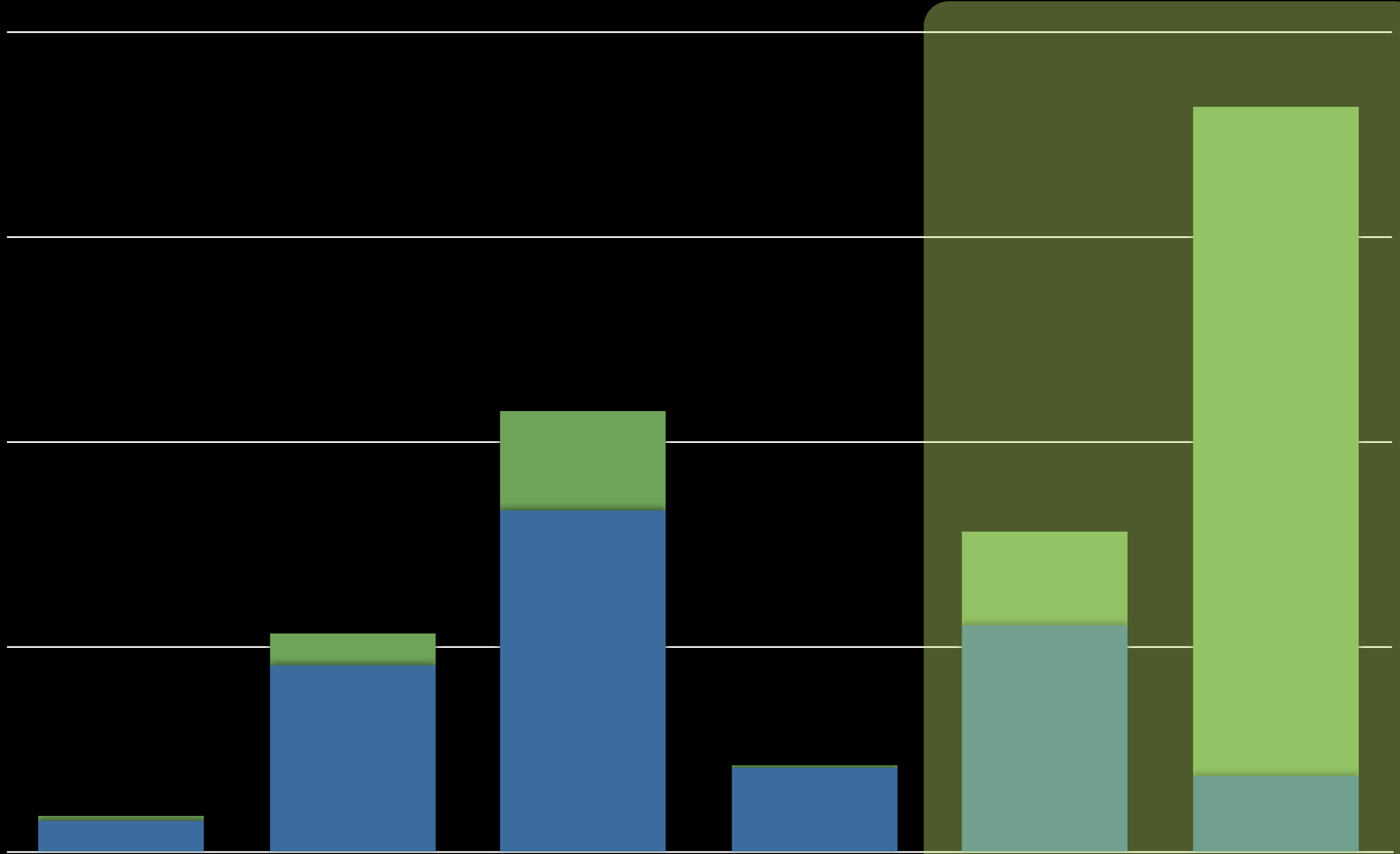
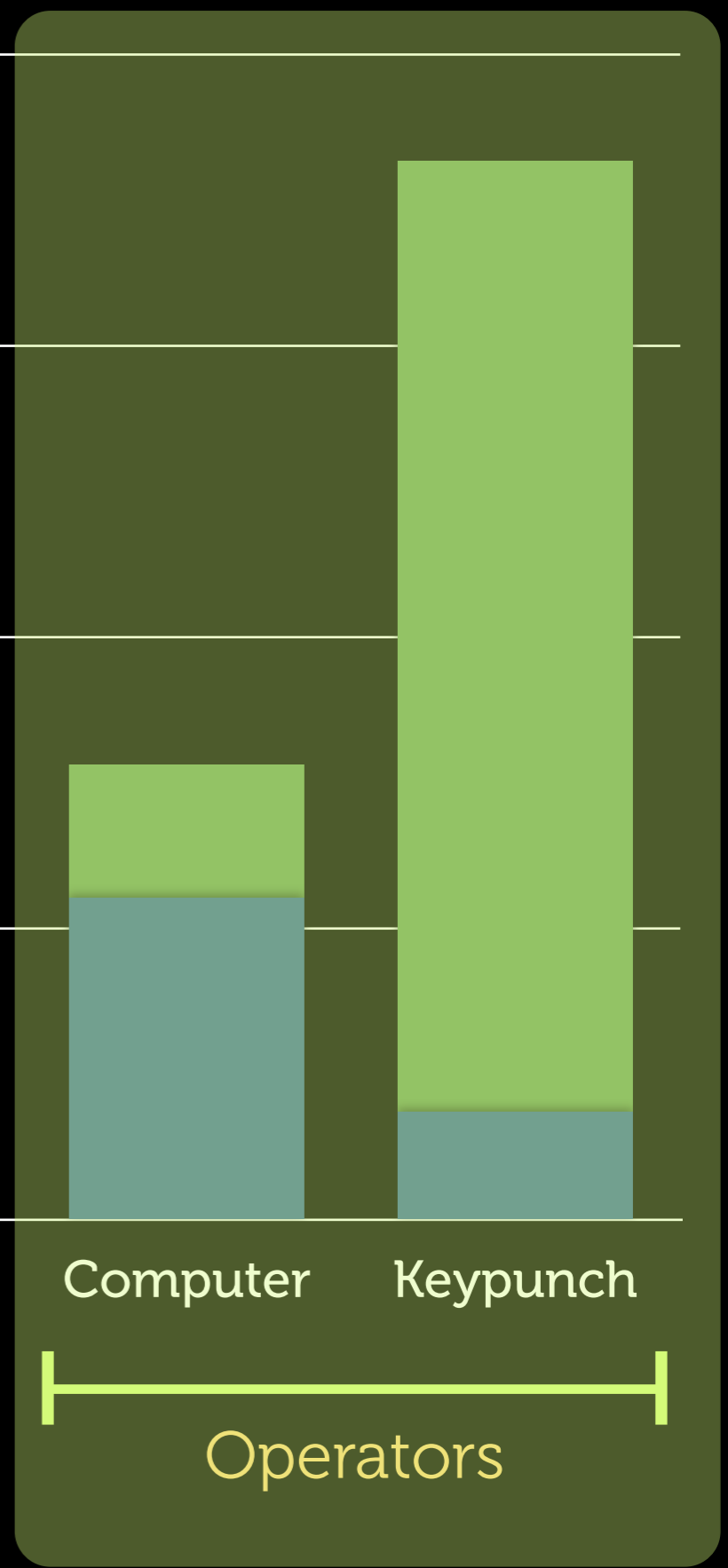
Analyst

Programmer

Technician

Computer

Keypunch





Friday, October 16, 2009



Friday, October 16, 2009

The deadly female.



A male operator's fingers, run carelessly over the surface of computer tape, can mar it. But the female of the species is far deadlier.

Scratches caused by her fingernails can result in drop-outs.

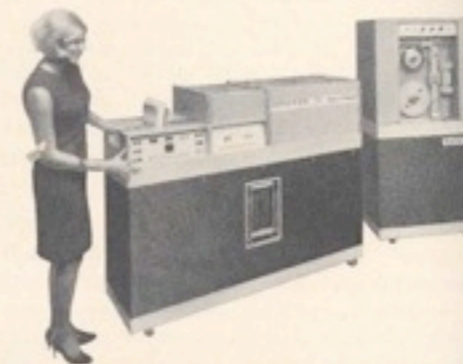
Moral:
Keep your fingers off the tape.



What has sixteen legs, eight waggly tongues and costs you at least \$40,000 a year?

Eight keypunch operators that one Digitek 70 will replace—and then some. This optical scanning system costs only \$30,000 and is a better, faster and more accurate way to feed your computer. It simply eliminates keypunching.

This versatile system reads pencil marked (original) documents at the rate of 2500 per hour and transfers information directly to magnetic tape—ready for the computer. The Digitek 70 not only saves labor, time and space, it also reduces errors, speeds the movement of data and adds to the efficiency of your whole computer operation.



Keypunching can account for as much as 35% of the total cost of your computer operation and up to 90% of time delays. We'll be happy to tell you how the Digitek 70 is solving this important problem for others.

Write today for information on this and other Optical Scanning systems that read a variety of hand- or machine-printed source documents.

OPTICAL SCANNING CORPORATION

Newtown, Pennsylvania 18940 Phone (215) 968-4611



Our optical reader can do anything your keypunch operators do.

(Well, almost.)

It can't get mad and make silly mistakes. Or pout for days. Or cry. But it *can* read. And gobble data at the rate of 2400 typewritten characters a second. It can read hand printing, too. And compute while it reads. And reduce errors from a keypunch operator's one in a thousand to an efficient one in a *hundred* thousand.

Our machine reads upper and lower case characters in intermixed, standard type fonts. It can handle intermixed sizes and weights of paper, including carbon-backed sheets.

An ordinary computer program tells our reader what to do . . . to add, subtract, edit, check or verify as it reads. Lets you forget format restrictions, leading and trailing zeros, skipped fields, and fixed record lengths. And our reader won't obsolete any of your present hardware because it speaks the same output language as your computer.

Our Electronic Retina Computing Reader can replace all—or almost all—of your keypunch operators. At least that's what it is doing for Perry Publications.

If you have a volume input application, it can do the same for you. Tell us your problem and we'll tell you how.



RECOGNITION EQUIPMENT Incorporated



Our optical reader can do anything your keypunch operators do.

(Well, almost.)

It can't make time on company time. Or use the office for intimate tete-a-tetes. Or be a social butterfly. But it can read. And gobble data at the rate of 2400 typewritten characters a second. And compute while it reads. And reduce errors from a keypunch operator's one in a thousand to an efficient one in a *hundred* thousand.

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If you have a volume input application, it can do the same for you. Tell us your problem and we'll tell you how.



RECOGNITION EQUIPMENT Incorporated



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(Well, almost.)

It can't take maternity leave. Or suffer from morning sickness. Or complain of being tired all the time. But it *can* read. And gobble data at the rate of 2400 typewritten (or hand printed) characters a second. And compute while it reads. And reduce errors from a key-punch operator's one in a thousand to an efficient one in a *hundred* thousand.

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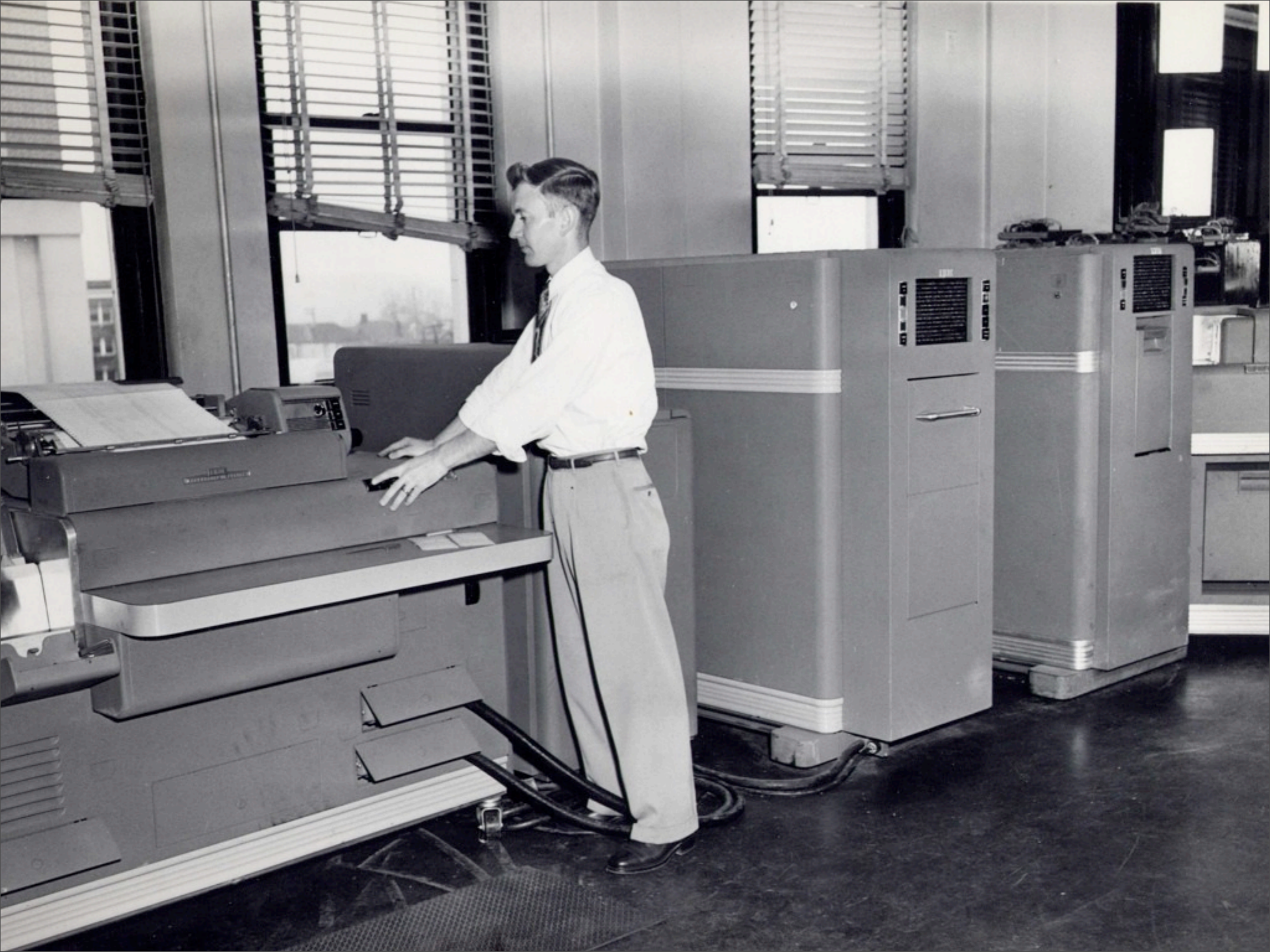
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If you have a volume input application, it can do the same for you. Tell us your problem and we'll tell you how.



RECOGNITION EQUIPMENT Incorporated



CHARACTERISTICS AND PERFORMANCE PREDICTORS OF 7094 COMPUTER SERVICE OPERATORS

BRUCE F. GORDON AND RICHARD A. DENNIS
Bell Telephone Laboratories, Incorporated
Murray Hill, New Jersey

At the time the present study was undertaken, there were 62 Computer Service Operators on the Bell Laboratories payroll.

Historically, input into the CSO classification has been limited to experienced EDP operators from the outside market. Recently a few without background experience in EDP have been trained.

The degree of experience of market hires has ranged from console-operated, tape-oriented computer systems (similar to the 7094 computer at BTL) to ability to operate EAM equipment and computer school graduates. Market candidates with experience have required 3 to 6 months on-the-job training before becoming proficient. This study is limited to experienced operators who have reached typical proficiency.

While input has been adequate for our computer facilities to date, it was felt that there was a need for better descriptors and predictors, if the Laboratories was to meet future manpower requirements.

1. The pool of available market hires with appropriate experiences was shrinking while the demand was increasing.
2. The extent to which in-house recruits or trainees would be able to meet job qualifications was not known.

*Investigation**

Computer Services Operators, Computer Services Supervision, and computer users or programmers were interviewed. A literature search failed to turn up relevant studies in the operation field.

CSO Job

The CSO operates the central system console and all of the peripheral equipment (tapes, printers, card readers, etc.). The operator manually loads and unloads each job and takes whatever actions are needed while processing each job, in response to a set of signals from the console or peripheral equipment.

The typical BTL computer facility has 8 CSO's operating per shift. During the course of each shift, all of the operators work as a team to coordinate console instructions with peripheral equipment operations. (Operators move from console to printers, to hanging tapes, to feeding cards into the card readers, etc.) In other words, no one operator handles a specific piece of hardware for one entire shift, but rather is called upon to operate all of the equipment.

*Early investigation was conducted jointly by Mr. R. A. Binz of the General Employment Department and Mr. R. A. Dennis of the Computer Service Operations Planning & Training Department.

Combining the interview comments from each of the groups mentioned above, the following list exemplifies those traits and abilities considered to be an essential part of the CSO job (not necessarily in order of importance):

1. Ability to program.
2. Ability to distinguish between machine malfunction, program error, and operator error and pinpoint the source of the problem.
3. Ability to handle nonroutine jobs with facility.
4. Ability to use the most efficient sequence in processing a job.
5. Demonstration of concern for each individual job — and the ability to pursue problems to the utmost.
6. Will seek out work upon completion of a job.
7. Ability to explain operations to others.
8. Follows computer center procedures to the letter but is not content with maintaining status quo — uses ingenuity in suggesting and implementing new procedures or modes of operation.
9. Ability to get along with others.
10. Ability to work quickly and accurately under pressure.
11. Retentive memory — ability to recall that which has been learned and apply or implement.
12. Ability to handle large volumes of tape, paper, and cards carefully and efficiently.

Interviewing and fact gathering supported the two following assumptions: (1) today's Computer Operator was yesterday's EAM Operator; (2) today's Computer Operator may develop into a commercial programmer of tomorrow. Both of the assumptions appeared valid at the time and were investigated as to validity by looking at the backgrounds of the current staff of computer operators and staff programmers.*

Preliminary investigation indicated that (1) intelligence, (2) programmer aptitude, (3) machine operator aptitude, and (4) attitude toward work (motivation) would be appropriate to measure by testing. The tests selected were the Programmer Aptitude Test, the Logical Analysis Device, the Punched Card Machine Operator Aptitude Test, the Work Inventory (Motivation Survey), and the Wonderlic Personnel Test.

A brief description of each of the testing devices selected follows

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An Automatic Supervisor for the IBM 702

BRUSE MONCREIFF

VERY little experience has been accumulated in the operation of a large commercial data-processing center. However, reflection on the subject has

BRUSE MONCREIFF is with The Rand Corporation, Santa Monica, Calif.

led to the conclusion that, in the large-scale operation of such a system, there will be a different emphasis from the one usually present in the operation of a large-scale computing installation. The general administrative problem in both cases is, of course, to keep both staff and equip-

ment operating efficiently. In the latter case, however, the emphasis is on new problem preparation, while in the case of the business application the emphasis must be on the efficient day-after-day operation of the same routines. The automatic supervisory routine described here is an attempt to solve those operating and programming problems peculiar to this "routine-dominated" situation.

The excuse for solving these problems with a machine program, rather than by instructions to the operator, is twofold:

1. The human operator cannot compete in speed with the machine in making routine decisions and in controlling the processing operations.

Moncreiff—An Automatic Supervisor for the IBM 702

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2. The human operator is more likely to make mistakes in carrying out routine instructions.

The purpose of a supervisory routine is, therefore, to keep the machine running efficiently in spite of the slowness and fallibility of the human operator.

The various aspects of the proposed supervisory routine will be approached by looking at these problems of both operator and programmer which the routine helps solve. A summary description of the way the routine works will follow.

Operating Problems

On a machine such as the 702, the major operating problem is the efficient handling of tape reels. Every few minutes, during a long run, either an input tape will have to be selected and mounted, or an output tape will have to be labeled and stored away. The malfunctioning of tape units will probably result in the

ments of alternate pairs should be made to physically adjacent tape units, as far as this is possible. The machine will print out a table of assignments which the operator will use as a guide in mounting tapes.

2. Once the tapes have been mounted, the supervisory routine will check to see that this has been done properly. Each input tape will be checked for proper type, proper cycle number (e.g., that it was the output of yesterday's run), and proper sequence number within type and cycle. The first record of each tape in the system will be a label containing the information required for this check. The supervisory routine will consult a table of cycle increments, one for each input type by job, and will keep track of the sequence of tapes mounted during each job. The routine will also check each tape mounted for the purpose of receiving output to guarantee that the information on this tape is no longer needed. It will do this by comparing the cycle

the passive switches. It is recommended that the physical switches be reserved for the active use, while a system of logical, or programmed switches, to be set by a punched card, be used for the passive, job-setup type. The supervisory routine will establish whether or not an alteration switch card is needed for each particular program, and if so, will wait until a card of the proper type is provided. This card will be stored in a standard drum section. This system relieves the operator of the responsibility of remembering to make the switch settings before each job. A file of prepunched cards can be maintained which will cover the majority of setups. Most, if not all, occasions of the use of program parameters can be handled by this control card.

As a further aid to the operator, especially for the purpose of retracing the steps of a process that went wrong, the supervisory routine will automatically keep a log. Entries will include job numbers, tape setups, switch settings, in-

Fig. 1. Supervisory routine: initial operations

