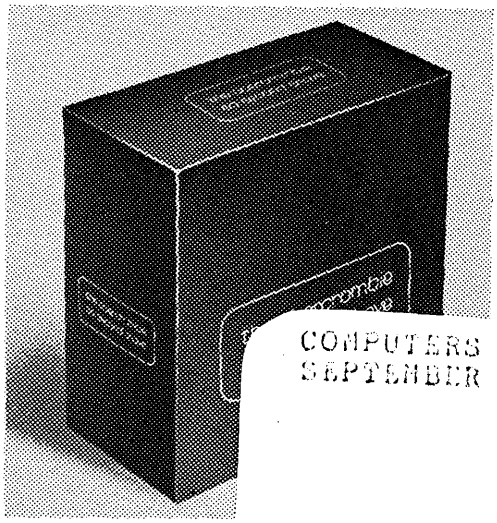
September, 1970
Vol. 19, No. 9

SCIENCE & TECHNOLOGY

computers and automation

"Cedar Grove"

"The 60-Second Shave, I'm glad somebody finally up and invented it. What a gift."



Inside this box, a new

Last Wednesday, Ronnie D
to us, tried the Abercrombi

Did it in 56 seconds.

Another friend took 64 sec
First time we tried the Aberc
cleaned our face smooth, c

And you're right—somebo
shaving is about the dulle
thing a man does. And we
thing that would keep you
we did the next best thing-
whiskers off your face—cl
a matter of seconds.

Result! The Abercrombie
shave you closely and
can return it, simple as th

Some friends in Europe
Second Shave for us. Tl
heads—instead of the
difference you see. Flip
start purring—covers m
method of shaving we'v

Each head is covered w
foil screen. A sort of sw

of tiny holes. These holes line up the whiskers—pfftt—the whiskers are sliced off low by the Swedish stainless steel cutters.

Making the whole thing work, is a motor of exclusive European design—never found a more powerful shaving motor.

The whole thing is so well put together by these Alpine craftsmen of Europe, that we guarantee the Abercrombie 60-Second Shave for two years—about twice as long as
shavers. And should it ever need serv-
it to the A & F Service Center in
formation is in the box on the

shaved with a blade. Only way
whiskers off. But for the past two
ıg the Abercrombie 60-Second
ose, clean, comfortable shave, all
ing into my shirt 60 to 62 seconds
hat's the best part.

over with so fast.

ıd Shave comes in a genuine lea-
case just by itself—makes a fine

MBIE & FITCH
ıton, Iowa 52732
tpaid _____ Abercrombie 60-
@ 32.50 each.
Ioney Order

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_____Zip_____
haver to cover cost of handling

New York, New Jersey, Florida,
Colorado and California add ap-

2—299—7—1160 1

Vol. 19, No. 9
September, 1970

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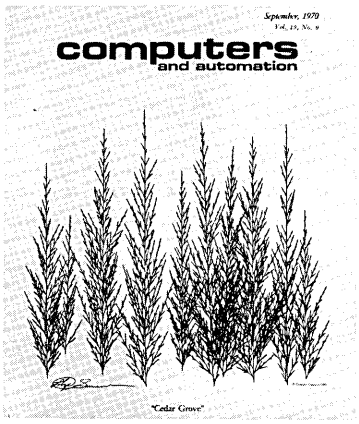
computers and automation

The magazine of the design, applications, and implications of information processing systems.



This Month's Cover

The front cover drawing was one of the entries in C&A's Eighth Annual Computer Art Contest (see the August issue). The artist is Lloyd Sumner, Computer Creations, P.O. Box 1842, Charlottesville, Va. 22903. The drawing was programmed in ALGOL and produced with the aid of a B5500 computer and a CalComp 565 plotter.

Lloyd Sumner is one of the first people to devote his full time to the development of computer art. He has exhibited his work throughout the world, and has lectured on computer art in Europe and the United States. He holds a degree in Engineering Science from the University of Virginia.

Departments

Key

[A] — Article
[F] — Readers' Forum
[E] — Editorial
[C] — Monthly Column

Computers, Automation, and Computer-Assisted Activities

In "the old days" of the computer field, which is about 20 years ago, there was much talk about the "automatic factory", the "automatic office", and "automation". There was a continuing argument about who had composed the word "automation", and there was another continuing argument about whether automation really was anything newer in 1950 than it had ever been before.

Ten years ago we published a definition of the word "automation", in the 5th edition of the "Glossary of Terms in Computers and Data Processing":

1. Process or result of rendering machines self-acting or self-moving.
2. Theory or art or technique of making a device or a machine or an industrial process more fully automatic.
3. Making automatic the process of moving pieces of work from one machine tool to the next.

This last kind of automation was sometimes referred to as "Detroit automation", because at one time there was a famous automatic assembly line for automobile engines. This production line had approximately 500 stages or stations; it took in at the front end a raw casting for an automobile engine, and put out at the far end a fully finished and inspected engine for installation in an automobile being constructed.

Nowadays, the "in" word is "computer-assisted". There are dozens, and perhaps even hundreds, of processes and activities which are called "computer-assisted". A few of these activities have almost become fields in themselves, such as

computer-assisted instruction;
computer-assisted education;
computer-assisted medical diagnosis;
computer-aided design;
computer-assisted laboratory instrumentation; etc.

A definite change in viewpoint has occurred. Whereas the old viewpoint implied that machines and computers could do something all by themselves, nowadays there is more emphasis on the contribution of the human being – and more effort to develop the system of "man and computer working together", each aiding the other.

Is this change permanent or temporary? Will machines by themselves unaided by human beings take over almost every productive activity? In the future, will we really have large-scale automation, or will we have large-scale computer-assisted activities?

I think the present fashion is a temporary turn in the spiral of development. I think in years to come there will be greater and greater strides towards full automation.

Here are a few of the reasons:

1. Computers will become far cheaper than they are now;
2. More and more programming will include provisions for taking care of more and more exceptions;
3. More and more activities still performed by human beings, such as visual observing and recognizing of objects, will become mechanized, because engineers will find out how to mechanize them. In fact, what seems to be today a permanent hard core of difficult tasks to give to computers, will yield to technical advances.
4. Human beings want to live more, play more, and work less, especially work less in the sense of having uninteresting monotonous tasks to do, like picking grapes or sweeping subway platforms.
5. Repetition of work soon becomes monotonous for any human being – but it is duck soup for a machine which regularly has no emotions designed into it; etc.

Prediction for twenty years from now: Less and less "computer-assisted" activities – more and more full automation.

What will human beings do? More and more of what they like, less and less of what they must.

Edmund C. Berkeley

Editor

Letters To The Editor

"The Limitations of Computers" – Comment

I found your magazine in the new library on Michigan State University's campus in East Lansing. I read your editorial in the June, 1970 issue ["The Limitations of Computers", page 6], and I believe your three points at the end of the editorial are very well said and I enjoyed reading them.

Teachers, lawyers, doctors, dentists, accountants and others all have to be certified by the states in which they practice. What is being done about the computer operators and programmers? I would be interested in hearing from any one who is working on the certification by a state board of computer professionals.

THOMAS R. ZICK, SR.
613 Cherry St.
Stockbridge, Mich. 49285

Articles That Would Never Appear Elsewhere

Presently I am engaged in research involving the future use of mini-computers in large MIS configurations. The finished product of my research may be of interest to your readers, and I will send you a copy for consideration for publication.

Regardless of your decision regarding my paper, I intend to continue as one of your subscribers. Perhaps it is because you maintain a paid readership that you are able to publish articles that would never appear elsewhere.

STANLEY JAFFIN
211 N. Piedmont St.
Arlington, Va. 22203

Patents on Software

In the February issue of *Computers and Automation,* Howard A. Silber expressed his feeling that if a computer program were translated into another computer language, it would circumvent copyright protection. [See "A Hypothetical Interview Between the President of a Computer Software Company and a Patent Attorney Specializing in Protection of Computer Programs", Feb. issue, p. 16.] This is not true with international copyright, which protects the "story line". International copyright provides protection only if the same function (book) is performed by essentially the same steps (story incidents, sentences). I believe a significant court case could be built by showing that nearly all subroutines in the copy of a computer program did like jobs, with like calling sequences, as did the original program.

If such likeness cannot be shown, I believe that even patent protection would be futile for that program, since one would be attempting to exclude something derived by an apparently independent mental process. I would be interested in hearing comments from others on this subject.

RICHARD MERRILL
34 George Rd.
Maynard, Mass. 01754

Railroads Seek Tougher Terminal

Railroads want a new, tougher terminal device to communicate data from yards to computers and other terminals. So the Management Systems Dept. of the Association of American Railroads has put together a verbal picture of what's needed.

Terminals for the input and output of all kinds of data – waybill information, train consists, payroll reports and the like – are now being used by railroads in some 2,000 locations.

The kind of device needed would be able to stand up under conditions found in the typical railroad yard – substantial vibration, much dirt, wide variations in heat and humidity – with a minimum of maintenance.

Another desirable feature would be suitability for installation in the field and modular features that would allow a user to operate either a simple basic device or to add compatible components.

The AAR isn't seeking bids on the device, but is sending the specifications to member roads and potential manufacturers. A vendors' meeting will be scheduled if sufficient interest is shown.

Any of your readers that are interested are invited to write to me for copies of our specifications.

R. A. PETRASH, Executive Director
Data Systems Div.
Association of American Railroads
Washington, D.C. 20036

READERS' FORUM

"WHAT WE MUST DO" — COMMENT

I. To the Editor, from John McLeod, Editor, *Simulation*, and Executive Director, SCi World Simulation, Simulation Councils, Inc., P. O. Box 2228, La Jolla, Calif. 92037

I appreciate your republishing "What We Must Do" by Dr. John Platt [June issue, p. 41]. I had some strong reactions to that article, which I expressed in a letter to the author [see below].

Incidentally, when I read your very good editorial, "The Limitations of Computers" [June issue, p. 6], I was reminded that I had not complimented you on having the guts, or whatever it takes, to publish the Sprague article in your May issue. That was a most remarkable – and frightening – study. But, regardless of the proof, there's one thing that I simply can't believe, and that is that 50 people could be involved in a conspiracy of that complexity without somebody "blowing" it!

II. Letter to Dr. John Platt, Mental Health Research Institute, Univ. of Michigan, Ann Arbor, Mich. 48104, from John McLeod.

I have just finished reading the *Computers and Automation* reprint of your November 28, 1969 *Science* article (which I somehow missed).

I am impressed by two things: the similarity of our thinking on the subjects which you discussed; and your failure to recognize – or at least to emphasize – the fact that computers, which you acknowledge are a part of the technology that "did not create human conflicts and inequities, but . . . has made them unendurable", might be the most powerful tool at our disposal to "devise new mechanisms" and "better ways of heading off these multiple crises. . .".

I do not believe that "the application of the full intelligence of our society is likely to be adequate" if that intelligence is unaided. I firmly believe that it is beyond the capability of the human mind to assimilate, correlate, recall, and manipulate all the information required to make the intelligent decisions that will be necessary in the crisis situations which you describe. I firmly believe that, by and large, our decision-makers would select the best (or at least better) courses of action if they could thoroughly understand the situations with which they are dealing, and the consequences of their actions – but *first there must be understanding!*

Now I will admit to a strong bias (born of 20 years of experience in the synthesis and analysis of complex systems) in favor of computer modeling and simulation, the latter being the use of the model for scientific experimentation. However, although you call for "inventive minds, who can put together methods, organizational designs, or 'social inventions' " you do not mention simulation by name. So, instead of our looking at what I recommend as simulation, let's look at it as a special kind of information storage and retrieval system.

In this system we will enter all of the pertinent information relative to the problem under study, but we will also enter information concerning how the individual pieces of data are related to, and influence other pieces of data, and on what time scale. Then, although input data will be available for retrieval if desired, the normal outputs of the system will not be this raw data but the *effect* on data of interest when the input data is modified. In other words, the system will answer the question, "what if?". What if some input data were in error?, or what if it were to be modified by changing conditions? You will, of course, recognize the foregoing system as a computer model, and the "what if" exercise as a simulation.

Philosophy aside, the time for action has passed, and very little action has been taken. I stated my feelings on the subject a year ago when I proposed a simulation of the world. Current progress, I think, is rather encouraging in view of the fact that we have had no outside funding. Now, however, circumstances preclude further financial support from Simulation Councils; and how fast we can progress on the basis of the voluntary efforts of the Trustees and others who have expressed an interest remains to be seen. I have, therefore, prepared a preliminary proposal in the hope of obtaining a grant to carry on our work. I would welcome your constructive criticism.

I hope that you will find our efforts along the lines of those for which you have so lucidly called, and that you can be interested in helping us make this project "fly" - *in time!* □

AUTOMATED POLICE STATE

Reprinted with permission from *Dataweek*, Business Publications Ltd., Mercury House, Waterloo Rd., London SE1, England, Vol. 11, No. 10, June 3, 1970.

During May, four students were killed by National Guardsmen at Kent State University in Ohio. Hard-hatted construction workers demonstrating their support for President Nixon in New York City bashed peace demonstrators with lead pipes. At Jackson, Mississippi, two black students died and at least a dozen were wounded when police opened fire on a crowd with deadly 00 buckshot, reaching far beyond self-defense or crowd control. Augusta, Georgia, suffered a Watts-type riot, and before it was under control six blacks were dead, allegedly shot in the back.

Respected American visitors, short haired, capitalist, often Republican, use words like "revolution", "dictatorship", "polarization", in a way that is chilling.

In this context, the innocuous installation of computer systems in Los Angeles and Sacramento to help California law enforcement officers check out stolen cars and suspected criminals brings mixed emotions.

On the one hand, we worry that people will ascribe to the computer great, menacing teeth, and a ferocious snarl that is not at all characteristic of the dumb beast.

On the other hand, we worry that people will *not* comprehend the potential for abuse of a near-perfect, on-line network. It's 14 years yet to 1984, but events in the past year on the social, technical, and ecological fronts make them look like very short years indeed. The power of the computerized information system, and the fear it engenders, may be very strong weapons in the California police arsenal.

The system is admirable, a feat of technology, and it represents a successful merging of private industry and government applications. But great care must be taken to ensure that it works for the good of all.

The message is, don't be afraid of computers, people; just be afraid of people. □

RELIABILITY OF INFORMATION IN C&A — COMMENT

I. From Norwood Jones
Data Processing Officer
First National Bank
El Dorado, Ark. 71730

As a user of Burrough's equipment, I have resolved each time I have read your "Monthly Computer Census" figures to write you. Until now the letter has never been written, but here it is. The method used in listing Burrough's equipment and the data in your "Computer Directory and Buyers' Guide" illustrate a lack of knowledge of their products. I am referring to the models listed as B-100, B-200, B-300, and B-500.

It would be easy for one unfamiliar with Burrough's equipment to believe these were separate computers, when in reality they are variations of the same machine. In fact, the name as often refers to a contract agreement as to a set of machine specifications. For example, I can change my B-300 into a B-500 by signing a new contract while keeping all my present hardware. A similar situation would be to list all the models of the IBM 360/20 series as separate computers.

Burroughs refers to this series of machines as the B-100/B-500 group. The CPU on all these machines is basically the same. The basic instruction set and character representation is identical, but some versions have a larger instruction set and added capabilities. Cycle time is either 10 or 6 microseconds and core memory comes in three sizes: 4.8K, 9.6K or 19.2K.

Your effort in presenting the true pictures of these machines would assist in correcting a distorted image of an excellent machine.

With reference to your list of characteristics of this equipment in your Directory, the following changes need to be made:

(a) Bits per digit = 6.
(b) Digits per Alphabetic = 1.
(c) Word length = 12 digits.
(d) Number of addressable positions in memory = 4.8K, 9.6K, or 19.2K.
(e) Access Time = 6 u or 10 u.

The misinformation on equipment that I know about caused me to distrust your information on the other equipment in your Directory. This is one reason why I did not order it this year.

II. From the Editor

Thank you very much for your most helpful letter.

The processes which we use for gathering information for *Computers and Automation* for such items as the Census and Characteristics of Digital Computers unhappily do not produce the kind of accuracy and reliability we would like. But because most companies treat this kind of information as proprietary, we have to rely on responses to surveys, and on people approving any information we can gather from outside sources. We do try to indicate the degree of accuracy of information for our readers – in the Census, for example, we use various symbols to show the sources of census figures, to show which figures are estimates, etc.

In the 1970 Directory, we will be publishing the Digital Computer Characteristics compiled by Keydata Corp. for their "Computer Characteristics Review". We believe this will be much more accurate and complete. But it is a never-ending struggle to get good, reliable information to publish – and we do appreciate your help. □

SJCC 71 — CALL FOR PAPERS

Dr. Nathaniel Macon
'71 SJCC Technical Program Committee
P. O. Box 30130
Bethesda, Md. 20014

The Spring Joint Computer Conference will be held in Atlantic City, N.J., May 18-20, 1971. The purpose of the technical program at the Conference will be to bring together professional design specialists and users of computer technology, to communicate significant advances and to discuss important issues. Papers are invited in areas of interest such as:

Computers and Elections
Computers and the Media
Data Files Versus People
Education and Training
Historical Perspectives
Law Enforcement and Judicial Administration
Manpower Survey
Techniques and Practices of Embezzlement
Teleprocessing
The Shaping of our Policies
Transportation

All of these topics have hardware, software and systems connotations. We seek an interplay among hardware people, software people, and users.

Participants will be expected to deliver a talk at the conference, provide an abstract for the technical program, and prepare a paper for publication in the proceedings. Deadline for initial submissions is October 9, 1970. Notices of intention to contribute a paper, and inquiries, should be sent to the address above. □

COMPUTERS AND CHEMICAL NOTATIONS

Charles E. Granito, Manager
Information Services
Institute for Scientific Information
325 Chestnut St.
Philadelphia, Pa. 19106

Mr. Wiswesser's article on computers and chemical notations [April 1970, page 35] is a fine contribution, and *Computers and Automation* is to be congratulated for bringing this notation to the attention of the computer world.

The Institute for Scientific Information has for several years provided subscribers to its *Index Chemicus Registry System (ICRS)* with computer tapes containing information appearing in *Current Abstracts of Chemistry and Index Chemicus.* Over 500,000 new compounds in Wiswesser Line Notation (WLN) form have now been covered by this service. In addition, rather sophisticated, though simple to use, software has been developed and tested.

The use of the WLN notation will be further enhanced by the publication of ISI's computer produced and permuted WLN printouts, which will enable even those without computers to do many useful chemical substructure searches. We invite your readers to write us at the address above if they are interested in receiving copies of these printouts. □

C.a NUMBLES

Neil Macdonald
Assistant Editor
Computers and Automation

A "numble" is an arithmetical problem in which: digits have been replaced by capital letters; and there are two messages, one which can be read right away and a second one in the digit cipher. The problem is to solve for the digits.

Each capital letter in the arithmetical problem stands for just one digit 0 to 9. A digit may be represented by more than one letter. The second message, which is expressed in numerical digits, is to be translated (using the same key) into letters so that it may be read; but the spelling uses puns or is otherwise irregular, to discourage cryptanalytic methods of deciphering.

We invite our readers to send us solutions, together with human programs or computer programs which will produce the solutions. This month's Numble was contributed by:

Stuart Freudberg
Newton High School
Newton, Mass.

NUMBLE 709

```
          A B U S E
        X       I S
      = I E R D E I O
+ B U I T W D T I B K D      K R = B U = W R
= W R I T T E N I N T O

31862  36064  77365  87960
```

Solution to Numble 708

In Numble 708 in the August issue, the digits 0 through 9 are represented by letters as follows:

D = 0	A,Y = 5
H = 1	K = 6
L = 2	N = 7
O = 3	T = 8
E,W = 4	S = 9

The message is: "They know as well that do not ask."

Our thanks to the following individuals for submitting their solutions to **Numble 707**: M. Bestgen, Riverdale, N.Y.; Roy J. Boeckler, Milwaukee, Wis.; A. Sanford Brown, Dallas, Tex.; W. S. Butts, Virginia Beach, Va.; Murray A. Chayet, Tucson, Ariz.; H. Royce Culpepper, Jr., Nashville, Tenn.; T. Paul Finn, Indianapolis, Ind.; George Gluck, Rockville, Md.; Hank Green, Durham, N.C.; William A. Leonhardt, Cincinnati, Ohio; Lambert J. Simon, Irving, Tex.; and Robert R. Weden, Edina, Minn. **Numble 706**: G. P. Petersen, St. Petersburg, Fla.

C.a

PUNCH LINES . . .

The very innovation and change of which we as scientists are so proud, has many people running scared. Whereas the world of science lives with change – in the form of new phenomena and new ideas and new techniques as the steady state – people who find their education outmoded and the skills by which they earn their living superseded are not so sure. When the pace and scale of innovation threatens to outrun the adaptability of the social system, there's bound to be some strain. That is what we are feeling now on many fronts. More engineers need to learn how to be persuasive in public debate, how to gain mutual respect and confidence for communications with political arms of government – from lower levels on up. They need to help win understanding of the impact of new developments and to make science an ally of society. When problems become sufficiently clear to enough segments of society, the legislation and other corrective measures that are needed can be passed and enforced.

– *Donald Hornig,*
Vice Pres. and Science Advisor
Eastman Kodak Co.
343 State St.
Rochester, N.Y. 14650

Everyone should have a health data base that is kept as a valuable paper. It should include not only information on an individual's health history and that of his family, but on other factors, such as economic and social, which may affect his well being. Each individual should carry this "problem oriented" record with him so that if he moves or has an emergency the information is readily available. It must be easy and cheap to establish this data base. The collection of information could begin as early as the first grade, when children could answer simple questions about themselves and their families. We must have this information written down, for the human memory is not good enough to accomplish this task of remembering.

– *Dr. Lawrence L. Weed*
Prof. of Medicine and Community Medicine
Univ. of Vermont
Burlington, Vt. 05401

Newspapers will look better and be produced more rapidly and economically in the 1970's. **Almost one-third of the country's 1,758 daily newspapers are now using computers to drive typesetting equipment.** Many are exploring or have adopted offset printing, photographic typesetters, high-speed data transmission, and mailroom automation. Because of this practical experience in changing traditional procedures, the groundwork has been laid for newspapers to utilize advanced communications technology.

– *Richard B. Tullis, Pres.*
Harris Intertype Corp.
55 Public Square
Cleveland, Ohio 44113

The implication for today's violent dissenters is that technology has provided the establishment with a potential for control far exceeding anything in history. Such items as computer bugging, infra-red surveillance (already in use at the White House), monitoring of telephone calls by satellite, introduction of mind control or disorientation drugs into the environment, and the like, already loom on the immediate horizon. **It is time to quit, for continuation of violent protest will only hasten the takeover of technopoly; i.e., the monopolistic domination by technological devices and systems over the thought, feelings, aspirations and behavior of man, and the resources at his disposal.** Perhaps at the community and professional level, channels of analyses and discussion will emerge which will create the constitutional solutions so necessary for the preservation of a system of ordered liberty, in a world rushing headlong toward technopolistic restraint.

– *Prof. Charles S. Padden*
The John Marshall Law School
315 S. Plymouth Court
Chicago, Ill. 60604

While it's easy to see "the knowledge explosion" as a supreme tool, we too seldom see it as a potential tyrant. The hard reality, however, is that in attempting to gather, process, absorb and disseminate information and knowledge today, we find ourselves living more and more in the confusion of tied-up telephones, computer printout, procedure manuals, stacked airplanes, unnecessary correspondence, meetings, mail, memoranda and aging files marked "Must Read".

In one way, the basic problem is similar to that faced a generation ago by nuclear scientists. **Given the inevitability of a force that can be of enormous benefit to mankind, we must still insure and maximize its benefit.** We must impose control on a potentially infinite and uncontrollable chain of reactions.

– *C. Peter McColough, Pres.*
Xerox Corp.
Stamford, Conn. 06903

The strength of the computer revolution is now unmistakable, and within 10 to 15 years, 50 per cent of all workers will be affected by or connected with the computer industry. **Computers need people, thousands every year.** Employers are almost conducting auctions for the services of experienced people – and people with no more than 12 months within the industry are deemed as experienced.

– *George Parkinson, Chairman*
Data Processing Services Ltd.
Stourbridge, England

REGULATIONS FOR INFORMATION SYSTEMS

Prof. Calvin C. Gotlieb
Dept. of Computer Science
University of Toronto
Toronto 181, Canada

"It is possible that introducing regulation and licensing for information systems might exact a price which is unnecessarily high at first, but I prefer to see caution on the side of protecting rights."

Information systems containing data about individuals are needed increasingly in the public sector (census data, tax records, medical statistics, police fields, etc.) and in the private sector (records for banking, credit, insurance, etc.). Governments need these records to carry out their responsibilities; planners and social scientists need them to understand our society and suggest measures to take it in the directions considered desirable; business needs the records for effective operations, service and management.

The Trend Toward Integrated Systems

There is a strong trend towards integrated systems – i.e., systems that contain heterogeneous information about many people and which are accessible to different authorities for different purposes. The ability to gather more accurate and consistent data, and the advantages of lower costs and better coverage, make such systems irresistible.

But our laws offer poor protection against the misuse of such systems. The concept of privacy is very poorly defined in Canadian law. Rules governing which agency may collect what information, how data should be verified and to whom it may be disclosed, exist in only a few situations. As a result the individual is not protected against the misuse of information about him.

Technological advances in storage and communications devices are leading to integrated information systems built around computerized data banks. Availability of terminals and ease of communications increase the danger that data about a person may be distributed without restriction and used for purposes detrimental to his interests. The dangers are often aggravated by an unjustified confidence in data coming from a computer.

Controversy Over Regulation

This chain of reasoning leads to proposals for regulating data banks, for example, by licensing them. Opponents of regulations argue that they are in general addressed to the wrong problem and in any case unenforceable. Proponents argue that it is essential to adopt firm measures before there is an irretrievable loss of human rights.

It is accepted in this paper that some regulation of information systems is required. No new arguments for regulation are advanced. Most people reading this have probably formed opinions on whether privacy is really being eroded. In my opinion the crucial question is: Can *effective* regulations be formulated and enforced?

"In my opinion the crucial question is: Can effective regulations be formulated and enforced?"

Many of the arguments against regulation are based on views that:

Based on a paper prepared for a conference on "Computers: Privacy and Freedom of Information", held at Queen's University, Kingston, Ontario, Canada, May 21-24, 1970.

– information systems are too thoroughly woven into the fabric of our technology to be limited;
– any regulation which would protect privacy would exact unacceptable costs in loss of efficiency and opportunities; and
– some diminution of privacy is unavoidable.

This paper is an attempt to examine goals and to show that adopting measures to achieve them is not impossibly difficult.

Goals

It is not difficult to list goals which are almost truisms. For example:

– The rights of an individual to privacy must be protected as much as possible, consistent with the legitimate needs of society.
– Data concerning individuals must be as accurate as possible.

The problems arise when it is necessary to interpret the meanings of specific phrases such as "individual rights", and "legitimate needs of society", in knowing when reasonable steps to provide protection or ensure accuracy are being proposed.

The first proposition above implies a middle position in privacy vs. freedom of information. It suggests that a person cannot expect to opt out of society by refusing to recognize that some records must be kept about him – for example, birth registration and social security number. But it does assume that there *are* rights of privacy for an individual. Since it is generally agreed that the legal concept of privacy is poorly defined in Canadian law, if at all, it follows that *there must be legislation to define individual privacy.* This is an essential point. If I do not dwell on it further in this paper, it is because I do not regard myself qualified to discuss where in Canadian law such legislation ought to reside – whether it should exist in a provincial law or in federal, or both, and in which sections of the law it would be most appropriate. I hope that very soon specific proposals for legislation will emerge.

Relating a Legal Concept to Rules

A legal concept of privacy, though necessary, is not enough. It is also necessary to consider how the concept should be interpreted when operating information systems. In particular it is important to relate the concept to the rules which those who are responsible for designing, assembling, and maintaining information systems, are to use in handling data. At present these rules are ambiguous. It will be taken as a general goal here that it is desirable to have an explicit statement of how information is collected, how it is verified and to whom and under what conditions it is transmitted, for any information system, public or private. This is desirable even for a police or security information system.[1]

In this paper the emphasis on the phrase *information system,* rather than data bank, is deliberate. Although computerized data banks are coming to the fore, most of the data about individuals is still in the conventional form of files or punched cards. The transition toward systems stored on magnetic tapes, or on magnetic disks which may be attached on-line to a computer, will undoubtedly continue for decades. But to make any regulation effective it must be applicable both now and through the transition period. Regulations must be considered for any information system which contains data about individuals, and not simply for computerized data banks. Since a system which contains information about a person may take a wide variety of forms, ranging from a telephone book to a security file, it is necessary to identify those systems for which regulation might be needed.

"Regulations must be considered for any information system which contains data about individuals, and not simply for computerized data banks."

A Classification of Information Systems

It is proposed here to classify information systems containing data about individuals according to three characteristics, each with two or three categories. The characteristics and categories are shown in Table 1.

Table 1

Characteristic	Category
Data Source	P – public record S – supplied by individual O – other
Distribution	I – internal E – external
Inspection	A – automatic R – upon request of individual F – forbidden

Although the terms used for the categories convey a general sense of their meaning, precise definitions have to be given.

Data Source

For Data Source it is clear enough when the data is supplied by the individual himself, and since "other" is defined by exclusion, the definition hinges on what is meant by public record. This could be defined by listing those sources which were acceptable – for example, public service awards, vehicle registrations, records of criminal convictions, voters' lists, etc. Careful thought would be needed to choose the list and it would have to be reviewed in the light of experience, but there does not seem to be any inherent problem in arriving at a definition.

Inspection

For Inspection the "automatic" category means that a *complete* print-out of the information about an individual is sent to him at specified points either periodically, or whenever a change is entered. In the "request" category there might conceivably be some small fee charged if a person wishes to see his print-out, so as to discourage

[1] An exception must be admitted for those (hopefully rare) systems, for which because of national security, the existence is not made known.

nuisance requests, but there should be no other condition imposed. In particular an individual must be allowed to see the *whole* record (otherwise the category should be "forbidden"), and he should not be required to sign forms which prohibit him from presenting claims for damages arising out of improper operation of the information system.

Distribution

The most difficult categories to define are "internal" and "external", with respect to the Distribution characteristic. Generally internal is intended to mean that distribution of information is restricted to the company or institution which maintains the information system, unless there is explicit permission of the individual about whom the data pertains, in every individual case, to transmit it elsewhere. However, in the case of government, federal or provincial, the organization is so large that it would be necessary to be much more precise than this, if the term "internal" were to have any validity.

Perhaps internal should mean a single department or office. For a company, a decision would have to be made whether various subsidiaries were to be considered internal, and even for a university the question arises whether different faculties and schools are all to be considered as internal to the one institution. If it turned out that it were not possible to define internal distribution with enough precision, it might be necessary to consider distribution for specific items of information rather than for the whole contents of the system. This possibility is discussed at greater length below, but for the moment it is assumed that the categories "internal" and "external" are meaningful.

Some Sample Classifications

Using this system a number of common information systems are shown in Table 2, along with their classification according to Table 1. It will be observed that fourteen of the eighteen possible types occur in this table. This is some evidence that the classification into types is useful. Most of these information systems have a long history of use, and methods for operating them have evolved to minimize problems of verification and accessibility.

In fact problems really arise only for the types OEF and SEF. Regulation of information systems could therefore proceed by first identifying those of type OEF and SEF. For all others, and this would include the overwhelming majority of systems – company payroll files, who's who lists, newspaper morgues, etc. – no regulations would apply. This would in itself encourage those operating systems to make their data open for inspection to the individual concerned, and to restrict general disclosure if possible, so that regulations would not apply.

Where it is judged essential to permit the transfer of records (for example, between one law enforcement jurisdiction and another), or it is judged not desirable for a person always to have access to his complete record (as might be the case with a doctor's report), the conditions for allowing disclosure or preserving security would be spelled out. I repeat that the essential purpose of the classification is to allow attention to be focussed on *any* information system where there are problems of security and disclosure, and not just on computerized data banks.

Table 2

Classification of Some Information Systems

System	Type
Bank Account	OEA
Payroll File	OIR
Who's Who	SEA
Medical Report	OIF
Personnel File	OIF
Police File	OEF
Credit Record	OER
Tax File	OIF
Telephone Book	PEA
Voters List	PEA
Sales Prospects' File	PIF, OIF
Sales Prospects' File for Sale	PEF, OEF
Membership List	SIA, SIR
(Club, Professional Society)	SEA, SER (if given to others)
Newspaper Morgue	OER, OEF
Court Records	PER
Welfare List	OER or OEF
Census Record	SIF
Biographical File of Company	OEA

Security Tags

Although this classification system could be adequate for setting up regulations about information systems, in actual operation it will probably be desirable to make much finer distinctions about categories of data. The most difficult question will continue to be: who should have authority to receive specified items of data? It is impossible to take a simplistic approach on this. Eventually the only satisfactory solution will be to attach security tags to every data field, and use these tags to determine under what conditions the information may be disseminated.

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In simple cases the user's authorization code may be sufficient to determine which fields are available to him; in more complicated situations it may be necessary to set up a table which relates authorization codes to tags.[2] There are definite overhead costs associated with security tags and these are discussed further below. In my opinion it will come to be recognized that these costs must be paid and a security tag system will be a regular part of every information system. But the lack of experience with such systems, and the fact that they are so far rare and would have to be added to existing systems over a considerable period of time, does not make it practical to suggest that proposed regulations on information systems make it necessary to include security tags for data.

Three types of costs will be associated with the regulation of information systems: direct costs, overhead costs,

[2]The IBM manual "The Considerations of Data Security in a Computer Environment" discusses, briefly, authorization techniques and tables (p. 16). See also Ware *et al.*: Spring Joint Computer Conference, 1967, pp. 279-303.

and inhibition costs arising from things which cannot be done.

Direct Costs

It will obviously take funds to maintain regulatory and licensing agencies. Other direct costs to be paid by the purchaser of hardware will be for scramblers, and other devices for protecting information, detecting possible taps on the communication channels, etc. These devices would certainly come into wider use if the operators of information systems were made to take on legal responsibilities for safeguarding data.

Overhead Costs

Overhead costs would arise from the more complicated software systems which would be needed. There would be costs in making transcripts of data available to individuals either automatically or on request, or simply in classifying different data fields and assigning tags to them. Care might have to be taken that this task was not expanded to the point where it had a whole mystique attached to it, as is said to be the case with data classified for military security. There would be costs for storing tags and the time taken to decode authorization numbers and match them against tags.

On this latter point it should be noted that there are already information systems in which a deal of redundant information is carried in the form of tags attached to data fields. In the Marc II system now being adopted widely for bibliographic information, perhaps 10% of the storage is used for tags that identify data, facilitate access and counting, etc. If this type of storage and processing overhead can be built into a system for handling bibliographic information, it is not too much to expect that it will also be built into systems for handling personal data.

Inhibition Costs

There would be inhibition costs because worthwhile activities would be more costly or forbidden. It would be more difficult or even impossible to carry out certain types of planning studies and experiments in the social sciences if access to personal data became more restricted. But we are used to such inhibitions in medical and psychological experimentation involving human beings, where there are very careful legal and other regulations about what may be done, and we accept the necessity for them. We will have to accept similar inhibition costs when using personal information.

"It would be more difficult or even impossible to carry out certain types of planning studies and experiments in the social sciences if access to personal data became more restricted."

Proposals

This paper concludes with three specific proposals which, it is believed, are capable of implementation, and which will have significant effects on the preservation of individual privacy if adopted.

1) **A legal concept of the invasion of privacy should be introduced in Canadian law.**

This should go beyond the present laws on nondisclosure governing lawyers, physicians, bankers, employees, spouses. It should be broad enough to be applicable to situations involving wiretapping, credit bureaus, health information systems, and other types of information systems.

2) **Certain types of information systems should be licensed.**

Legislation could follow the general line suggested in Computers and Freedom[3] and Bill 182[4], and Privacy and Commercial Reporting Agencies. The licensing should be for information systems and not merely data banks, and should be based on a classification which categorizes systems according to their mode of operation. The transition to computerized information systems should simplify the application of controls.

3) **Technical improvements which permit greater security and control over the transference of information should be encouraged.**

Particularly needed are effective techniques for matching data with authorized users, and inexpensive hardware for maintaining security. The encouragement could take the form of research grants on projects and incentives to manufacturers and software companies to develop and market systems, and publicize the methods and devices already known. Systems analysts and designers should use the tools presently available.

Man is learning that not all the effects of technology are beneficial. Our concern over pollution is only one aspect of the review which has to be undertaken about many side-effects of technology. Especially serious are those cases where the processes are almost impossible to reverse. A polluted lake is a much greater problem than a polluted river. I do not feel that we are far along an irreversible process in the way we are allowing information systems to operate now. But it is noteworthy that every review of the tolerance for pollution or radiation leads to a downward revision of the permitted levels.

"Man is learning that not all the effects of technology are beneficial."

I feel that it is possible that introducing regulation and licensing for information systems might exact a price which is unnecessarily high at first, but I prefer to see caution on the side of protecting rights. Experience has shown that overprotection is in fact, very rare. In my opinion if the problems regarding protection of individual privacy are explained to the public, and to those responsible for political and legislative action, and the alternatives are set out, they will be willing to pay the price of keeping our social environment healthy. In fact they may well insist that the price be paid. □

[3] NCP Old Queen Street Paper: 8, Conservative Research Department 1968

[4] An Act to Provide for Data Surveillance, 2nd Session 28th Legislature, Ontario 1968-69

PROBLEMS OF LIABILITY FOR THE EDP SERVICES INDUSTRY

Milton R. Wessel
Kaye, Scholer, Fierman, Nays and Handler
425 Park Ave.
New York, N.Y. 10022

I believe that the decade of the nineteen seventies will see a broad expansion of the liability of the EDP services industry's to all whose lives and businesses it affects. This liability will be founded upon new and far-reaching socio-economic considerations. The companies which fail to recognize this and take protective action may well be among those which do not survive.

Fundamental Shifts in Society

Any discussion of this industry's liability problems during the next decade must be predicated in large part upon an evaluation of what is happening in the streets and on the campuses. Protests regarding Southeast Asia and war generally, ecology, civil rights and poverty are not simply the passing fancies of a bunch of kids or hot-headed radicals, but a reflection of fundamental shifts in our society which are changing all the rules.

Already we have witnessed many of the incidents of private property, until recently a sacrosanct legal cornerstone of democracy and its free enterprise system, give way to a host of intrusions based upon social considerations. No longer can one be secure that he will be permitted to do what he wants, when he wants with what he owns. If you don't agree, ask Consolidated Edison of New York, or General Motors, or the owner of a restaurant in Macon, Georgia, or a home in Chicago.

Similarly, the former economic touchstone of gross national product is beginning to yield to considerations of quality and ecological preservation, and we already have a new concept of "net" national product, deducting pollution and depletion, with economic and social objectives modified as a result.

Milton R. Wessel is a law partner in the New York firm of Kaye, Scholer, Fierman, Hays and Handler. He is also attorney for the Association of Data Processing Service Organizations (ADAPSO), and he represents the American Federation of Information Processing Societies (AFIPS).

And so it is all along the line. One has only to examine the decisions of the United States Supreme Court in a variety of areas since the nineteen fifties – civil rights, criminal prosecutions, even the Association of Data Processing Service Organization's (ADAPSO's) bank case extending the citizen's right to call government officials to account – to see the legal consequences of these enormous changes.

The law is in fact developing rapidly, to reflect this economic, social and political revolution. And nowhere are the changes in the law during the seventies likely to be more dramatic than in the EDP services industry, for it is a new one having major societal impact where these modern developments do not meet the resistance of history and tradition – what lawyers call *stare decisis* – to the same extent as in older established industries.

Liability to the Public

Industry problems of liability during the 1970's can be considered in terms of the two major groups to which liability extends: (1) the public (including governments and competitors); and (2) those with whom the industry has contractual relationships – customers, owners, employees and suppliers. A recent decision, the impact of which has not yet been fully appreciated either in industry or legal circles, may be helpful in furnishing an overview of the current and anticipated broadening of liability to the first of the groups to which industry liability extends, the public.

A Kentucky citizen, John T. Swarens, purchased an automobile on credit through the Ford Motor Credit Company. He paid his monthly charges, but the inevitable error occurred and collection agents visited. Swarens satisfied them by exhibiting cancelled checks. The visit was followed by a second, and Swarens again showed his cancelled checks. But on the third visit, Swarens exhibited only his shotgun and chased the men away, unsatisfied. Ford seized and sold the vehicle, and Swarens brought suit for compensatory and punitive damages. A jury, sustained all the way through, awarded Swarens his full damages plus 250% in punitive damages, a quasi-criminal type of punishment. The Kentucky Court of Appeals went out of its way

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in a final paragraph to make clear the obligations being imposed upon EDP service organizations. It said:

> Ford explains that this whole incident occurred because of a mistake by a computer. Men feed data to a computer and men interpret the answer the computer spews forth. In this computerized age, the law must require that men in the use of computerized data regard those with whom they are dealing as more important than a perforation on a card. Trust in the infallibility of a computer is hardly a defense, when the opportunity to avoid the error is as apparent and repeated as was here presented. 44 S.W.2d 53, 57 (Oct. 17, 1969)

It is significant to add that despite much talk, no legislature has yet imposed a statutory obligation upon computer users to interpose such human judgment between computer and public. *Swarens* is thus far more important in its general teaching than in its specific ruling, for the court imposed the obligation on its own, even authorizing sanctions criminal in character. By parity of reasoning, computer services companies which feel secure on the privacy issue must take note, despite their success thus far in blocking any statute giving individuals the right of access to data banks or imposing additional statutory liability for disseminating erroneous information. In a proper case, I predict that a court will take this action on its own without a statute, based upon the expanded social concepts which are entering the law.

"It is significant that despite much talk, no legislature has yet imposed a statutory obligation upon computer users to interpose human judgment between computer and public."

In an effort to avoid liability, EDP services organizations should, individually and through groups, introduce measures which will: (1) guard against the dissemination of erroneous information from a data bank; and (2) permit members of the public in appropriate circumstances to obtain assurances concerning their files. The ADAPSO Board of Directors has the matter of privacy and related problems under intensive consideration, but up to this time neither it nor any EDP services organization has taken action.

Impact on Licensed Professionals

As EDP services continue to expand – and despite the gloom, the present financial crisis is temporary and profitable expansion *will* return – their impact upon the licensed professions such as accounting, engineering and even medicine and law will increase. I believe that intensified regulatory activity will result during this decade, including injunctive and punitive action against services organizations for unlawful practice. The wise services organization will exercise caution in these areas, as well as take preventive action such as by appending the disclaimer recommended by ADAPSO to its reports.[1] I regret having to report that only a handful of companies have yet done so.

Concentration of Services

Industry economic forecasters are agreed that the present trends towards concentration of EDP services into fewer but larger economic units and proliferation of communications applications, will accelerate during the seventies. As services organizations thereby become regional and national rather than strictly local units, their activities are bound to become subject to closer antitrust scrutiny, both by public enforcement agencies and private parties seeking the windfall of treble damages. Liability for violation of the antitrust laws can be huge, not just in terms of damage recoveries, but also because of the enormous direct and indirect costs that litigation of this kind inevitably generates.

Despite restrictions seemingly imposed by the United States Supreme Court, I believe that the application of the related state laws of unfair competition[2] will probably continue to be intensified in this decade as they have been for some time now, with the result that the industry will

also experience increased liability to competitors for conduct such as alleged theft of trade secrets or interference with advantageous commerical relations.

On the plus antitrust side, I predict that the Robinson-Patman Act provisions relating to price discrimination will continue to enjoy the disrespect of most antitrust authorities, and that it will not be extended either by statute or judicial construction to apply to purely EDP services.

Liability to Customers

The liability of manufacturers and suppliers generally to their customers has been expanding for a half century and more, and the decade of the 1970's will also see the EDP services industry's liability to customers extended far beyond anything which presently exists. A Minneapolis decision, now on appeal, imposed an almost one-half million dollar liability on a service center despite written contractual disclaimers, and without any proof of *scienter* or

"A Minneapolis decision, now on appeal, imposed an almost one-half million dollar liability on a service center despite written contractual disclaimers, and without any proof of specific intention to misrepresent."

specific intention to misrepresent. A Los Angeles decision, subsequently withdrawn but still significant as suggestive of the trend, sustained a customer's right to sue for one million dollars punitive damages for improper service. These reveal only the top of the iceberg, for underneath lies the possibility of what lawyers call "secondary" or "consequential" damages. One large brokerage house, in folding, blamed its problems in large part upon computer difficulties. The losses to the brokerage house alone were catastrophic; but in addition, the threat of claims by customers who were injured or by the stock exchange which covered some of the losses, has been posed and cannot be ignored.

The former legal rule of *caveat emptor* – "let the buyer beware" – meaning that a seller could say pretty much what he wanted without liability, is already well on its way out, and is being replaced by a variety of both judicially-imposed and statutory sanctions protecting the consumer. I believe that this trend favoring the consumer will also be accelerated during the seventies, especially in the EDP services industry, to be replaced by presumptions and rules such as *res ipsa loquitur,*[3] placing a heavy burden of responsibility on the vendor of services. Last year a Minnesota legislator introduced a statute which provided:

> Whoever is injured ... [by computer error] ... shall recover therefor *unless* the person who caused the injury establishes that he was not negligent.

ADAPSO reacted immediately and positively as it should have, and the statute was defeated. But the result was only to gain time, not ultimate victory, for I predict that in a proper case, a court without a statute will impose liability on just this theory, in effect shifting the burden of establishing proper conduct on to the members of this industry.

The answer to all of this? Contractual disclaimers and the errors and omissions insurance coverage soon to be offered through ADAPSO will be helpful. But first and foremost EDP services organizations must furnish high quality service, so that there are as few errors as possible. In addition, however, because errors are inevitable in a commercial environment where costs are relevant, caution also

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suggests fair dealing with customers through such means as the circularization of the ADAPSO position paper on error-free servicing, designed specifically to guard against this kind of liability. The EDP organization which sends the ADAPSO paper out to customers, has a useful defense to any claim of misrepresentation by one of its employees, for the paper itself constitutes evidence that the customer should not have relied on an obviously unauthorized representation. Here again only a few companies have followed this procedure, in spite of the fact that the organization which fails to send out the paper will have a far heavier burden to satisfy when a client refers to a salesman's promise, and then proves that the company failed to follow industry suggestions to disseminate this paper.

Liability to Shareholders and Owners

The period since World War II has seen a broad expansion of the liability of directors to shareholders, partners and other owners; although individual director liability is not asserted, the EDP services industry already has a three-quarter billion dollar derivative stockholder action pending for failure to take action to protect the interests of owners.[4] I predict this area of liability will also be greatly extended in the seventies, accompanied by an expansion of enforcement activity by the Securities and Exchange Commission (SEC), as soon as that much harassed agency is able to get some of its more current and urgent problems under control.

Statutory Software Protection

The EDP services industry is characterized by huge investments in software, on the values of which stockholders and owners rely. During the 1970's, there is likely to be established a new statutory form of software protection unlike copyrights, patents and trade secrets, although combining some portions of each. Reliable legal protection for software under any circumstances, however, is still some years off.

"Reliable legal protection for software is still some years off."

Today, decisions of the Supreme Court suggest that even trade secret protection may be in danger. The recent write-offs by industry giants of millions of dollars of

intangible software investments, because they proved worthless, are small compared to the losses which would result from invalidation of trade secret protection. There is an obvious exposure to personal liability to stockholders for failure to disclose the possibility of such write-offs or losses based upon presently existing legal impediments which should have been recognized. The answer? Fair disclosure, and far greater caution in valuing intangibles.

Let me add parenthetically in connection with relationships with owners, that the present financial crunch has made the raising of money extremely difficult and in many cases impossible, with disastrous consequences. This industry can no longer expect the public funds so sorely needed for expansion to be channeled to it whenever requested, on the expectation of huge multiples of earnings. In addition to a return to the fundamentals of sound economic growth and true (as distinguished from purely accounting) profit, and attention to all the common alternatives of financial planning, it must pay attention during this decade to the special financing techniques which have been used so successfully in some other industries, and which have made them far more attractive than this one to many sophisticated investors.[5]

Liability to Employees

During the seventies, as mass production techniques grow – and they must and will if the industry is to prosper – organized labor will enter the industry. It has already done so in a few cases. The EDP manager must know how to deal with it, or he will have added just one more problem to those which he already faces. He should be especially alert to the legal requirements in this field, and companies should work together to counteract the union strategy of "divide and conquer".

It seems fair also to anticipate that as population increases, the economy expands, and concepts of freedom mature further, employment restrictions will be more difficult to enforce. Covenants limiting an employee's right to approach customers or otherwise compete during the next decade will be even more confined in space and time than they are today.

Moreover, as the industry grows during this decade, enforcement of the Fair Labor Standards Act and similar wage, hour and working condition statutes will become more intensive, perhaps on the basis of a single-industry campaign. This has been the experience in other new or developing industries; the liability for failure to adhere to these laws can be substantial. The industry must also be alert to the possibility of increased governmental and private enforcement of the civil rights and equal opportunity laws, especially as even the smaller services organization becomes no longer a local enterprise.

Liability to Suppliers

I have kept discussion of liability to suppliers for last, because it is the one area about which I am most optimistic. The chances are that during the 1970's the increased liability of suppliers to the EDP services industry will far outpace any increase in the industry's liability to suppliers. I believe also that irrespective of their outcomes, the pending antitrust litigations will result as a practical matter in significant competitive benefits to this industry. Indeed, some of these benefits may already have been experienced.

But still a word of caution, added with some trepidation out of fear of being misunderstood because of the strong feelings about IBM held by so many: Too many in this industry blame IBM and SBC for their own commercial failures, and file suit as proof – I count nine major suits against IBM alone and threats of many others. The courts will ultimately determine the merits of these cases, and I certainly am not perspicacious enough to predict their outcome. But the EDP manager who regards any litigation as a substitute for proper operation of a business does so at his own peril.

"The EDP manager who regards any litigation as a substitute for proper operation of a business does so at his own peril."

Conclusion

What does all this add up to? The EDP services industry will finally grow up during the seventies, in a legal environment in which the rules are not yet defined. However, it is clear that fundamental principles of integrity, quality and the like are going to become more and more dominant. Professionalism and ethical practices are not just moral commitments; they are sound as commercial judgment as well.

I believe that in the seventies industry liability will be broadly expanded. It will be predicated in large part upon morality and ethics, which are far better measures of legal standards of conduct than some of the conceptual considerations of the past. Viewed from afar and *very* long range, this can only be good, and the EDP company which attends properly to its affairs and survives will be a better one for it. □

References

1. The disclaimer recommended by ADAPSO states: "The foregoing presentation has been processed electronically by computer from data furnished to us, has not been analyzed by professional [accountants] [engineers] [architects] [doctors] [lawyers] or other persons purporting to have expert knowledge of [accounting] [engineering] [architecture] [medicine] [law] and is furnished without [accounting] [engineering] [architectural] [medical] [legal] opinion of any kind.

2. A federal law of unfair competition may even be enacted. The former Lindsay Bill is now being revised by a National Coordinating Committee of lawyers from the American Bar Association, the United States Trademark Association, and other bar associations, in consultation with the Antitrust Division of the Department of Justice.

3. Meaning that in the absence of a contrary explanation, certain conduct will be presumed to have been the result of negligence. Literally, "the thing [conduct] speaks for itself".

4. Although this article is concerned only with substantive liability problems, the industry's exposure will also undoubtedly continue to be enlarged during the decade as the result of broadened procedural remedies such as the class and citizen's actions. ADAPSO's bank litigation, in which the United States Supreme Court enlarged the standing to sue concept, is a good example.

5. e.g., the "tax shelter", which is particularly suitable to the EDP services industry and has given it an as yet untapped, but very real, financial competitive advantage because of limitations imposed on other industries by the Tax Reform Act of 1969.

SYSTEMS TEST

Dwight M. Frazier, Jr.
IBM Corp.
P.O. Box 12195
Research Triangle Park, N.C. 27709

An article in the *Harvard Business Review,* January-February, 1968, reads: "The most successful U.S. manufacturers today are making much greater and more sophisticated use of the computer than they were just three years ago. The day may not be far distant when those who analyze business failures can add another category to their list of causes – failure to exploit the computer."

To "exploit the computer," many modern corporations are installing, or planning to install, very complex interplant, inter-divisional, computer-oriented data processing systems which will serve management at all levels, from manufacturing supervisors to corporate presidents.

Design and Development Costs

Thousands, even millions, of dollars are being invested in the design and development of such systems. When installed, the output from these systems is used to make vital decisions which can mean the success or failure of a corporation. Management *must* be able to assume that the information from these systems will always be available and will always be correct.

Dwight M. Frazier, Jr. is an associate programmer at IBM's Systems Manufacturing Div. facility. He was graduated from East Carolina Univ. in 1963 with an A.B. degree in mathematics and a minor in physics. Prior to joining IBM in 1968, he was a programmer-analyst with the Carolina Telephone and Telegraph Co. in Tarboro, North Carolina, for three years.

After installation, what happens if the new system stops working, even for a short period of time? Old systems have been discontinued, and no decision-making data is available. An even graver situation would be an undetected malfunction. Decisions based on incorrect data can be and likely will be wrong, resulting in time, manpower, and dollars lost or wasted.

Since today's fast-moving, fast-changing and highly-competitive environment demands the exploitation of the computer for the development and installation of modern data processing systems, how can needed systems be installed and the undesirable consequences such as those mentioned above be avoided? I believe the answer is a step which is often not formally included in the development plans for computer-oriented data-processing systems. This step is called "systems test."

What Is a Systems Test?

Systems test is a test of all the computer programs and associate procedures which make up a computerized data processing system. Its purpose is to insure that they fit together and perform as specified in pre-programming plans (User Manuals, Design Specifications, etc.).

What can a systems test do for you? To help answer this, let's look at an experience which occurred in an IBM manufacturing plant in the southeastern United States. This plant's Systems and Programming department was assigned responsibility to develop a data processing system which could be installed in nine of the corporation's manufacturing plants. They were located in many sections of the United States and one was in Canada. This system was to control orders and bills for certain customized products whose sales amounted to millions of dollars each month.

The orders were received at each plant from the corporation's sales division, whose offices were in every state, and several foreign countries. The billing information was to be returned to the sales division at a central location via magnetic tape.

Approaching Perfection

Management concluded that, to install such an interplant, inter-divisional system at remote locations, the system itself must very closely approach perfection. To guar-

"It is quite possible that without a good system test, some projects may incur installation problems and be scrapped unnecessarily because of misunderstandings, lack of education, and a natural resistance to change."

antee this perfection, systems test was included in the development phase for this system. It was to last three weeks, and was to be performed at a location other than the developing or installing plants. Installing plants were to send representatives (both user and programming personnel) to review the system, watch it operate, and examine the test results. The installing plant's representatives were to have the responsibility of determining if the system could or could not be installed and made operational in their plant's environment.

The developing plant assigned impartial personnel the responsibility of preparing for this systems test. Plans were developed and test data were prepared. Most of this test data was run through the system at the developing plant to help programmers unit-test (a test of an individual program) their programs. By doing this, many "bugs" (errors) were discovered, and corrections were made before the official three-week systems test began.

Success of the Test

Once the systems test began, and logistics problems involved in assembling and making lodging accommodations for fifty or so people had been solved, things went quite well. Every plant reviewed the structured test and added additional test cases. Some even ran sample live data through the system.

Program errors were discovered and fixed. Sign-offs were received from all plants stating that the system could be installed and made to operate in their environment. In fact, all plants were running live with the new system within six weeks after the completion of the systems test.

This example shows the importance of a systems test and what role it can play in the development cycle of a large, sophisticated system. However, this was only one system and only one systems test. The following is a list of benefits which can usually be derived if systems tests are properly planned and executed:

1. **More Reliable System** – During the systems test, many errors (hopefully all) will be discovered and fixed. This can greatly reduce the parallel run time necessary after installation. Also, some of these errors will probably be the type that could go undiscovered for years under normal production conditions. Errors discovered and corrected beforehand will therefore not occur after installation, when they may result in time, manpower and dollars lost or wasted.
2. **Education and Training** – To prepare the test data or examine the results, one must become thoroughly knowledgeable about the system. He is forced to read and understand "User Manuals" and "Design Specifications" to learn how to use the system, how it is maintained, what it does with the data, and how its output is to be interpreted.
3. **User Involvement** – Because he is preparing test data and examining results, the user becomes acquainted with the system prior to its installation. Otherwise, the testing responsibility is usually left entirely up to Systems and Programming personnel, who often dislike the task and often do not do a thorough job. Now, instead of having to use a system tested entirely by someone else, the user is able to use a system he has helped test.
4. **Increased Confidence** – Because users have been involved in the testing of the system and have helped make it operate successfully, they will not hesitate to use the system after it is installed. Their confidence in the system is greatly increased.
5. **Diagnostic Test Deck** – This can be condensed from the system test to be used for a quick system check-out when future program changes or modifications have to be made.
6. **Common Programs and Common Documentation** – If the system is to be installed at other locations, this becomes a very important benefit. At the end of systems test, all programs and documentation must be updated to the latest level and released. In this way, all installing locations know what the latest level is and can be assured of receiving it.

Systems Test Guidelines

Systems tests must be designed to fit the system that is being tested. Since all systems vary in purposes and complexities, no two systems tests will be exactly alike. However, there are certain basic rules and guidelines which should be followed to develop and execute a successful systems test. They are as follows:

1. **Organize a "test team"** as soon as design specifications have been completed. It should consist of representatives from Systems and Programming and from the user areas. This team should report directly to management which is in control of systems and programming and user areas. A chairman should be elected or appointed, and a regular meeting schedule arranged. The following is a list of recommendations for test team activities:

A. **Study Systems Flow** – What programs make up the system, and in which sequence are they executed?
B. **Study System** – What is put into system, and what comes out of system? What does each program in the system do to the data? Usually it is a good idea to look at system output first, then to go back through every program in the system to determine what the original input must be.
C. **Examine System Environment** – What type of hardware (computer) is the system going to be run on? What type of input and output devices will be utilized (cards, disks, tapes, video display, etc.)? What types of software (programs which control the computer) will be utilized?
D. **Prepare Test Plans** – What test cases and runs will be necessary to properly test the system? on what dates will these runs be made? Test plans should be considered very carefully. The test cases themselves will actually determine how good the test is, and the dates will be used as targets which must be met as the test progresses. Any slippage in these dates will also mean a slip in the system's installation.
E. **Design Forms** – Forms will furnish input data, and will document expected results. What happens to this data after it goes into the system? Does it come out on a report or go into a master file for on-line retrieval later? Over-lay forms (foils), which will facilitate the reading of non-formatted computer outputs (data set dumps, etc.), are often very useful time savers. As the test progresses, errors will be discovered in programming and documentation. They must be controlled. This establishes a need for a vital form, the "trouble report".
F. **Establish Control Procedures** – These should be used to handle various trouble reports which will arise during the testing of the system. The status of these trouble reports must be known at all times. When was it received? What program was affected? What was the level of the program? Who is working on the problem? Once the problem is fixed, the trouble report must be returned to the originator with an explanation of what corrective action has been taken.
G. **Establish Control Center** – To control (1) flow of data between computers and test team, (2) system level, (3) program levels within system and (4) Trouble Reports. Without a centralized control center to handle these functions, the system may get out of control and may never be brought to successful completion. This control center should be manned by members of the system test team. For examples of Control Documents see exhibits 1, 2 and 3.

2. **Centralize Final Phase of Test** – Bring together at a central location representatives of all installing or using locations. With the developing department's systems analysts, programmers and test team to review systems test results, installing and using representatives may consist of both user and programming personnel. The customers should now be able to add additional test data if it is deemed necessary. However, be wary of attempts to foil the system with unrealistic data (outside the specifications), which could prolong the test cycle without accomplishing anything really valuable.

At this time the control center becomes a very critical part of systems test. Its role is increased to control flow of data between computer, test team, and installing or using representatives.

3. **Obtain Sign-Offs** – At the end of the final systems test phase, all installing locations or customers should be required to sign a document stating that the system does, or does not, operate according to specs and is, or is not, installable. Even though the system may not do everything that users now want it to do, it must be installed if possible. Otherwise desired modifications and changes could keep the system from being installed indefinitely. Desired modifications and changes should be documented as possible updates to the system after its installation. If the sign off concludes that the system does not operate according to specs and cannot be installed, the problems should be documented in a written letter to the developing project manager with a copy to all responsible management, including the corporate president.

An economic evaluation of the problems and possible solutions should be made, and either a redevelopment cycle scheduled or the system scrapped.

Economic Justification

The cost of a good systems test will vary from system to system, depending upon variables such as amount of test data necessary, manpower, etc. Actual dollar savings as a result of the systems test may be impossible to calculate accurately. However, the savings resulting from a short installation time, elimination of bad decision-making data, elimination of down time and maintenance time after installation, etc., will certainly repay the cost many times. It is quite possible that without a good system test, some projects may incur installation problems and be scrapped unnecessarily because of misunderstandings, lack of education, and a natural resistance to change. This results in a one hundred percent loss of the development cost and still leaves the corporation without the needed system.

Summary

To exploit the computer, corporations need to develop and install computer-oriented data processing systems. However, before installing a computer-oriented data processing system, the corporation must be reasonably certain it will work correctly. To do this, every system should be required to clear a final hurdle before installation – the systems test. If this hurdle is cleared successfully, then the system is declared sound and installable. If not, the system cannot be installed and must be either reworked or scrapped. Regardless of the results, the systems test has worked toward the good of the corporation. □

THE USER/MANUFACTURER INTERFACE

David F. Stevens
Lawrence Radiation Laboratory
Bldg. 50A, Rm. 1135
Univ. of California
Berkeley, Calif. 94720

"The user must recognize that some change is inevitable; the manufacturer must realize that not all change is desirable."

The relationship between the manufacturer of a computing system and its users was, until recently, a reasonably well-defined, if somewhat nonproductive, affair. Unbundling, however, has introduced a measure of uncertainty into that relationship, and the resulting turbulence may provide us with an opportunity to redefine it (the relationship) in a manner profitable to both parties. The purpose of this article is to examine the current state of this uneasy alliance and to suggest how it can be improved.

A Parable

That a certain amount of friction has always existed between manufacturer and user is clear from the following story told about the first installation of a large scale system. Since it was, in fact, the first system, it was quite simple. The manufacturer was rather tractable by today's standards: there was only one portion of the system he insisted that the users not diddle – a particularly critical tree structure. But this, of course, was too much for one of the more subtle graduate students, and he convinced the junior systems programmer (there were only two: it was a small installation) that a small change would surely not be disastrous. The manufacturer discovered the change and closed down the installation, driving out the programmers; also, being rather old-fashioned, he laid a curse on the graduate student: "... dust shalt thou eat all the days of thy life" .... Now this was perhaps over-reaction on the part of the manufacturer, but his attitude is illustrative of current attitudes, and users' behaviour certainly hasn't changed at all.

One result of the long cold-war which manufacturer and user have continued to wage against each other has been a self-reinforcing hardening of attitudes, in which each side has created an uncomplimentary stereotyped image of the other and then, to a certain extent, adopted, as a model for its own behaviour, the stereotype created by the other side. Our examination of the current state of the interface begins with a consideration of these stereotypes.

The Manufacturer as Seen by the User

The manufacturer, as seen by the user, is *possessive:* the system is his product, and his pride of creation is inordinate. Because it is his creation, he refuses to recognize its shortcomings or failures. Discrepancies between specifications and product are often eliminated by changing the specifications (the product, being created perfect, is beyond change). Also, during those sensitive formative months when the product is developing, it is jealously screened from all contact with the world, lest reality should accidentally shape that development. Requests by prospective users for any level of detailed information are promptly and firmly denied.

To the user, the manufacturer is *myopic:* his vision is limited not only in distance, but also in direction (he has tunnel vision). He fails not only to foresee the users' future needs, but also to foresee the uses to which they will put his current products.

"The user feels that the small additions which the manufacturer does adopt from him are often accepted in the same spirit of amused toleration with which one accepts a mud pie from a four-year-old."

The manufacturer is also *condescending:* he knows that he has nothing to learn about computing from the user, and that therefore he is able to create, in a communications vacuum, products of universal utility. What small expertise the user has he acquired from the manufacturer, and it is several years out of date. The user can create nothing of his own, worthy of notice by the manufacturer, and those small additions which the manufacturer does adopt are often accepted in the same spirit of amused toleration with which one accepts a mud pie from a four-year-old.... One especially notices that the toleration becomes ever more strained with each succeeding offering.

To the user, the manufacturer is *overconfident:* he overestimates the performance of his products and he underestimates the time it will take him to deliver them. (There are some users who would state this particular case more strongly; they see the manufacturer as *misleading:* he overstates the performance of his products and he understates the time it will take him to deliver them. The difference is one of intent. I take the more optimistic view here because if the other is, in fact, the true state of affairs, then there is little hope that any measure of cooperation between user and manufacturer can ever be achieved.) He assumes that they will work as advertised. He assumes that he has solved the problems of the world, and that his products will need little correction, less modification, and no extension.

Finally, the manufacturer, to the user, is a *radical:* he subscribes to the Detroit philosophy of planned obsolescence, change for the sake of change. Good programmers are creative people, and he must allow his programmers to express themselves. (That this frequently imposes a distasteful burden upon the users' programmers is unfortunate, of course, but it can't be helped.) Furthermore, it is in his interest to keep the users somewhat off-balance and hence somewhat dependent upon him.

The User as Seen by the Manufacturer

The user, as seen by the manufacturer, is *possessive:* the system is his by purchase or lease; possession is nine points of the law. He is unwilling to relinquish one memory cell, one storage cycle, no matter how great the benefit. It must be made to work in accordance with his conception of how a system should work regardless of whether his concepts were designed into it or not. Since the system is his, its past and its future must be his also; his curiosity about these matters is insatiable.

To the manufacturer, the user is *visionary:* his estimates of the cost (to the manufacturer) of a "minor" change in direction are unrealistically low; his estimates of the benefits to mankind of the implementation of his pet project are unrealistically high. He ignores side effects.

"To the manufacturer, the user's estimate of the cost of a "minor" change in direction are unrealistically low; and his estimates of the benefits to mankind of the implementation of his pet project are unrealistically high."

The user is also *self-important:* his problems are the most important problems in the world, and should be solved first; his solutions are the most promising, and should be tried first. Whatever is in his interest is in the interest of the whole universe of computing. Features he does not use are barnacles on the ship of progress. His is the one clear voice of truth amid the constant tumult and the shouting.

The user, to the manufacturer, is *implacable:* he is unforgiving, vindictive, and possessed of a very long memory. The slightest delay is intolerable, the tiniest imperfection is inexcusable, the least hint of change in specifications is totally unacceptable. The user is an expert in the creative interpretation of reference documentation, and unrelenting in his efforts to secure the realization of his inferences. He is no less skillful in the creation of iron-clad contractual commitments out of preliminary, tentative, incomplete, and inaccurate data.

Finally, the manufacturer sees the user as an *archconservative:* he resists progress at every level if it involves change. ("The old ways are the good ways.") Technological improvements are complications to be mistrusted: old, familiar, trusted tools are not to be abandoned, no matter how much more potent their replacements are. The game is never worth the candle.

Who Is Which?

It should be emphasized that these stereotypes have broad applicability: the term "manufacturer" is not limited to "hardware manufacturer" any more than the term "user" is limited to "occasional Fortran or Basic user". In fact, most people involved with computing alternate between these roles, sometimes with bewildering rapidity in the course of a single conversation.

The lines are most firmly drawn, however, and the stereotypes most firmly entrenched, at two levels (both of which exist in almost every shop): the interface between the outside vendor and the systems programmers, and the interface between the systems and applications programmers. One result of this situation might be that systems programmers, having a foot in each camp, serve as conciliatory agents. They might, when dealing with the outside vendor, remember that they, too, have delivered late; that their own products have been released with live bugs; that their own documentation has been incomprehensible or non-existent. Remembering these things, they might react with sympathy and understanding. They might, when dealing with the applications programmers, remember that they, too, have resisted change; that their own programs have failed to run on new releases; that the documentation they have received has been incomprehensible or non-existent. Remembering these things, they might react with sympathy and understanding.

But of course they do not. They remember, certainly, but instead of acting as filters they act as amplifiers. The abuse hurled at them by the applications programmers is hurled with increased vigor at the vendor; the scorn heaped upon them by the vendor is heaped even higher upon the applications programmers. The process is iterative and with each iteration the stereotypes become ever more firmly entrenched and reality approximates the stereotypes ever more closely.

Changing the Image

It is clear from the above that the relationship between user and manufacturer has become a combative one – highly ritualized, it is true, but combative nonetheless. It will continue to be combative until the pejorative stereotypes have been replaced by more cooperative models, for the user as well as for the manufacturer. The substitution need not be instantaneous, but it must be undertaken by

"The relationship between user and manufacturer has become a combative one – highly ritualized, it is true, but combative nonetheless."

both parties or it will be ineffective, incomplete, and quite temporary. The models suggested below may not be optimum, but they are steps in the right direction.

The attitude a manufacturer adopts towards his creations should be somewhat akin to parental pride, remembering that good parents recognize and treat illness and injury. Good parents foster the development of their children (and much development takes place outside the home), and recognize that they have limitations beyond which they should not be pushed. The users, on the other hand, should recognize that children are often recalcitrant, and usually require some training before they are capable of behaving properly away from home.

Standards of Communication

User and manufacturer need to adopt standards of communication not involving ritual attack and defense. The manufacturer should seek the users' advice before he fixes the specifications of a new product; he should recognize that users have a legitimate need for advance information. Users should remember that advance information is often inaccurate or misleading, and should accept that risk when they accept the information. Dialogue concerning bugs should be undertaken with the object of improving the product, not as exercises in invective (by the user) or skillful evasion of responsibility (by the manufacturer).

Both manufacturer and user need to broaden their perspectives: The manufacturer needs to recognize that the users harbor a wealth of experience and expertise which could be tapped, if the manufacturer would make the effort. The users need to recognize that the manufacturer must be responsive to other users with other priorities. Both user and manufacturer should try to look at things from the other point of view before criticizing.

Progress Exacts Its Toll

Finally, user and manufacturer should work together to define and regulate the development of the product. The user should recognize that improvement is rarely achieved without some sacrifice, that progress exacts its toll. The manufacturer should recognize that change must be justified, and that his estimate of the cost of the change should include the cost incurred by the users in adopting it. The user must recognize that some growth (change) is inevitable; the manufacturer must realize that not all progress (change) is desirable. User and manufacturer should agree upon which changes should be provided by the manufacturer and which should be left to the user. The manufacturer must expect the user to make some changes; those areas where changes are likely should be designed to simplify their installation. The user who makes such changes must be willing to accept the non-conformity he has thus created.

In brief, both the user and the manufacturer need to grow .up a little. The present struggle is fun, but it is childish. There is much loose talk about the coming-of-age of the computer (which is a far different thing from the coming age-of-the-computer): The computer cannot achieve maturity until those who direct it do. □

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C.a

PROBLEM CORNER

Walter Penney, CDP
Problem Editor
Computers and Automation

PROBLEM 709: SQUARES – OR SOMETHING

Harry was beaming as he punched the keys of his trusty desk calculator. "I'll have to publish this," he said, "I've never seen it in any mathematics book."

"What's that?", asked John, "Did you prove Fermat's Last Theorem or something?"

"Something, all right. I've been calculating factorials and subtracting each one from the next larger square. And what do you know – every difference is a square. At least for N greater than three."

"Are you sure that isn't just coincidence?"

"Coincidence? I'm up to 10 ! and everything's working out right. 10 ! is 3,628,800; subtract that from 3,629,025 which is 1905^2 and you get 225 which is 15^2. Likewise 9 ! is 362,880; subtract that from 603^2 and you get 729 or 27^2. And so on down the line."

"Yes, you've got something there, all right, but I'm not sure what."

"All right," said Harry. "I'll work out one more case on this cement mixer, and if it's O.K., I'll write a program for the first 100 factorials. Here goes 11 !"

"I'm still skeptical," said John.

Has Harry stumbled onto something big?

Solution to Problem 708: A Coin Tossing Program

The average number of tosses for H H H is 14 and for H T H is 10. The number of ways of getting H H H on the third, fourth, . . . toss is 1, 1, 2, 4, 7, 13, . . . where each value is the sum of the three preceding. For H T H the corresponding figures are 1, 2, 3, 5, 9, 16 . . . where $u_n = 2u_{n-1} - u_{n-2} + u_{n-3}$.

Readers are invited to submit problems (and their solutions) for publication in this column to: Problem Editor, Computers and Automation, 815 Washington St., Newtonville, Mass. 02160.

THE "LANGUAGE EXPERIENCE" APPROACH IN TEACHING READING—COMPUTERIZED

Mrs. Florine L. Way
P.O. Box 499
Monticello, Fla. 32344

"Both the content and the language of each pupil's reading lessons need to be relevant to his own life experience and understanding."

Learning to read can be inhibited by the use of material that is irrelevant, too difficult, or just plain boring. A pupil's self-image can reach rock-bottom when he fails to learn to read – and when he can't learn without someone beside him helping him with every word. But where are there enough teachers – or even enough dedicated volunteer tutors – to sit beside each pupil who can't read and help him in a one-to-one relationship?

There is no single, simple answer to the problem of teaching everybody to read.

What is "Language Experience" Reading?

One of the most promising practices for teaching beginning and remedial reading was introduced in the early 1900's by a teacher named Miss Flora Cooke. She used the pupils' own language to create the content of the reading lessons. This way of teaching reading has earned a respected place in education. It has been used to teach: beginning readers, retarded readers, and adult illiterates. It has been used to teach Persian peasants, prison inmates, Maori children in New Zealand, delinquents who were nonreaders, children with limited backgrounds. The most common name by which this method is known is the "Language Experience" approach.

In the Language Experience approach, the teacher literally brings together the pupil and his environment to create his reading lessons.

Advantages

The advantages of using each pupil's own language are clear. Regardless of his age, sex, race, social status, or cultural background, each pupil in a classroom can have relevant content with which to learn the skills of reading. Regardless of the difficulty of the words and concepts he uses, he can already recognize them aurally, understand them, and use them orally, before he dictates them. Once I had to keep a dictionary beside me to spell the technical words that a seventh-grade non-reader used, when he dictated his own experience stories for me to type to create his reading lessons. Real and vicarious experiences can be arranged for the pupils, so that their vocabulary and conceptual understanding can be internalized, before dictating their lessons.

Disadvantages

The disadvantages of using the Language Experience approach are also clear. Teachers already have too much to do, especially teachers of beginning readers, retarded readers, and adult illiterates. How can they take on the added task of typing or writing for each pupil his own dictated lessons every day? How can they make time to sit beside each pupil until he attains the sound-sight relationship between what he has dictated and what is on the page? How can the teacher have time to make a test for each pupil on his separate lessons to see how well he is learning? What kind of reporting can be done when each pupil dicates different lessons about different experiences? The teacher needs to have the time to use her humanness and her expertness to motivate pupils, to interact with them, to create the environment in which they can learn.

"How can the teacher take on the added task of typing or writing for each pupil his own dictated lessons every day?

In an effort to solve some of the problems that are involved in making the Language Experience approach practical to use in a classroom setting, a small grant from the Florida State University Research Council was obtained, and I conducted an evaluation pilot study at the

Mrs. Florine L. Way is one of the two prizewinners in the Second Annual Martin Luther King Memorial Prize Contest sponsored by *Computers and Automation*. (See announcement in Aug. issue, page 9.) Mrs. Way has been a classroom teacher for twenty-nine years. She has an A.B. from the Univ. of Miami, and an M.S. from Florida State Univ.

Federal Correctional Institution in Tallahassee, Florida, in 1965. This pilot study was successful. The results and the responses of the illiterate inmate pupils (e.g., "Man, you got to do something to get this way of teaching reading so everybody that needs it can use it") indicated that the work should be continued.

An Experimental Class

An experimental class at the Institute followed the pilot study. During that time, it was found that technology could be used to perform many of the chores for making the Language Experience approach practical to use in a classroom. From experience as a classroom teacher and from the reactions of the illiterate prison-inmate pupils, I designed and wrote the specifications for a project called DOVACK (Differential, Oral, Visual, Aural, Computerized, Kinesthetic). The Florida State University Computing Center whose director is Dr. E. P. Miles, Jr., developed computer support for this project.

In the DOVACK project of implementing the Language Experience approach with a computer, the essential attributes are: (1) to give each pupil a chance to dictate his own reading lessons to be processed by the computer for independent study with his dictaphone; (2) to give each pupil a chance to use multi-sensory techniques in his independent study; (3) to give each pupil a chance to be tested on his own vocabulary; and (4) to provide the teacher with evaluations and reports at regular intervals to be used in finding, and planning for, the needs of each pupil.

It was necessary to obtain federal funds in order to field-test and perfect the project. ESEA Title III granted the necessary financial support to the Jefferson County School Board, for me to direct a DOVACK project for three years (1968 to 1971) in Monticello, Florida.

The following is a brief description of the project in Monticello. There are two classrooms, two black teachers and four black aides. This year, they serve one hundred pupils a day. (A larger pupil-to-aide and to-teacher ratio is possible under different circumstances. Presently there are many visitors, many other demands on staff time, requirements for field-testing teaching strategies and techniques, etc.) At present, all of the pupils are black. The classes range in size from four beginning readers in kindergarten to fifteen severely retarded readers in the sixth grade. Other classes are for pupils from the first, second, fourth, and fifth grades. It is anticipated that this fall the minimum class size will be thirteen, and that a larger total number of pupils will be served, although the staff will remain the same.

Technological Support

In this project, technology supports learning, but does not intrude. There is a dictating machine on each desk, which is used by approximately four pupils at different periods during the day. Teacher aides use these machines for transcribing the dictations of pupils, and the teacher uses them for voice-taping the models of their lessons.

Sound-resistant material protects the classrooms from noise. Aides punch cards on key punches to submit to the computer, or use a Teletype for direct communication with the computer at the Florida State University Computing Center, which is about thirty miles from the project center. The aides have learned on the job how to operate the machines and use the necessary precision in their records.

The Teacher

It is not necessary for the teacher to understand computer programming or the technical aspects of the project. In order to use a computerized Language Experience method of teaching successfully, the teacher's attitudes, teaching philosophy, and strategies for creating the learning environment, are crucial – just as they are in all teaching.

"It is not necessary for a teacher to understand computer programming in order to successfully use a computerized Language Experience method of teaching."

The teacher helps the pupils expand their experiences and broaden their understanding, so that they can internalize their expanded vocabulary and concepts. The teacher supplements the pupils' real experiences with vicarious experiences by reading to them, showing films and film strips, etc. All of the techniques and strategies that are used with other Language Experience teaching can be used effectively when the method is computerized.

The project capitalizes on the experience, folk humor, and prior comprehension of each pupil. When each pupil dictates his own lessons from his own experience and understanding onto the dictating machine, he uses the language patterns to which he is accustomed to speak, listen, and understand. Both the content and the language of each pupil's reading lessons need to be relevant to his own life experience and understanding, so that each pupil's own self-image and self-confidence are raised by assuring him of positive support for the way in which he communicates with his family and his peers.

In addition to the strategies and techniques ordinarily used in the Language Experience approach to teaching reading, there are strategies and techniques peculiar to DOVACK which enable the teacher, supported by technology, to fit to the individual three essential elements or phases: teaching, testing, and reporting. [The documentation for computer support for these three phases, which comprise the DOVACK FORTRAN (and COMPASS) package, is available on request.]

Objectives

Inherent in all of the educational objectives for this project is the goal of enhancing each pupil's own self-image.

The teacher, supported by technological help, works with each pupil to help him achieve the following objectives:

- develop skill in manipulating his own equipment and materials;
- become independent and self-pacing in his study habits;
- develop favorable attitudes toward reading; and
- develop proficiency in word recognition, word attack skills, and general reading achievement.

Agenda

Each pupil has an Agenda on which various items are listed. He chooses the several activities that he is going to engage in the following day. Then he numbers them on his Agenda in the order in which he plans to do them. Each day, when he comes into the room, he gets his box containing his materials and proceeds independently to follow his Agenda for that day. After he completes a task, he records the time beside it. The Agenda includes such items as: Dictate a story. Read my story to the class. Study *WORD ATTACKER,* which is a simple device for teaching the sound-sight relationships between the names and sounds of the letters and the consonant blends.)

Procedure

For example, let's observe a boy in a class, during the week of Martin Luther King's birthday. The teacher has read stories to the pupils about Dr. King and has shown them film strips and pictures. They have discussed his life. Then each pupil dictates into the microphone of his dictating machine what he understands from the lessons. Here is the last part of the dictation of one boy in the fifth grade, severely retarded in reading:

> . . . He was a good man. They had to walk fifty miles; Boy, they must have been tired. When one had to use the bathroom, they just waved their hand and a truck come along. There was some colored people and some white people walking . . . . He was a leader of the Negro. He liked to be good to others. He just wanted them to be good to him. All he wanted was peace and white persons and colored to go together. He was a good man. He wanted peace. That is the end of my story.

The pupil finishes dictating his story, removes his dictating record, and takes it to the basket for the aide. The aide transcribes the story on punch cards. The aide spells the words correctly as she transcribes, but she does not change the language usage, nor the grammatical structure of the pupil's dictation. This transcription is included with others, to be submitted to the computer each day for batch processing.

When the pupil returns to his desk, he proceeds to the next item on his Agenda. This might be: study his yesterday's story; join a peer for a mutual sharing of stories; etc.

Self-Teaching

The next day, this pupil receives the story he dictated the day before, prepared by the computer for his independent study with his dictating machine. Each line of his text is numbered. Each new word in the story is alphabetized with a number beside it showing the line on which the word first appears in the text of the story. He puts on his earphones and listens to the verbatim voice tape the teacher has made of his story. This voice-taping by the teacher of each story for each pupil serves as a model for clear enunciation and standard pronunciation. The pupil keeps it in his box so he can use it for review any time he needs it. As he listens, he follows the text with his eyes. He listens as many times as he feels is necessary and then studies his word list. Then he puts aside his earphones and studies without earphones. When he studies his word list, if he does not know a word, he looks at the number beside the word which shows the line on which it first appears; he goes back and reads that sentence again and recognizes the word in context. With the WORD ATTACKER and other phonics devices, the pupils are taught various other skills that they can use in attacking unrecognized words. Finally, when the pupil finishes studying yesterday's story, he proceeds to the next item on his Agenda.

"Each day, a pupil receives the story he dictated the day before, prepared by the computer for his independent study with a dictating machine."

Testing

Every six days this pupil, along with the other pupils in each class, receives a Random Sample Vocabulary Recognition (RSVR) Test. The words in his latest story are compared by the computer with all the words in his stored word bank; all new words in his story are added to the bank. At the time for each RSVR Test, the computer generates a random number and derives each pupil's test from his own stored list of new words that he has used in his dictations for that six-day period. The computer uses a sample size designed to yield a standard deviation equal to 5 per cent of the estimate.

Each pupil administers his test to himself at his dictating machine. This is a test of word recognition only. He says the number beside the word (the words are numbered by the computer) and then pronounces the word. Then he takes the dictated record to the test basket. At the same time the computer prints out all of the tests, it punches a card for each pupil with a record of his work for that six-day period. After checking the tests, the aide completes the record on each pupil's card. The completed deck is returned to the computer for calculating and compiling reports.

Reports

After each six-day RSVR Test, reports are printed out. The estimated number of new words learned, and the estimated rate of new words learned per class period present, are based on results of the Test.

There is a ten-item pupil progress report for each pupil and a summary report of these ten items for each class. Three digits of each pupil's identification number are used to plot his position on the graphs. One histogram shows for each pupil the total number of new words dictated during that six-day cycle; another shows the estimated number of new words learned during that cycle.

One coordinate graph shows a plot of type-token ratios against RSVR Test scores for each pupil in each grade. (The *type-token ratio* is the ratio of the number of new words used to the total number of words used.) Another coordinate graph shows for each pupil in each grade a plot of the percentage of new words learned against the number of new words dictated. For the latter coordinate graph, to supplement the teacher's judgment, a transparent overlay is furnished. The midpoint of the overlay is placed over the computer-located coordinate point of the medians. In each quadrant, a paragraph on the overlay suggests the kind of help that the pupils who fall in that quadrant need.

Alternate Forms of Communication

The teacher and the aides write composite stories for each pupil, using his own vocabulary. These composite stories serve several purposes. They give each pupil a chance to recognize his own vocabulary in a different context. They give him a story to read about himself, and, since they are frequently shared, about his peers. In the composite stories, there is a subtle introduction to standard usage, but the content is still based on each pupil's own vocabulary.

"Here is one kindergartener's own story: 'The rooster is to the mama hen. The house is made of wood. The one what drinking water is the sister and the one what ain't is the brother. The hen is looking at the rooster . . .' "

The pupils understand that *both* ways of communicating are good – the non-standard and the standard. (For example, here is one exuberant kindergartener's own story: "The rooster is to the mama hen. The house is made of wood. The one what drinking water is the sister and the one what ain't is the brother. The hen is looking at the rooster. . . .")

Following the Reports

During the class periods following the reports, the teacher attempts to meet the needs of the individual pupils as indicated in the reports. Some pupils need to extend their experiences, expand their speaking vocabularies, and use a greater number of new words in their dictations. Some need to work more on using the Language Experience technique for finding and recognizing words in context. Others need to interact more with peers and to exchange stories with them.

Criteria of Success

Three criteria are being used to judge the success of the field-tests of the project: (1) adaptability to the populations for whom it was designed; (2) effectiveness in meeting the specified learning objectives; and (3) economic feasibility.

Hard data are being collected for one part of the evaluation. A formal report will be made on this phase of the evaluation when the data are analyzed. Especially interesting should be the analysis of the correlation between each pupil's own rate of learning his own vocabulary and his standardized test scores in mental maturity and in reading achievement.

A teleprocessing version of the DOVACK Model is being field-tested this year, using paper tape for input and output via telephone line. It is hoped that eventually it can be used on a shared-time, shared-cost basis. □

C.a

REPORT FROM GREAT BRITAIN

While the common carriers in America are under heavy pressure from computer users and manufacturers to provide satisfactory solutions to the network problem, there are signs in Britain that things are on the move.

Several significant events in the past month add up to the conclusion that a decision may be forthcoming soon on the form which a UK network (possibly connected to the European continent) could take.

The Network of the Post Office Corp.

On the side of the monopoly, the Post Office Corporation, a 48 kilobit transmission link has been set up connecting London with Birmingham, and has functioned since July 1 as the fastest data service in Europe. Its main function for the moment is to enable users to familiarize themselves with problems of using such a rapid means of transferring data in bulk. Equally important, if the service is to be a commercial success, is for manufacturers of terminal equipment to use the new switched network to develop 48 K units compatible with Post Office installations – very little standard interface equipment in this group has so far been built.

Almost simultaneously with the 48 K switched network announcement, the Post Office disclosed that the number of terminals in the UK is now 14,000, and is doubling each year. This suggests much higher installation figures than the conservative 50,000 by 1973 and 1/2 million by 1983 that the monopoly common carrier is using for planning purposes.

The National Physical Laboratory's Facilities

While all this was going on, the "ginger group" at the National Physical Laboratory threw open its doors to the computer press to show what it had achieved in the construction and operation of a digital network. It is providing flexible communications between all parts of the very extensive laboratory, with a spur to the NPL's ship test facilities.

I call it a ginger group because for several years it has been prodding the elephantine Post Office in the path it should tread to provide a satisfactory network according to NPL's lights. This would be based on a trunk system with high-speed digital characteristics having small control computers at its nodes. These would function as the nerve centres to which local computers would connect, serving either groups of peripherals or subscribers' own computers.

Nodal design would give a response time of ten milliseconds between the five furthest points in Britain. Information is broken up into "packets" of 1,024 bits and the message switching computers at the nodes would have capacity to handle 2,000 of these packets a second.

The NPL network now in use applies these principles – which have already been adopted by at least one American organization – and has a small computer to which all peripheral equipment connects directly (or through multiplexers if the units are slow in operation). The "node" computer switches packets of information to give intercommunication between any of the laboratory's devices. These can be simple printers, displays, experiments, and laboratory computers. There will also be a large computer-controlled magnetic file available to all users.

The main objective in establishing the design has been to set up a system which will cope with any sudden demands for extra services and which is independent of any particular technology.

The Plessey Terminal

A significant feature is the use of a data terminal built by Plessey Telecommunications Research. It operates at 1.152 bits/second or fast enough to transmit all Shakespeare's plays in under two minutes. Plessey has also been the recipient of an important slice of repayable government aid – $10 million to be precise – to which it will add a similar sum. The whole is being applied to the construction of a stored-program control system for electronic telephone exchanges.

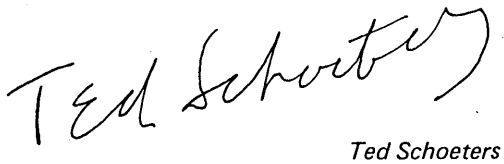
Traditionalists vs. Innovators

This development program, aimed at the second half of the decade, should go a long way to solving the increasingly serious problems of telephone communications in Britain. But will it help in the development of a full-scale switched data network? Many observers think not.

This is because there appears to be a fight between the traditionalist telephone engineers and the innovators who believe their biggest customer in the second half of the decade will be the computer. The stored program controller is about as far as the traditionalist will go. Any mention of a separate data system sets off an immediate panic reaction.

This is because – as in America – there is an immense amount of money sunk in local connections from subscribers to exchanges. In Britain the estimate is for about $1 billion worth of equipment which, the Post Office says, cannot be discarded and must work out its useful life.

Nevertheless, we are seeing the emergence of the first, fast, dedicated system linking three major cities now. And, who knows, perhaps it will link all major centres in five years from now.



Ted Schoeters
Stanmore, Middlesex
England

Computers and Automation believes that the profession of information engineer includes not only competence in handling information using computers and other means, but also a broad responsibility, in a professional and engineering sense, for:

- The reliability and social significance of pertinent input data;
- The social value of the output results.

In the same way, a bridge engineer takes a professional responsibility for the reliability and significance of the data he uses, and the safety and efficiency of the bridge he builds, for human beings to risk their lives on.

Accordingly, this department of *Computers and Automation* will publish from time to time articles and other information related to socially useful input and output of data systems in a broad sense. To this end we shall seek to publish here what is unsettling, disturbing, critical – but productive of thought and an improved and safer "house" for all humanity, an earth in which our children and later generations may have a future, instead of facing extinction.

The professional information engineer needs to relate his engineering to the most important and most serious problems in the world today: war, nuclear weapons, pollution, the population explosion, and many more.

OUR TOP PRIORITY

William B. Johnson
President and Chairman of the Board
IC Industries, Inc.
135 E. 11th Place
Chicago, Ill. 60605

"The blunt truth is that there could be ample warning of almost every emergency and agonizing dilemma before it hits us between the eyes — provided we organize to generate the forecasts."

Propriety impels me to warn the sqeamish that they are about to see a man walk, quite deliberately, into a vast field of quicksand. I propose to speak of an area where a fellow must be fast on his feet and keep in constant motion to avoid sinking into the morass without a trace. I'm not sure I can avoid that fate, but in my view someone should give it a try.

My proposition simply is that an effort must be made to set up on firm ground a system of national priorities for attaining essential, long-range social and economic objectives. Presently, we are lurching erratically from one crisis to the next. We react frantically to current public expressions, which are as volatile as quicksand and involve hidden pitfalls that are just as treacherous.

Public opinion is, of course, the decisive voice that influences national policy. Unfortunately, much of the public is often poorly informed and their views are too frequently shaped by emotional forces that distort the rational judgment essential for reaching sound decisions. Further, public attitudes are often conflicting and they change continually, sometimes capriciously. In the absence of priorities, stopgap solutions to problems of current public concern are contrived hurriedly even though the problems should have been anticipated a decade earlier and resolved primarily by logical analysis.

This article is based on an address which Mr. Johnson delivered to the Town Hall of California, an organization of 6000 businessmen, in Los Angeles on June 2, 1970.

To underscore the constant shifts in public opinion, let me take you back two short years. At this time in 1968, the Presidential primary campaigns were reaching a climax here in California. The most controversial issues then were the war in Vietnam, racial conflicts and urban deterioration.

The Priorities: Political and Social

What are the major political and social issues today? I think you'll agree that they are inflation, the war, environmental pollution and the rising incidences of crime and narcotics addiction. None of the difficult problems that commanded the public's attention in 1968 has been resolved. The problems are just as urgent now as they were two years ago, but with the exception of the war, the nation's demands for decisive action are focused on an entirely new set of priorities.

There generally is substantial agreement among architects of our society – economists, sociologists, ecologists, scientists and politicians – on what should be done to improve the quality of life and promote the nation's welfare. But there invariably is chaos when it comes to deciding which problem should now receive the main thrust of our resources and our coordinated planning and implementation.

The normal political reaction is to downgrade the priority issue, to please as many as possible by doing a little bit of everything. The inevitable result, of course, is that nothing is done properly. The band-aids we slap on unsightly sores do not remedy the source of spreading infection.

What I'm proposing is practiced by every business executive as a matter of necessity. The component parts of a business enterprise are not different from the various departments of government. The requests for capital expenditures always exceed the money a company can afford, even in boom times. Even when every request can be justified, some projects must be deferred and others abandoned because more urgent plans take precedence in timing or importance. There are many fancy definitions of decision-making, but they mostly boil down to one key element – the art of choosing priorities.

Benefits of Evaluating Priorities

The country will derive three immediate benefits if public priorities are evaluated in perspective, by a rational and orderly process.

First, problems will be analyzed and approached objectively instead of by quick response to a series of heated emotional emanations. All of us are acutely aware that shrill propaganda by special pleaders now exerts undue influence on national policy. The squeaky wheel gets the most grease. Congress must at least be exposed to expert analysis, free of political pressures, or there will be no judicious allocation of public funds and public effort.

The second benefit is that priorities will help restore a sense of balance and continuity to the federal government. In a less turbulent era, the interrelationship of important issues was more visible and pointed the way to national goals. Although the thorny issues have increased greatly, they can – and must – be integrated into an overall pattern. That can be done only by weighing alternatives and sticking to the judgments reached. But we are continuing to fling ourselves onto white horses and charge off madly in all directions, pursuing multiple, inconsistent alternatives. We need the benefit of choice.

"A broad-gauged ordering of federal programs will expose an incredible mishmash of bureaucrats who are impeding progress to current goals, by maneuvering to preserve little empires set up to achieve objectives that have become obsolete."

The third benefit brought by a system of priorities will be reflected immediately in the budget. A broad-gauged ordering of federal programs will expose an incredible mishmash of bureaucrats who are impeding progress to current goals by maneuvering to preserve little empires set up to achieve objectives that have become obsolete. Those of us with corporate experience know how insidiously these empires spring up and hang on. We clean them out periodically – although not often enough – but in Washington they keep on growing with every new administration.

A Remedy: Known but Unused

Twenty-one years ago a commission headed by former President Herbert Hoover submitted a landmark report on the reorganization of the federal government. Its Number One recommendation was the elimination of *two-thirds* of the agencies reporting to the President. Since then, there has been such a vast proliferation of agencies and commissions and task forces that it's safe to say 75 percent of them can be dropped with a corresponding increase in efficiency – and no loss in terms of achieving "what the world needs now."

A typical example of confusion and cross-purpose in Washington is the current study of weather modification. The Department of the Interior looks at it from the standpoint of increasing rainfall. The Department of Agriculture is interested mainly in reducing crop losses. The Federal Aviation Administration is pushing for measures to combat fog. None of the three agencies is concerned primarily, or even significantly, with total systems effects or possible side effects.

Sometimes it seems that painful experience has taught us nothing. Just last month a Presidential study group submitted a report to the White House identifying continuing leadership in science and technology as a vital national goal.

I quote from the report: "Our national progress will become even more critically dependent upon the excellence of our science and technology. A vigorous, high-quality program aimed at advancing our scientific and technological capabilities – including the social, economic and behavioral components – is vital to all national goals and purposes."

Here we go again. The study group threw practically everything into the pot. It is foolhardy, and terribly wasteful, to blaze away indiscriminately with a battery of howitzers instead of appointing a squad of expert riflemen to aim at the most imperative targets.

The crux of the story, as reported by *The New York Times,* came in the closing paragraphs. The study group, tacitly conceding that maybe we cannot dominate the entire scientific spectrum, recommended that the Office of Science and Technology, which is headed by the President's chief science adviser, be designated to establish priorities in the field. It is rather typical that the one realistic note was added as an afterthought.

Underaction and Overreaction

Look at our overreaction to environmental pollution, which suddenly has assumed the gravity of a full-scale national emergency. Please believe I am not trying to dismiss the problem, nor am I implying that we have been sold an unduly alarming bill of goods. But I do know that we have been bombarded with many wildly conflicting predictions and a great deal of emotionalism and frenzy.

As a concerned citizen and businessman, I would like to know whether the dangers of pollution have a more serious physical and psychological impact on American life than the housing shortage, which has been plaguing us for a generation. Before we embark on a giant crash program to stamp out pollution, at any cost, I'd like to know something more about that cost. For example, will a convulsive effort to correct our abuses against nature delay – or derail – the drive to correct other historic abuses perpetrated against our fellowmen. The social climate also is a vital part of our environment.

I don't mean to belabor the pollution issue, but it is a conspicuous example of the tendency of government on federal, state and local levels to react too late, and then too violently, to questions that were swept under the rug years

ago. Industry suddenly has become the arch-villain in the agitation against pollution. The crusaders blithely ignore the fact that there has been a drastic and sudden change in the rules of the game. For more than a century, all that the public asked of technology was that it turn out a succession of cheap new products and services that made life a little easier and more convenient.

"Industry suddenly has become the arch-villain in the agitation against pollution. Yet for more than a century, all that the public asked of technology was that it turn out a succession of cheap new products and services that made life a little easier and more convenient."

Since cheap, efficient consumer goods was the public's top priority, industry responded by raising the standard of living in America to unrivaled heights. Now, suddenly, critics are rejecting the benefits of mass production and are applying new criteria to the technology that makes it work.

Industry Efforts to Curb Pollution

Industry concedes that pollution must be curbed. Some 20 percent of the capital expenditures of steel companies is directed to environmental control, with a resultant drop in productivity per million dollars of investment. Detroit is pouring the equivalent of a fair-sized South American country's annual budget into research to reduce air pollution by automobiles. Manufacturers of bottles, cans and paper cartons are earmarking millions of dollars for the development of self-disintegrating containers. Airlines are experimenting with noise-abatement devices.

A lot more will be done as soon as Washington sets up guidelines for questions that surely cannot be ducked indefinitely. But there are also the questions of who is to pay for environmental control and what it will cost the people. What is the top priority – a pollution-free environment or low cost products and services? Suppose the former makes the latter impossible – and surely we can't have it both ways. If Washington yields to popular pressures and makes industry, and thus the product users, absorb the burden of curbing pollution *as a cost of doing business,* we'll see an unknown degree of violence done to another facet of the environment – the daily cost of living. That may indeed be the best answer, but it should be done knowingly, if at all, and there should be no later surprise at the consequences.

The Whipping Boys of Change

The growth and stability of small businesses is a highly desirable element of the free enterprise system, but some of us have become aware that the campaign against pollution is beginning to take a heavy toll of small or marginal operations. In states where stringent pollution laws have been adopted, many small foundries that cannot afford to comply with the regulations have shut down or are for sale at a sacrifice. It is a predictable cinch that similar difficulties will cause widespread havoc in other sectors of the economy.

The Public Utilities

What about public utilities? They have been made whipping boys for air and water pollution with complete disregard for the facts. Until a few years ago, regulatory agencies were slow to approve the use of cleaner fuel and the installation of purification equipment in public utility plants. Public Service Commissions, concerned mainly with holding down rates, generally withheld the necessary permission.

A knock-down fight is brewing in Chicago, my hometown, over power rates. Chicago always generated its power by burning cheap coal from nearby Illinois mines, but this coal is relatively high in sulphur. In response to today's public agitation, and apparently without considering technological decontaminants, Chicago has simply outlawed the coal of its own state and now is bringing low-sulphur coal from Wyoming. It hardly is necessary to hold a degree from the Harvard School of Business to understand that rates must be increased to meet the cost of hauling more expensive coal halfway across the continent, but the utility's application for the rate increase is bitterly opposed by those whose agitation has contributed to its necessity.

This is the public-be-damned attitude with a reverse twist. If the rate increase is not granted, the investors in the utility bonds and stocks will be thrown to the wolves for the benefit of pressure groups who demand higher-cost electricity at the old low rates.

It has become a cliche to say that critical events erupt with bewildering rapidity in the pressure-cooker we call our world. It is comforting for our government officials – and businessmen – to take refuge in that bromide to excuse copping out on their responsibilities to take effective action when they are confronted by difficult decisions. The blunt truth is that there could be ample warning of almost every emergency and agonizing dilemma before it hits us between the eyes – provided we organize to generate the forecasts.

The Auto: Boon or Bad?

Nothing illustrates so clearly the fallacy of identifying national goals by emotion, without consideration of eventual consequences, as the evolution of the automobile. Although the motor vehicle has contributed heavily to the serious financial plight of the railroad industry, of which my business is a part, I must confess that it has had a more profound impact on our society than any invention of the twentieth century.

It is impossible to envision the United States as it is today without automobiles and trucks. The majority of the population would be living in abject poverty in rural areas. Industry would be concentrated in huge, dreary complexes that would make the factory towns of Victorian England look like garden spots. The amenities of suburban life, leisure and cultural interests would be confined – as they always had been – to the very rich. Yes, the motor vehicle opened up alluring vistas of freedom, mobility and flexible freight transportation. Who could have foreseen that Henry

Ford's marvelous Model T would lead to poisoned air and congestion that is strangling our cities?

Yet, innumerable gentlemen made precisely those forecasts when cars began to burgeon on the streets and roads

"There were fewer than 10 million motor vehicles registered in 1920, compared with more than 100 million today. But even then, traffic engineers were drawing up projections of monumental congestion in cities and intolerable driving conditions on highways."

of America after World War One. There were fewer than 10 million motor vehicles registered in 1920, compared with more than 100 million today. But even then, traffic engineers were drawing up projections of monumental congestion in cities and intolerable driving conditions on highways in the event that private cars supplanted public transit systems for commuting to work and engaging in social activities.

40 Years of Congestion

So the federal government and states proceeded to pour tens of billions of dollars into highways that compounded congestion. Even back when I was going to college in the 1930's, it was true that a boy on a bicycle could cross midtown Manhattan faster than an automobile could. Traffic in downtown Boston, Chicago, Philadelphia and other major cities was a worsening mess. It seemed to be obligatory for every comedian doing a radio or TV show from Hollywood to pull gags about the jams and accidents on the freeways around Los Angeles – although I doubt that the conditions were a joke to people who had to endure them.

Getting to work or going down to see a movie at night became an increasingly harrowing ordeal, and still the top priority in transportation was ignored. In the last 15 years, $200 billion of taxpayer funds have been spent on highways compared with $61 million on railroads, mostly since 1966 in the northeast corridor from Washington to Boston. In 1966, after 20 years of earnest petitions, the federal government finally created a Department of Transportation, but still there is no balanced transportation system or fund allocation to achieve one. Last year $16 billion were spent on highways and only $30 million on railroads.

The shape of things to come was seen on last April 22, Earth Day. New York City banned all vehicles from a major traffic artery and closed Fifth Avenue for two hours at noon, turning it into a pedestrian mall. Inevitably, all private cars and trucks will ultimately be banned or heavily taxed during the day in the business sections of *all* cities, as vehicle registrations keep pace with the population increase.

Alternatives – and Costs

New York has a serviceable, although deteriorating, subway system that keeps the city viable. But what will Los Angeles do when it becomes necessary to bar the private cars of workers, shoppers and visitors? Los Angeles is the only city of its size in the Western world that does not have a *single* commuter railroad line. Its municipal transit system is reputedly something less than adequate. What is Los Angeles planning to do when the freeways no longer are permitted to disgorge cars into business sections? Has serious consideration been given to constructive plans to cope with the situation?

Deciding on the top priority in any broad area that affects the public interest involves something much more profound than comparing the costs of alternatives. It embraces a philosophy of government – and that is the crux of the transportation problem.

"Deciding on the top priority in any broad area that affects the public interest involves something much more profound than comparing the costs of alternatives."

Permit me to pose a hypothetical situation that is not as far-fetched as it may seem. President Nixon recently called for a crash program cutting emissions of pollutants by automobiles up to 93 percent by 1980, regardless of the cost or the effect on the performance of cars. In March, *The Wall Street Journal* carried a front-page story reporting that many top engineers in Detroit doubted that the internal combustion engine can be redesigned to meet those requirements. Other authorities declared that a cleaner engine will boost the price of cars by several hundred dollars, increase maintenance bills and add to operating costs by yielding from 10 to 16 percent less mileage on unleaded gasoline. Apparently, the President will soon propose a substantial tax on the more efficient leaded gasoline.

An Example: Fuel Cells for Automobiles

Now, as many of you know, scientists have been experimenting for more than 50 years with the fuel cell, a battery that runs on air by converting it into its chemical components. The fuel cell emits absolutely no pollutants and it is more than a visionary dream. It is the source of electrical power in the Apollo space vehicle and Allis-Chalmers Company has converted it to experimental use in tractors.

There are two problems that have barred the adaptation of fuel cells for automobiles. First, the battery must be recharged frequently and there are no facilities to perform that service. That's not a serious obstacle; stations would spring up overnight if they were needed. The more imposing complication, however, is the weight and the cost of the fuel cell which now rule it out as a substitute for the internal combustion engine in cars.

No one who is even vaguely familiar with the small miracles wrought by technology in this generation doubts for an instant that the fuel cell eventually will be reduced in weight and cost to make it practical for automobiles. You may recall that when computers were introduced 20 years ago, they had more than 1,000 vacuum tubes and were so expensive and bulky that their commercial applications were extremely limited. Today, computers contain no vacuum tubes and compact desk models are on the market.

Similar advances in the fuel cell unquestionably will be made.

Let us assume, as an intellectual exercise, that General Motors is on the verge of the big breakthrough. Officials of the company meet with Congressional committees and tell them: "We can completely eliminate pollutants from cars in three years by spending $200 million on research and development of fuel cells. We can reduce pollutants 90 percent in five years by spending $200 million on redesigning internal combustion engines. We can't underwrite both programs. On which one do you want us to concentrate?"

Effects on the Oil Industry

Your impulse is to select the fuel cell. It will achieve better results faster. But hold on a minute.

The giant oil industry has invested billions of dollars in equipment and installations in this country and abroad. Cutting its market in half will throw a monkey wrench into the nation's economy, perhaps touch off another recession. What about the millions of employees and stockholders of oil companies? Oil still will be vital to the nation's defense. Should the federal government subsidize the industry to ensure ample reserves, and what will the cost be? There are 222,200 gas stations in the United States. They support two million people, counting the families of owners and attendants. What happens to them and the operators' investments, as business dwindles with the gradual disappearance of gasoline-powered vehicles? Incidentally, the 100 million cars and trucks on the roads today would not ordinarily be phased out entirely for some 10 years. Whose obligation will it be to maintain enough gas and service stations to keep them running?

The Priorities: Sifting and Weighing

The solution to the original problem seemed clear at first, but on further thought it opens up a barrel of snakes. There are so many ramifications that Congress is reluctant to choose between the internal combustion engine and the fuel cell. Is a 10 percent reduction of air pollution below a minimum tolerable level, achieved two years sooner than it otherwise might be, worth the economic dislocation it entails? Congress seeks a Presidential recommendation, or leaves the decision wholly to him.

"Is a 10 percent reduction of air pollution below a minimum tolerable level, achieved two years sooner than it otherwise might be, worth the economic dislocation it entails?"

All right, Mr. President, what's your decision? The President is not, of course, personally qualified to make one. He must have the counsel of competent experts who are qualified to reach a balanced judgment on the basis of evidence presented on both sides of the question. Most important, it must be a nonpartisan panel.

In 1967 Representative Emilio Daddario of Connecticut introduced a bill to establish an early-warning system to identify the probable consequences, good or bad, of technological developments before they reach widespread use. He proposed to set up an Assessment Board to advise Congress – which votes the money for more than half the nation's research programs – on emerging technologies that are likely to be beneficial to society. By the same token, the Assessment Board would spell out for Congress those developments that might lead to unwanted or unintended results and, therefore, should be restricted.

The board would solicit the advice of authorities in appraising a wide spectrum of activities affecting the public interest, ranging from human organ transplants to the ecological implications of building dams, from the impact of automation to genetic engineering. In short, Representative Daddario's bill provided the machinery for a system of priorities after considering the benefits and drawbacks of technological trends, much like the procedure of the Food and Drug Administration in studying new medical products for damaging side effects. The bill was shelved in committee. □

The Need for an Assessment Board

I'm all in favor of something along the lines of Mr. Daddario's proposal – with certain modifications I'll discuss in a moment. Let me first explain, however, the need for a board to identify national priorities. Friends and associates, who have heard me sound off on this idea, understandably throw up their hands and groan, "Another federal agency! We already have too many bureaus, boards and committees in our hair, driving us up the wall with red tape and regulations."

There are, indeed, too many agencies and it is for that precise reason that a master board is needed to coordinate and eliminate hundreds of bureaus that run around aimlessly putting out brush fires. Their activities are fragmented, diffused and often biased because there are no clear guidelines to what national policy should be.

Identifying national priorities is an enormously difficult job bristling with political booby-traps, but it is a responsibility the federal government has already assumed, and I merely suggest that it be done in a more sensible way. It may sound new, but I believe there is nothing heretical in asserting that a prime function of a republican form of government is to look ahead, recognize trends and practices that hold the seeds of social problems, then chart the courses that best serve the interests and ambitions of the greatest number of citizens. Businessmen have identical responsibilities to their customers, stockholders and communities. Progressive executives meet that obligation by setting up profit centers that draw upon all available scientific methods to solve their problems.

There is no earthly reason why a national priorities board cannot follow a similar procedure of analysis and evaluation, then submit its recommendation – with a minority report where appropriate – to the President.

Public Endorsement

Public opinion must express itself through duly elected representatives and under our Constitution the ultimate authority must lie with the Congress, not the executive of an Assessment Board. This will temper the unwarranted – but understandable – objections of the people to a dictatorship of eggheads on the board. Franklin D. Roosevelt's Brain Trusters aroused just such antipathy a generation ago, and the influx of Ivy Leaguers who accompanied John F. Kennedy to Washington met similar opposition. National policy must have the strong endorsement of the people to be effective, a lesson several Presidents have learned the hard way.

The Political Hazards of Priority-Picking

Mr. Daddario's proposal would set up a 13-man board composed of a director appointed for a six-year term, two Senators, Two Representatives, the Controller General and seven members appointed by the President. I don't want to get bogged down here in the specifics of the board's composition, but surely I would not include members of Congress. The country needs definitions of goals that are not distorted by partisan political considerations. That is one of our major problems now.

Another important revision should be made in Mr. Daddario's bill. He would have the director of the board report to the Controller General, who then will send the recommendations to Congress. You know what will happen. The recommendations will be lost in a maze of reports by ad hoc committees, winding up in musty pigeonholes crammed with old blueprints for a brave, new world.

"The country needs definitions of goals that are not distorted by partisan political considerations. That is one of our major problems now."

I believe it essential for such a board to report directly to the President, just as does the Council of Economic Advisers. The prestige and high visibility of his office must be used to help gain acceptance of policies opposed by special interests.

An Obscured View of the Future

We must hope that the public will support the right decisions if it possesses a reasoned evaluation of all the facts pertaining to major issues. At least we would have a better chance than we have today. Lord knows we are overwhelmed by facts, but we need broad-gauged analysis of information to put them in proper perspective. A songwriter assures us that on a clear day we can see forever. It is comforting to embrace that romantic notion, but on most issues it is a harsh reality that currently we aren't looking much beyond today's crisis – or the next election. And it is not air pollution alone that is obscuring our view of what the future can be.

We have no clear concept of our role in the international arena, of our ultimate social goals, of the proper relationship of capital and labor to government, or of foreign policy versus domestic objectives. Science has given us the tools and techniques for evaluating alternatives and then reaching sound, balanced judgments. A priorities board, chosen for competence rather than political considerations, can help forge policies that will point the way to the attainment of logically reasoned objectives.

Formulating a philosophy of government is a task for people with far more imposing credentials than I possess. I'm just a pragmatic businessman with a legal background – one who knows the government is dissipating talents and money on opportunistic and bureaucratic wheel-spinning. The main thrust of our attention is now devoted to laws and regulations that are merely ad hoc expedients to meet given situations. But the squeaky wheel should *not* always get the grease. And although the Daddario proposal may not be the best approach to the problem of defining national priorities on a reasoned and orderly basis, there should be *some* approach, so that we do get the three benefits of objectivity, balance and termination of obsolete activity. *We really can't do everything that everybody wishes; and decibel count is no basis for making the hard choices.* The basic policy problems confronting us are long-haul. Nothing short of a deliberate and rational process of evaluation will guide us safely through the series of crises that will continue to beset us in our own time. □

Computers and Automation believes that the possibility of conspiracies in the assassinations of important American leaders in our times is of the utmost interest and significance to every American — and especially to computer people, because computers can be used: to handle large amounts of information easily; to correlate the information rapidly and accurately; to prove or disprove certain theories or possibilities of conspiracy; etc. Therefore, computer people can make a unique and important contribution to society in this area. Already a computerized analysis of information regarding the assassination of President John F. Kennedy is underway in Washington.

Accordingly, Computers and Automation is publishing from time to time articles and reports on: investigations into assassinations; the major evidence; and the application of computers to the evidence. Our purpose is to present important, useful, and authoritative information objectively in order to find out the truth. Since this subject is not receiving adequate and comprehensive coverage anywhere else that we know of, Computers and Automation has taken the responsibility to publish.

No scientist, no honest man, ever refuses to consider new evidence or to correct errors. If corrections are needed or new evidence appears, Computers and Automation will publish both.

PATTERNS OF POLITICAL ASSASSINATION:
How Many Coincidences Make a Plot?

Edmund C. Berkeley, Editor
Computers and Automation

Are certain killings so extraordinary that the theory "it is just a coincidence" must be abandoned and replaced by the theory "these killings are correlated and there exists a correlation, cause, or conspiracy of some kind"?

Edmund C. Berkeley concentrated in mathematics while attending Harvard College, and graduated in 1930 with an A.B. summa cum laude. From 1930 to 1948, except for 3-1/2 years active duty in the U.S. Navy, he did actuarial work, first in the Mutual Life Insurance Co. of New York, and then in the Prudential Insurance Company of America. He passed 12 professional actuarial examinations from 1931 to 1941 and became a Fellow of the Society of Actuaries in 1941. He is the author of 12 books, including "Probability and Statistics: An Introduction through Experiments", 121 pages, published in 1961, which has sold over 15,000 copies. This book also accompanies a scientific kit bearing the same name, which is now published by Math-Master, Big Spring, Texas. He has been editor of Computers and Automation since 1951.

CONTENTS

Exhibits and Tables

The Death of Fifteen Russian Generals

In The New York Times during May 1969, there appeared three short reports about deaths of Russian generals. These are shown verbatim in Exhibit 1. In summary, according to these reports, 15 Soviet generals died in the period April 19 to May 20, 1969.

This raises a significant question:

> Are there enough generals in the Soviet army so that 15 of them can die from natural causes in 30 days? or can we confidently conclude from a scientific calculation, that "coincidence" is extremely unlikely and therefore a common element, perhaps a conspiracy, was responsible for their deaths?

In order to answer this question a naive person might think of inquiring of the government of the Soviet Union, for it might seem reasonable to ask for more information. But the reticence of the Soviet government to give out information is well known. For example, in the summer of 1966 there was a bad earthquake in Tashkent; I happened to be in Moscow on a vacation at the time, and asked my Intourist guide, "How many persons were killed?" I was told, "In this country we do not make public figures like that." Another example: during at least 40 years, Aeroflot (the Soviet government airline) has been flying scheduled air flights in the Soviet Union; it seems virtually impossible that that airline should have had no accidents in the Soviet Union, resulting in the deaths of passengers. But though I have searched for any announcement by Aeroflot of plane crashes in the Soviet Union, and of the resulting number of deaths, I have never found any reports.

There exists however another way to answer the question about the deaths of 15 Russian generals in 30 days — by a scientific calculation of the probability:

1. We calculate the number of expected deaths. This turns out on conservative assumptions to be 4.
2. We know the reported number of actual deaths: 15.
3. We look in an appropriate probability table to determine what is the chance that a deviation as big as 15 or bigger could occur without correlation, cause, or conspiracy.
4. We determine the answer: the chance is less than 6 out of 100,000.

On the basis of this calculation we can come to a very confident conclusion:

> There definitely exists a strong correlation, an extreme departure from normal happenings, in the "coincidental" deaths of 15 Russian generals within one month.

One possibility, of course, is that the 15 Russian generals were together in a plane, and the plane crashed. Or that the 15 generals were in a conference room, and the conference room was bombed. Or something else. But the most reasonable explanation of 15 deaths occurring from April 19 to May 20 "after a short illness", appears to be that a secret action of the Soviet government or the Soviet Communist Party produced the deaths of at least 10 or 11 of the 15 generals. The basic reason for this supposition is that the Soviet Union has had a history of purges and liquidations, notoriously while under the rule of Stalin; and even currently, persons who picket, protest, or dissent are treated extremely harshly. The supposition is supported by a scientific calculation which is described later.

The scientific calculation of probabilities can also be applied to some questions of tremendous importance to the people of the United States:

1. Are the political assassinations of liberal American leaders during the 1960's truly the work of lone individuals in each case?
2. Does a thorough study of the evidence concerning the assassinations of President John F. Kennedy, Senator Robert F. Kennedy, and Martin Luther King, indicate conspiracies in their deaths? and perhaps even a common conspiracy?
3. What is it that is happening in the United States that has produced the deaths by assassination of three outstanding leaders in five years?

It is important for Americans to determine answers to these questions. If we decide that these three deaths are pure coincidence, we take one course of action — mainly, sit back and hope. If we decide that these three deaths demonstrate correlation or cause or conspiracy, we take other courses of action — mainly, we organize to put a stop to the assassination of liberal American leaders. The interpretation of events necessarily guides the behavior of citizens.

The purpose of this article is to look into some of the facts and some of the science that bears on these questions.

The Definition of Conspiracy

What is the meaning of the word "conspiracy"? One unabridged dictionary gives this definition:

Exhibit 1

THREE DISPATCHES FROM

THE NEW YORK TIMES, MAY, 1969

May 12, 1969: A SOVIET GENERAL IS DEAD; 12th REPORTED IN 3 WEEKS

Moscow, May 11 (UPI) — The Defense Ministry newspaper Krasnaya Zvezda today reported the death of Maj. Gen. Avgust A. Nemme, the 12th Soviet general to have died since April 19.

The death was announced in a notice signed by "a group of comrades in arms". Nothing in the recent obituaries of Soviet generals has suggested that there is any connection between them.

General Nemme was identified as a retired veteran of the armed forces. His age was not given, but he was described as a veteran of the 1918-1921 civil war and of World War II. No other details were given.

May 18, 1969: ANOTHER SOVIET GENERAL DIES

Moscow, May 17 (AP) — The death of another general was announced today, bringing to 14 the number of Soviet generals whose deaths have been disclosed in the last three weeks. Krasnaya Zvezda, the official newspaper of the Soviet Defense Ministry, reported the death of Lieut. Gen. G.K. Volkov at the age of 70.

May 22, 1969: SOVIET GENERAL DIES

Moscow, May 21 (UPI) — The military newspaper Krasnaya Zvezda reported today the death after a brief illness of Lieut. Gen. Aleksandr G. Chernyakov.

conspiracy: 1 a: an illegal, treasonable, or treacherous plan to destroy another person, group, or entity; e.g., the conspiracy to murder Caesar; e.g., his theory of the trade union movement as a conspiracy against the unorganized worker — L. A. Fiedler.
b: an agreement manifesting itself in words or deeds and made by two or more persons confederating to do an unlawful act, or use unlawful means to do an act which is lawful: confederacy. 2: a combination of persons banded secretly together and resolved to accomplish an evil or unlawful end; e.g., a conspiracy made up of storm troopers and disgruntled aristocrats. 3: a striking concurrence of tendencies, circumstances, or phenomena as though in planned accord; e.g., the portentous conspiracy of night and solitude and silence — Ambrose Bierce
conspiracy of silence: a secret agreement to keep silent about an occurrence, situation or subject, esp. to promote or protect selfish interests, e.g., local manufacturers were accused of a conspiracy of silence on the child-labor situation
— Webster's Third New International Dictionary, unabridged, published by G. & C. Merriam Co., Springfield, Mass., 1961, 2062 pp.

The Varieties of Conspiracy

There are many varieties of conspiracy.

Over 5000 lynchings of Negroes have occurred in the United States over more than 100 years. Was this a conspiracy by Southern whites? To a large extent, yes, by the Ku Klux Klan at least, and other organizations; but in a wider sense, no. For many of the lynchings were locally organized and sprang from local attitudes of race hatred, akin to the hatred that produces genocide on a very large scale.

During the civil rights drive in the 1960's, Medger Evers, a Negro leader working on voter registration, was shot in Mississippi. A white man was arrested and tried; he was tried twice. The evidence was conclusive that he had shot Medger Evers, but in each trial the jury refused to find him guilty. Was this a conspiracy by each of the juries? In one sense, yes. In another sense, no. Certainly, the jurors represented the strong feeling of a great many whites in Mississippi — that it was trivial for a white man to shoot and kill a black man.

The Conspiracy of Silence: The Concert of Ideas or Attitudes

In a conspiracy of silence, the members of a certain class of persons, because of their point of view, or the way they tend to behave, or the kind of education which they have received, or their economic interest, etc., stay silent about matters that almost cry to high heaven. No spoken agreement is necessary for this kind of conspiracy to exist: simply the common interests of a group of persons. The principle may be expressed quite simply: "Don't rock the boat".

One example is the conspiracy of "respectable" people about the misdoings of their own kind. Tobacco firms, knowing that they will have to cut down their advertising of cigarettes soon, step up their current advertising so as to "hook" more people before they are required to stop; and there is no protest. Drug company XYZ charges as a price ten times the cost of antibiotics, until the Federal government compels it to cut the price down to three times the cost — but no other drug companies talk about it. The air in Los Angeles is sometimes so dangerous, due to pollution by automobile engines, that school children are forbade to physically exert themselves during recreation time. Yet the automobile and oil industries are certainly not breaking their backs to quickly eliminate the gasoline-driven car.

Various important things happen as a result of the conspiracy of silence. The damage that a bad condition produces continues much longer than it otherwise would. The profit which a lawbreaker makes by breaking the law grows much greater, and continues much longer than it otherwise would. The spirit of the young people in a society tends to break, because the older people set a bad example in tolerating and sometimes defending evil conditions that the older people ought to be able to change and ought to try to change.

The Argument from Authority

In the case of political assassinations, many people take the position that they cannot know whether or not some conspiracy occurred until accepted authorities have investigated and announced a conclusion. They wait for authorities to speak.

For example, the American people by and large suspended judgment after the assassination of President John F. Kennedy in Dallas, Texas, on November 22, 1963. Ten months later, the Warren Commission announced that Lee Harvey Oswald was the sole assassin. Because of the Warren Commission's official prestige, many Americans discarded their previous doubts and accepted the findings. This acceptance allowed them to continue their ordinary way of living without a nagging suspicion of a conspiracy that had been covered up.

In 1968, two more political assassinations occurred: Reverend Martin Luther King in Memphis, Tennessee, on April 4, 1968; and Senator Robert F. Kennedy in Los Angeles on June 5, 1968. Again, the majority of the American people suspended judgment and awaited the conclusions of official investigations. Again, authoritative sources reported that a sole assassin was responsible: James Earl Ray, who pleaded guilty to the murder of Martin Luther King; and Sirhan B. Sirhan, who pleaded not guilty in the shooting of Senator Kennedy. Both were convicted in trials and sentenced.

The authorities, the standard newspapers, and the establishment now consider these cases "closed". And it seems as if they have often done their best to stop these cases from being reopened.

It is of course sensible to study the findings of official groups in regard to political assassinations. In such study the basic questions to be asked include the following:

— Has the official group looked into all the important questions, including cui bono (to whose advantage?)?
— Have the findings reported on all the evidence systematically and impartially?
— Has the group honestly and fairly evaluated the evidence that clashes with their own conclusions?

It is frequently true that the "authoritative" sources are not disinterested experts. For example, after Senator Kennedy's death the Los Angeles Police Dept. certainly did not want to seem to appear as incompetent as the Dallas Police appeared after President Kennedy's death. Perhaps this is one of the reasons why their report, as expressed by Robert A. Houghton, Chief of Detectives, in his book, Special Unit Senator, deliberately suppressed very important and disturbing evidence of a conspiracy.

Likewise, government officials certainly had "a lot at stake" in the report of the Warren Commission. What if there was a conspiracy? How would it affect the nation and the government? The principle of "a lot at stake" also applies to the unofficial investigators who seek the fame that may accompany startling conclusions. Therefore, it is always important to consider the interests of the person or group providing explanations.

People should not be misled by the "cult of the expert": that only experts know the truth, and that ordinary people should believe experts, to the degree that the expert has authority. "Truth is not shaped so that it can fit into the hand of any one person", says an old maxim.

Two of the most important arguments for dealing with the political assassinations, reports about them, and the question "How many coincidences make a plot?" — are the argument from tell-tale facts, and the argument from statistical reasoning.

The Argument from Tell-Tale Facts

Although it is sensible (and necessary) to study the findings of official groups in regard to political assassination, it is sometimes difficult or even impossible to consider their conclusions to be true. There are too many "tell-tale" facts, that provide a "dead give-away" of important information.

In the case of the political assassinations of two Kennedys and Martin Luther King, important questions appeared immediately after major events in connection with the assassinations. A great many of these questions remain either without answers, or with extremely improbable answers, because of tell-tale facts. Here is only one of the many such questions regarding each of the three assassinations:

1) How could Jack Ruby walk into the Dallas police station on November 25, 1963, with a gun, without being stopped, at just the right time to shoot and kill Lee Harvey Oswald — who had claimed he was a "patsy"?
2) Where and how did James Earl Ray acquire the large sums of money he used while hiding in the United States, Canada, England, Belgium, etc., until his arrest at London airport?
3) Who was the "girl in the polka-dot dress" who was reported to have run down a stairs and said, "We've shot him. We've shot him;", and who was seen with Sirhan B. Sirhan prior to Senator Kennedy's assassination by at least five witnesses? (Only two of these witnesses are mentioned in the book Special Unit Senator by Robert L. Houghton.)

A reasonable estimate is that there are dozens of tell-tale facts of this kind, that upset the official or authoritative conclusions, for both the assassinations of Senator Robert F. Kennedy and Martin Luther King — and hundreds of such facts in regard to the assassination of President John F. Kennedy.

After all, there is a single tell-tale fact which if it existed could completely disprove the Warren Commission's conclusion that Lee Harvey Oswald was the sole assassin of President Kennedy. This would be a photograph of the 6th floor easternmost window of the Texas School Book Depository Building between the first shot and the last shot at President Kennedy, showing no one at all in that window. There is reason to believe that such a photograph exists or did exist, taken by a man named N. Similas; that photograph was acquired by the Federal Bureau of Investigation, and is now unavailable. (See the article "The Assassination of President John F. Kennedy: The Application of Computers to the Photographic Evidence" by Richard E. Sprague, in the May 1970 issue of Computers and Automation, Table 2, p. 50, and Table 3, p. 56.)

But whether or not many tell-tale facts are available, there is often available another very strong and powerful argument: the argument from statistical reasoning.

The Argument from Statistical Reasoning: Statistical Interlude

Over and over again in ordinary, everyday life, we apply arguments from statistical reasoning, based on the laws of probability. Much of the time we are not even conscious of doing so. Often we use these arguments rather unscientifically, and sometimes incorrectly because of prejudice or habit. But all of us have a practical knowledge of many basic concepts of probability and statistics. This is revealed by words and phrases that we use correctly over and over: "probably, likely, often, seldom, almost always, almost never, the chance is good that ...., maybe and maybe not", etc. All of these terms refer to facts studied in the science of probability and statistics.

The arguments from statistical reasoning take a variety of forms. Also, they require observations, and counting and classifying of observations.

When we are examining rare events, however, events that are reasonably expected to be unusual, it happens to be easy to apply powerful statistical reasoning. We then come out with important conclusions, leading to decisions that have an extremely good chance of being reliable.

For example, the whole business of insurance is built around the rarity of events insured against.

Suppose your house is worth $20,000, and you insure it against fire for one year. Suppose the annual premium the insurance company asks you to pay is $80. The insurance company has basically two costs: expenses for operating; and the cost of paying claims. Suppose $30 of the premium goes for expenses of operating. Then $50 is available from your premium (and a similar amount from a great many other people's premiums) for paying claims. If the chance of your house burning in one year is 1/500, then the average claim cost for insuring your house (and many similar houses) is $40, and the insurance company has $10 per customer which is left over for profits and contingencies.

It is a good bargain on both sides. You have the important safety of protection against fire; and the insurance company can pay its claims and its expenses and stay in business. In the long run, the risks will all average out. The more contracts the insurance company enters into, the smaller will be the fluctuations, the scattering, the spread. Such fluctuations can wipe out a small company; but a big company can weather them.

Calculating the Expected Number of Events

First, we have to explain how the expected number of events can be calculated. How is the calculation made?

In the science of probability and statistics, the expected number of events is always computed from the following rule:

(the population out of which the events occur)
TIMES (the probability of the event occurring)
EQUALS (the expected number of events)

For example, if you toss a coin 100 times, and the probability of getting heads is 1/2 (in other words a 50-50 chance), then the expected number of heads is 50. Of course, common everyday experience will tell you that fluctuation is likely. It would

be unusual if you should obtain exactly 50 heads; the result you would obtain might be 47 heads, or 51 heads, etc.

But the ratio of number of heads to total number of tosses will come closer and closer to 1/2, as you toss more and more times. And if that should not happen, you would be certain that some bias was present. Perhaps you are tossing in a biased way, or perhaps the coin is badly made (perhaps bulgy on one side and flat on the other), etc. Human beings have proved this law of probability literally billions of times; it is not possible for the laws suddenly to apply no longer.

Measuring Spread or Scattering

Having estimated the expected number of events, and knowing the actual number of events, we now come to a different question:

> What is the probable spread or scattering or deviation of the number of events? For example, suppose 4 is the expected number of events and 15 is the actual number observed? Is 15 a reasonably probable fluctuation?

This question has a very definite answer, determined by the laws of probability and statistics. The applicability of the laws in this case depend on several conditions which are here true; these conditions will be described more completely further on. The particular law of probability applying here is called the "Poisson Distribution"; this law will also be described more completely further on. The laws of probability and statistics (including the Poisson Distribution law) have been demonstrated by experience to be valid in literally billions of instances.

Drawing on this knowledge, one can calculate with complete correctness that a given wide deviation is extremely rare as a chance coincidence, but is instead almost certainly due to definite correlation or cause or conspiracy. To make this calculation, first, we compute a measure of spread or deviation called the standard deviation. Let us call it S (the statisticians use a small Greek letter S and call it "sigma"). Second, (in this case, the Poissondistribution case), we apply the scientific formula for computing S, which is:

> (The standard deviation S)
> EQUALS THE SQUARE ROOT OF
> (the mean M)

Since M is equal to 4, S is equal to 2.

The standard deviation is a useful measure of degree or extent of deviations. As soon as we measure a deviation (degree of spread) in units equal to the standard deviation, then we can immediately use a probability law to say how common or how rare such a deviation is. This is explained in the next section.

Deciding Between Pure Coincidence and Definite Correlation

Suppose we consider all the deviations that we may find as actual observations; we can classify them according to the chances that they will occur. (See Table 1, "Categories of Possible Deviations.")

This table says the following:

- Deviations that are within two standard deviations away from the mean are in a REASONABLE RANGE; the chance of getting such a deviation is 19 out of 20.
- Deviations that are further out than two standard deviations from the mean but not so far out as four standard deviations from the mean are UNUSUAL or STRANGE or SUSPICIOUS; and the chances of getting such a deviation are less than 1 out of 20 but more than 6 out of 100,000.
- Deviations that are four standard deviations away from the mean or are further out still are almost certainly due to CORRELATION, or CAUSE, or CONSPIRACY: the chance of such a deviation is less than 6 out of 100,000.

Table 1

CATEGORIES OF POSSIBLE DEVIATIONS

Possible Deviations	Category	Chances of Observing
(1)	(2)	(3)
Two standard deviations from the mean or closer	Reasonable range (R)	19 out of 20
Further than two standard deviations from the mean but nearer than four	Unusual, strange or suspicious range (U)	Less than 1 out of 20 but more than 6 out of 100,000
Four standard deviations from the mean or still further out	Correlation, cause, or conspiracy range (C)	Less than 6 out of 100,000

Conditions for the Statistical Distribution of Rare Events to Apply

Above we referred to certain conditions which enable the probability law called the Poisson Distribution to apply.

This law was named after a French mathematician named Poisson; he was the first person to use it, to study the distribution of rare events. The particular historical case which he first studied was the distribution of deaths of soldiers from kicks by horses in Prussian regiments over the years!

From this unusual beginning, the applicability of this probability law has spread far and wide. In the past the law has been called the Law of Small Numbers or the Law of Rare Events — but these poor names for it have been abandoned.

The conditions under which this distribution applies are:

1. The events are independent; in other words, the occurrence of one event (a death) is not associated with, has no likely influence upon, the occurrence of any other event in the class of events being considered. (Clearly, if fifteen people were together in a plane, and the plane crashed, their deaths would not be independent.)
2. The ratio of the number of expected events (M) to the number of the "population" out of which the events occur (N) must be "small". "Small" is regularly taken by statisticians to mean less than 1/30. If the proportion of M to N is greater than 1/30, then the formula for the standard deviation changes to a more complicated formula. And the Poisson Distribution changes to another distribution called the Binomial Distribution. If we make these changes, then the formula for defining the standard deviation changes. Of course, we can deal mathematically with this case also, if we desire to. But for rare events we do not need to.

The Instrument for Decision: End of the Statistical Interlude

For cases where the Poisson Distribution applies, we can construct a powerful "Instrument of Decision" that anyone can use.

This is a precalculated table of ranges of fluctuations. We have chosen three ranges of variations or deviations of fluctuations:

1) a range of fluctuations that are reasonable and to be expected;
2) a range of fluctuations that are unusual or strange or suspicious;
3) a range that almost certainly (the chance is of 99994 out of 100,000) indicates correlation or conspiracy or common cause.

See Table 2.

This table applies when: (1) the number of the population (out of which the events occur) is 30 or more times the expected number of events; and (2) the events are mutually independent — in other words, the occurrence of one event does not affect or influence the occurrences of any other events.

For example, if the expected number of events is 4, it is reasonable that the actual observed number be from 0 to 8 — the chance is 19 out of 20 that an observation will be in this range. If the actual number of events is 9 or 10 or 11, this is unusual or strange or suspicious — the chance is less than 1 out of 20 but more than 6 out of 100,000. If the actual number observed is 12 or more, then correlation or conspiracy or common cause is almost certain; the chance of such an observation is less than 6 out of 100,000.

The method which we have just described is a powerful method for making decisions regardless of authority. Just as anybody is able to decide correctly and prove to his satisfaction that 2 plus 3 equals 5, so anybody can decide that a figure is far outside of a probable range, so far outside that the figure indicates correlation or conspiracy or common cause.

This power to practically decide that some occurrences are not a coincidence, but that there is correlation or conspiracy or common cause, is truly a great power. It increases your independence of authority. It stops the wool from being pulled over your eyes. It enables you to free yourself from some of the misinformation which is offered for you to believe. It helps you distinguish truth from falsehood. Especially in the "credibility gap" between the government and the people of the United States, this method is valuable for distinguishing what is probably true from what is definitely to be classified as untrue.

Table 2

INSTRUMENT FOR DECISION ABOUT RARE EVENTS:

— REASONABLE VARIATION (R);

— UNUSUAL OR STRANGE OR SUSPICIOUS (U);

— CORRELATION OR CAUSE OR CONSPIRACY (C).

Category:	R:	U:	C:
Expected Number of Events	Reasonable Range: Chance, 19 out of 20	Unusual, Strange, or Suspicious Range: Chance, less than 1/20 but more than 6/100,000	Range of Correlation or Cause or Conspiracy: Chance, 6 out of 100,000 or less
1	0 to 2	3 or 4	5 or more
2	0 to 5	6 or 7	8 or more
3	0 to 7	8 or 9	10 or more
4	0 to 8	9 to 11	12 or more
5	0 to 10	11 to 14	14 or more
6	1 to 11	0, 12 to 15	16 or more
8	2 to 14	0, 1, 15 to 19	20 or more
10	3 to 17	0 to 2, 18 to 22	23 or more
15	7 to 23	0 to 6, 24 to 30	31 or more
20	10 to 30	3 to 9, 31 to 37	0 to 2, 38 or more
25	15 to 35	6 to 14, 36 to 44	0 to 5, 45 or more
30	18 to 42	9 to 17, 43 to 51	0 to 8, 52 or more
40	27 to 53	15 to 26, 54 to 65	0 to 14, 66 or more
50	35 to 65	22 to 34, 16 to 78	0 to 21, 79 or more

Note: This statistical table applies when the "population" (out of which the "events" occur) is 30 or more times the expected number of events, and the events are mutually independent.

Applying the Instrument for Decision to the Case of the Fifteen Russian Generals

Let us return now to the case of the 15 Russian generals. How shall we apply the argument from statistical reasoning, the instrument of decision, to the deaths of 15 Russian generals in one month from April 19 to May 20, 1969?

The procedure is:

1. Estimate the number of persons in the population.
2. Choose a typical or average age.
3. Look in an appropriate table of observed annual death rates to determine the death rate that applies to that age.
4. Multiply Item 1 by Item 3, obtaining the expected number of deaths over a year.
5. Find the period of time for which these persons were exposed to death (in years and fractions).
6. Multiply Item 4 by Item 5 to obtain the answer, i.e., the expected number of deaths in the period observed.

We have very little information about the size of the Soviet army and the number of Soviet generals. So, suppose we make two estimates, one which is likely to produce the highest reasonable number of expected deaths and another which is likely to produce the lowest reasonable number of expected deaths:

First Estimate:

1. Suppose we estimate the average age of Soviet generals as 60. (Probably high.)
2. The annual death rate from all causes for men aged 60 is 20 per thousand. (This rate is the actual death rate shown in a widely accepted Mortality Table called the Commissioners 1958 Standard Ordinary Mortality Table. This rate could reasonably apply to another advanced industrialized country like the Soviet Union.)
3. Suppose we estimate that the size of the Soviet Army counting both men on active duty and in the reserves, including veterans, is 12 million soldiers. (Almost certainly overstated. Some of the mentions of Soviet generals in the Army newspaper Red Star imply that a general who is retired from the Army remains classified as a general. The size of

the active U.S. army is about 3 million men; the size of the reserves perhaps 4 million. But the Soviet population is greater than the U.S. population, and the area of the Soviet Union far exceeds that of the U.S.).

4. Suppose that there is one general for every 5000 soldiers. (This is also probably high. In the American army there is reportedly one general for every division of 20,000 men; it is possible that more than just "full" generals might be classified as generals by Red Star.)

With these suppositions, we can calculate how many deaths we would expect:

1. There would be 2400 Soviet generals all together (12,000,000 / 5000).
2. There would be 48 deaths expected in a year's time (2400 x 20 / 1000).
3. In the course of 30 days (or 1/12 of a year), there would be 4 deaths from natural causes (48 / 12).
4. We look in Table 2 in the line for the expected number of deaths equal to 4. We find that 15 deaths imply correlation or cause or conspiracy.

Second Estimate:

1. Suppose we estimate the average age of Soviet generals as 55.
2. The corresponding death rate from the same mortality table is 13 per thousand.
3. Suppose we estimate the size of the Soviet Army as 4 million men.
4. Suppose we estimate the number of generals as 1 per 20,000 soldiers.

With these suppositions we again calculate how many deaths we would expect:

1. There would be 200 Soviet generals all together (4,000,000 / 20,000).
2. There would be 2.6 deaths expected in a year's time (200 x 13 /1000).
3. In one month there would be 0.2 (2.6 / 12) deaths on the average from natural causes.
4. Suppose arbitrarily we call this 1 death. We look in Table 2 in the line for the expected number of events equal to 1. Again we find 15 deaths to imply correlation or cause or conspiracy.

Other possibilities of course exist. For example, suppose that due to errors of reporting by Red Star, a number of deaths of generals spread over several months all happened to be reported in one single month. However, if the information published in Red Star is to be believed, reporting 15 deaths of Russian generals in one month, the probability is overwhelming that a correlation or cause or conspiracy affected the 15 Russian generals who "died after a short illness".

For a final check, let us determine what the effect of 15 deaths of generals per month would imply per year and per five years: 12 times 15, or 180 dead generals per year; and 180 times 5 or 900 dead generals per five years. This rate of mortality among generals seems on the order of magnitude of Stalin's distrust of Soviet generals and their consequent widespread death.

The Case of Political Assassinations in Germany, 1918 to 1932

There is important confirmation of a pattern of political assassinations in a number of historical situations. One of these is the political assassinations that occurred in Germany after she was defeated in World War I, and before the coming to power of Hitler as Chancellor of the German Reich in 1932. The following account is by E. J. Gumbel who was a professor of statistics at the University of Heidelberg, 1923 to 1932:

> ... The illegal military groups included an array of fanatic terroristic organizations, small in size, but important for their work of political assassination in eliminating first the leaders of the [Weimer] Revolution, then prominent Republicans, and finally the enemies of the illegal rearmament. ...
>
> ... Within the German population, especially during the inflation period, substantial popular backing, or acquiescence, was given to the evasion of the Versailles Treaty. For the nationalists of all shades these efforts were necessary for the restoration of national honor. ...
>
> Terror as an Instrument for Enforcing Support for Illegal Armaments. During the period of illegal German rearmament, terrorist methods were wielded against the opponents of rearmament. These included acts of personal violence carried out by the terroristic nationalist groups supported by manipulation of the legal system.
>
> Altogether, there were about four hundred political assassinations of the nationalists' foes. A considerable literature was published in Germany which detailed the charges. ...
>
> The nationalist terrorists who enforced acquiescence in the rearmament of the Reich included many men who later became Hitler's trusted adjutants, for overseeing the mass extermination program which the Nazis carried out during the Second World War...
>
> The Role of the Law Courts. The political assassinations committed by the members of the former Imperial and the secret armies put a heavy burden on the administration of justice. The murderers had to be acquitted and the victims had to be shown as guilty. This task was fulfilled by the employment of military courts which sided with the military men when they were accused of murder, by the slowness of the justice enforcing agencies, by inability to find the guilty, by issuance of false papers of identity by the police, etc.
>
> Another procedure consisted in accepting at face value the claim of the accused murderer that the victim had tried to escape. ...
>
> To insure sentences members of the Reichswehr responsible for the secret rearmament were called as witnesses for the prosecution. In order to terrorize the public, many more trials were started than could ever be completed. ...
>
> — From "Disarmament and Clandestine Rearmament Under the Weimar Republic" (pp 203-219) by E. J. Gumbel, in Inspection for Disarmament by Seymour Melman and 19 authors, published 1958 by Columbia University Press, New York, 291 pp.

With a number as large as 400 deaths, it is hardly necessary to invoke the instrument of statistical decision. In this case, there is ample significant and accepted evidence, which is reasonable and overwhelming proof at first glance of foul play and not "coincidence".

Footnote:

E.J. Gumbel was one of a small group of pacifists who exposed the illegal rearmament and the terrorisms connected with it. For this activity he was three times charged with high treason. In 1932 he was dismissed from the University, and expatriated by the Nazi government on its first list. He eventually came to the United States and taught at Columbia University. During the summers 1953 to 1957 he was Visiting Professor at the Free University of Berlin; and in 1956 his dismissal from the University of Heidelberg was declared void.

Let us now consider the application of the arguments from tell-tale facts and statistical reasoning to the deaths of Black Panthers.

The Black Panthers are one of the newer groups of young black men who are challenging the treatment of black people in the United States. Their platform was adopted in October 1966; it contains a number of planks, some progressive, some revolutionary, some expressing condemnation of the existing power structure in strong and derogatory terms. Furthermore, many of them arm themselves, and they refer to policemen as "pigs".

In Exhibit 2 is a list of 19 Black Panthers meeting violent death, in the period April 1968 to December 1969. This list is derived from a report in an article in Life magazine, Feb. 6, 1970. Eleven of these 19 men were shot by the police; and when the inquest was held, the decision in every case was "justifiable homicide".

The Black Panthers claim that there is a conspiracy to kill them off, and that 28 of their group have been killed in accordance with this conspiracy.

Whether or not there is a conspiracy depends partly on the meaning to be assigned to the word "conspiracy", and partly on the interpretation of the events that have happened.

Among the tell-tale facts to be considered are these two:

- On December 4, 1969, in the predawn period, the Chicago police raided the apartment in Chicago where two Black Panther leaders lived. There is strong evidence that almost all the shots were fired by the police from outside the room, and that the Black Panthers inside — some of them sleeping until the police raid — fired only a few shots at the police outside. Fred Hampton, Illinois chairman of the Panthers, and his colleague Mark Clark were both killed. See the newspaper account in Exhibit 3.

- Wesley C. Uhlman, Mayor of Seattle, Washington, stated in February, 1970, that he had been asked by the federal government (or a part of it) to organize a midnight raid on Black Panther headquarters in Seattle, and he had refused to do so.

A question we need to consider with our statistical "instrument of decision" is the significance to be attached to the 28 deaths. The locations of 19 of the deaths are Chicago, Long Beach (Calif.), Los Angeles, New Haven, Oakland, and San Diego. The number of members of the Black Panthers is reported to be about 1200.

The number of natural deaths to be expected from a group of 1200 Negro men, average age 25, say, is about 4 per thousand. Over 1 and 3/4 years the expected number (M) of deaths among such a group of 1200 persons is 8 (1200 x 4 / 1000 x 3/4). If we look in Table 2, on the line for 8 events, we find that 28 actual deaths would imply correlation, cause, or conspiracy.

In this case, a life insurance company would not apply a rate of death from natural causes to this group of persons, but instead a higher rate, because of additional hazards. Consequently, the argument from statistical reasoning is not as sound as it might appear to be on its face. However, the tell-tale facts together with the statistical argument would seem to be strong evidence of a conspiracy by elements of federal and city governments in the U.S. against the Black Panthers.

Exhibit 2

BLACK PANTHERS MEETING VIOLENT DEATH

(Information chiefly from "Black Panthers: the Hard Edge of Confrontation" in Life magazine, pp. 22-27, Feb. 6, 1970, Vol. 68, No. 4)

1. Spurgeon Winters, 19, shot by police, Chicago, November 1969. Inquest ruled it "justifiable."

2. John Huggins, 23, shot to death, UCLA lunchroom, January,1969; rival black militants convicted.

3. Walter Pope, 20, shot by police, Los Angeles, October 1969. Inquest: "justifiable homicide".

4. Alprentice Carter, 26, shot, UCLA lunchroom, January 1969; rival black militants convicted.

5. Welton Armstead, 17, shot by police, Seattle, October, 1969. Inquest ruled it "justifiable homicide".

6. Sidney Miller, 21, shot by storekeeper, Seattle, November, 1969; storekeeper was not charged.

7. Fred Hampton, 21, Illinois chairman of the Panthers, shot Dec. 4, 1969, by police, Chicago, in a predawn raid on his apartment. Inquest termed it "justifiable homicide".

8. Mark Clark, 22, shot by police, Chicago, December 1969. Inquest called it "justifiable homicide".

9. Tommy Lewis, 18, shot by police, Los Angeles, August 1968. Inquest ruled it "justifiable homicide".

10. Sylvester Bell, 34, beaten and shot, San Diego, August,1969; rival black militants have been accused.

11. Bobby Hutton, 17, shot by police, Oakland, Calif., April 1968. Grand jury ruled it "justifiable homicide".

12. Steve Bartholemew, 21, shot by police, Los Angeles, August 1968. Inquest ruled it "justifiable".

13. John Savage, 21, shot on San Diego street in May 1969; rival black militant is awaiting trial.

14. Frank Diggs, 40, found shot to death in Long Beach, Calif., December 1968. Assailant unknown.

15. Nathaniel Clark, 19, shot by wife, who Panthers say is a police agent, in Los Angeles, September, 1969.

16. Larry Robertson, 20, shot by Chicago police, July, 1969, died in September. Judged "justifiable".

17. Robert Lawrence, 22, shot by police, Los Angeles, August 1968. Inquest ruled it "justifiable".

18. Arthur Morris, 28, shot in 1968, Los Angeles gun fight, not involving police. No one was charged.

19. Alex Rackley, 24, tortured, shot, New Haven, Conn., May 1969. Panthers are charged with murder.

Exhibit 3

From The Gazette & Daily, York, Pa., January 26, 1970

INQUEST ON DEAD PANTHERS OPENS UP MANY QUESTIONS

Chicago — The finding last Wednesday of a special coroner's jury that the deaths of two Black Panthers in a predawn police raid Dec. 4 were "justified" were based, the verdict noted, "solely and exclusively" on testimony presented by the police and the coroner's office.

But that evidence itself appeared to raise a number of questions about the incident, which the police have described as a gun battle lasting at least 10 minutes, touched off by shot-gun blasts from the occupants of the small West Side apartment.

Members of the Black Panthers declined to testify because of pending criminal trials.

Among the unexplained points raised by the testimony were the following:

— A police firearms expert testified ammunition recovered from the apartment were the shell casings of five .32-caliber bullets. He testified that these did not match any of the alleged Panther weapons the police say they found and that the list of police weapons carried on the raid did not include any of .32 caliber.

— The same police expert, John M. Sadunas, testified that none of the 130-odd expended shell casings and slugs recovered from the apartment matched 17 of the 19 weapons the police say they seized.

— Sadunas testified that three shot-gun cartridge casings the police said they found in the apartment matched the remaining two shotguns. Yet no slugs or shotgun pellets were recovered from the area where the shotguns were supposed to have been fired.

— Although the police raiders repeatedly testified that there had been a number of shotgun blasts directly out of the doorways of the two bedrooms, no pellets or slugs were recovered from the opposite walls, and visitors to the apartment saw no marks on the walls.

— Police Sgt. Daniel Groth, who led the raid, testified that there was no tear gas "available," although the raiders had drawn three shotguns and a submachine gun from a special weapons arsenal.

— Sergeant Groth also testified that no fingerprints were taken from any of the weapons the police said they seized.

— All 14 policemen who took part in the raid testified thaty they had virtually no prior knowledge of the Black Panthers, although they are assigned to the Special Prosecutions unit of the State's Attorney's office, which was set up last spring with a specific mission of keeping an eye on black youth groups and street gangs.

— Despite the heavy volume of fire described by the police, the only injuries they received came when one policeman cut his hand breaking a window with his pistol and another was grazed by gunfire coming through a wall, apparently fired by the police.

Testimony about the three shots fired into Fred Hampton, who was the Illinois chairman of the Panthers, raised a number of questions about the path of the bullets that were fired and the nature of the wounds.

The Case of the Assassination of Two Kennedys and Martin Luther King

For most Americans, by far the most important and most disturbing instances of political assassination in recent years in the United States are the assassination of two Kennedys (in 1963 and 1968), and of Martin Luther King (in 1968).

President John F. Kennedy was shot to death about 12:30 pm while riding in an open car on November 22, 1963, in a motorcade in Dallas, Texas. Lee Harvey Oswald was arrested in a movie theatre early that afternoon, and charged with the crime, which he steadily denied; then he was shot to death two days later in the basement of the Dallas jail by Jack Ruby, while being transferred from one jail to another. Ruby is now dead also.

Martin Luther King was shot to death while standing on the second floor balcony of a motor hotel in Memphis, Tennessee, on April 4, 1968. He was shot by a rifle bullet from the window of a rooming house a short distance away. Some months later an escaped convict, James Earl Ray, was arrested in London Airport, and was brought to trial. He pleaded guilty on the advice of his lawyer at the time, was sentenced to 70 years in jail, and is now in jail in Tennessee.

Senator Robert F. Kennedy was shot to death about 12:15 am, June 5, 1968, in the kitchen area of the Ambassador Hotel in Los Angeles, just after he had won the California Democratic primary election on June 4. Sirhan B. Sirhan, a Jordanian who became a naturalized American, was arrested in the kitchen, with a gun in his hand, after he had fired eight bullets. Sirhan was tried, pleaded not guilty, and was sentenced to death. He is now in jail in California.

A question which confronts a great many people in the United States is: Are these killings so extraordinary that the theory "it is just a coincidence" must be abandoned and replaced by the theory "these killings are correlated, and there exists a correlation, cause, or conspiracy of some kind"?

At the present time, the answer derived from applying the laws of probability and statistics is inconclusive. It is easy to show that if these were three normal people running ordinary risks, the expected number of deaths out of this group of three young men (two Kennedys and Martin Luther King) would be very close to zero and that even one death occurring would be in the range of unusual, strange, suspicious.

But there is the important question, what kind of death rate should apply to these persons? If the life of such a person was to be insured, a life insurance company would charge an extra premium because this kind of person runs extra risk, extra hazard.

Even so, the argument from statistical reasoning declares there is very likely a correlation or cause or conspiracy (or concert of ideas and attitudes), and this is confirmed by the abundance of tell-tale facts about the assassinations.

Probably the best summary at present is the following:

1. In regard to the assassination of President John F. Kennedy, there was a conspiracy in Dallas.
2. As to the killing of Martin Luther King, James Earl Ray appears to be either a hired gunman or a "patsy", either of which means a conspiracy.
3. As to the killing of Senator Robert F. Kennedy, there is evidence which points toward conspiracy.
4. As to a possible inter-connection between the three slayings, there are a number of

COMPUTER-ASSISTED ANALYSIS OF EVIDENCE REGARDING THE ASSASSINATION OF PRESIDENT JOHN F. KENNEDY — PROGRESS REPORT

Richard E. Sprague
Personal Data Services
Hartsdale, N.Y.

A computer project has been initiated at the headquarters office of the National Committee To Investigate Assassinations (NCTIA), 927 15th St., N.W., Washington, D.C. The project was started in June, 1970, by the Committee's Executive Director, Bernard Fensterwald, with the assistance of two board members.

Twelve volunteer workers have contributed to the project during the summer months. Three of them have designed a coding structure for feeding evidence into a computer system and storing it; they have also coded an appreciable amount of evidence to date. Six workers are contributing to system design and programming work. Three others have offered computer time.

Specific Objectives

The objectives of the project are fourfold. First, to organize and store in computer-based form all significant factual evidence pertaining to the John F. Kennedy assassination.

Second, to make easily and efficiently available to researchers: (1) evidence having interest, and (2) answers to queries pertaining to the evidence.

Third, to provide an index to voluminous textual, photographic, and physical material on the assassination, presently located in many different locations around the United States.

Fourth, to provide an analytic capability comprised of a combination of information retrieval and computing techniques to augment human efforts in examining the evidence to solve the John F. Kennedy assassination.

The fourth objective is of rather longer range than the first three. A pilot analysis program is contemplated in which a specific set of dates, places, persons, organizations, and events will be analyzed to see whether a proposed solution to part of the planning for the assassination can be verified.

Coding Structure

The coding structure developed so far provides a general framework for numerically coding raw data elements and relationships among them in the following categories: People, organizations, places, events, times, and objects. A coding form permits several relationships and data elements to be represented in one grouping. For example, two people met at a certain time in a specific place. Or one person is related to a second person and is also a member of an organization.

Utilizing this coding structure, the coding volunteers have ploughed their way through several important sources of evidence and information, producing several thousand completed coding forms for eventual entry into a computer system. The sources include: The Warren Report; NCTIA files of evidence; the book Accessories After the Fact by Sylvia Meagher; the book Oswald in New Orleans by Harold Weisberg; and others.

Systems Design

Two systems design approaches are under study. The first is a batch-processing approach using punched cards and tapes with standard printed reports. The output in this case would be primarily organized indexes, to be placed in manually available files and scanned by researchers.

The second system is a random-access interactive approach using disc files for storing all the evidence in coded form, and an English language translator to produce readable output. The programming language under consideration for this system is Integrated Data Store (IDS). The researcher would be able to formulate a series of questions and enter them through an interactive terminal, receiving online answers at each step of his exploration.

Taking the pilot program as an example, the researcher will be able to formulate a problem as follows. He wishes to determine the likelihood that meetings among a group of specified people took place in a specific period of time in a particular place or places in a specific city or geographic area.

He can explore via his terminal all of the evidence pertaining to the whereabouts of the group of people during the period of time in question. He can also explore the events which took place in the locations in question during the time period.

Thus in the long run he will be able to gather evidence for and against his proposed hypothesis.

If any readers of Computers and Automation are able to contribute assistance with key punching, programming, machine time, or money to help continue this research, it is suggested they write to the National Committee To Investigate Assassinations, 927 15th St. N.W., Washington, D.C. 20005.

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parallels in the cases which might indicate a common modus operandi and which normally would be subject to official, governmental scrutiny.

5. The absence of such scrutiny is extraordinary, and implies collusion of powerful parts of the government and of the establishment.

Nowhere in the United States can concerned Americans apply to have their questions about political assassinations answered reasonably. Only a few agencies, such as courts and Congressional committees, have the power to issue subpoenas, compel the appearance of witnesses, and ask direct questions. The rights of the people to know are defective. □

CORRECTION

In the May issue, in the article "The Assassination of President Kennedy: the Application of Computers to the Photographic Evidence", in the "Spatial Chart of Northern Half of Dealey Plaza" pages 48 and 49, in the lower center of the chart, in the "scale of feet", please replace the numbers 10, 20, 30, 40 by the numbers 20, 40, 60, 80, respectively.

ACROSS THE EDITOR'S DESK

APPLICATIONS

REVENUE AGENTS TRACK DOWN CIGARETTE BOOTLEGGING WITH AID OF COMPUTER

Georgia revenue agents have put their computer to work to help stop illegal cigarette shipments. Cigarette manufacturers supply all states with monthly computer tape records of cigarette shipments coming into a state. "By comparing computer reports every month we can spot sudden changes in volume that might indicate bootlegging activity. For example, if a city showed a sudden decrease in per capita tax paid cigarette sales, we would suspect it as a point of bootlegging activity and send investigators," said Georgia Tobacco Licensing Chief Jerry Wynn, who spearheaded the program. Although other states are using the tapes, Georgia is the only state to use them in this way.

Tapes are fed into the IBM System/360 Model 40. A printout of the information by wholesaler or distributor gives the number of cigarettes, packs, cartons, their destination, their shipping point in the state and computes the tax as well. Manual auditing systems formerly used by the state required as much as a month to complete the audit of each wholesaler — with the computer, time has been cut to one day.

Since the system is very new, no accurate figures on collection increases resulting from it are yet available. Georgia's Revenue Commissioner, John A. Blackmon, said, however, that cigarette bootlegging is a national problem that results in an estimated annual revenue loss of nearly $100 million. "...Eventually we hope to share information between states, which will help us further in stopping the flow of bootlegging activity from low tax states to high tax states," he said.

POST OFFICE TESTS COMPUTERIZED POSTAGE SYSTEM

Two companies working with the Post Office are using computers to determine postage for different size packages and to automatically print the amount on pre-printed labels. Parcel post rates are determined by weight and distance being mailed. Loa Corporation in Omaha, a catalog mail order house, stores rates from Omaha in their System/360 Model 20. Sarah Coventry in Newark, N.Y., a major distributor of costume jewelry, stores rates from Newark in the firm's System/360 Model 40.

The computer-aided mailing process bypasses multiple handling of packages by the mailer and by the United States Post Office. As orders arrive, clerks enter a code number designating a specific item of merchandise, its weight and to whom it is being sent. The computer matches this information with the proper weight and destination rate; prints the correct postage amount on a pre-printed label, and, also prints the name and address of the customer in ZIP Code sequence. The boxes are put in mail bags for delivery to the Post Office from where they are immediately shipped. The mail bags are not even opened at the Post Office.

Billing is on a weekly basis. Using computer listings of all mailings, the Post Office charges for total postage as figured by the computer. Periodically, a postal official verifies package weights to ascertain computer-figured postage rates are correct. The computer also verifies its calculations under direction of a statistical sampling program. Officials at both firms have reported reduced costs with the computerized mailing process. Postmaster General Winton M. Blount added that by presorting their packages according to ZIP Code, delivery is speeded by 1 to 1½ days.

CALIFORNIA COMPANY BREEDS TURKEYS BY COMPUTER

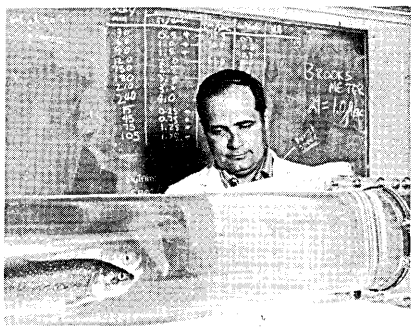
A computer is keeping records on individual birds and entire flocks, allowing experts at Williams Turkey Breeding Farms, Inc. (Oakdale, Calif.) to conduct research that results in improved breed lines and rigid quality control. Using an IBM 1130 system, Williams researchers are able to select parent turkeys that will produce poults with specific desirable characteristics. These attributes, including superior body conformation, fast weight gain and high meat yield, meet the specific requirements of the market in North America, South America and Europe.

Computer records, noting characteristics, are kept on every breeder bird — dating back five and six generations. When a turkey with certain characteristics is needed, the computer can give the wing band numbers of the tom and hen most likely to produce these birds. The system also keeps track of the eggs, by flock, from the day they are laid until they hatch. Thus researchers can determine if variations in feed and other factors affect the number and quality of the eggs. Additionally, the company plans feed formulations on the computer and figures cost per pound on birds as they are being readied for market.

The company was a pioneer in the development of the "MINI", an 8 to 12-pound bird specifically bred for white meat and small size. Williams also raises the traditional large turkey. Both are produced for national and international markets.

COMPUTER PROVIDES INSIGHT TO CHANGES IN GREAT LAKES

Researchers at the Great Lakes Fishery Laboratory at Ann Arbor, Mich., are using a computer to interpret the effect changing lake conditions are having on the fish population in the Great Lakes. Dr. George Y. Harry, director, said laboratory researchers rely on the IBM 1130 computer to interpret the data being gathered both in the lab and on the lakes.



Researcher Tom Edsall, shown above, examines a computer printout of data gathered on Lake Trout. The fish are shown in a tunnel-type respirometer, which enables researchers to control water pressure, temperature flow rate, dissolve gasses and vary soluble toxicants and observe fish reactions. The Fishery Lab (operated by the U.S. Department of Interior) operates four research vessels on the lakes, recording data on fish population by geographical area and type, and noting biological, chemical and physical changes taking place in the water. Researchers combine these data with "catch" information and other historical records provided by both commercial fishermen and state agencies for computer processing. The computer correlates the data into charts for conservationists.

"By understanding the changes that are taking place in the lakes," Dr. Harry said, "we can suggest corrective measures to head off developing problems. Changes in species composition also give clues about changes taking place in lake water."

According to Dr. Harry, measures already have been taken that are aimed at re-storing a biological balance in the lakes.

HOSPITAL PROJECT USING COMPUTER SYSTEM TO AID SURVIVAL OF FETUSES

At the Department of Obstetrics and Gynecology, Univ. of Chicago Lying-In Hospital (Illinois), medical researchers are developing a small computer-based monitoring system for obstetric patients in the active stages of labor. The system is designed to recognize those conditions crucial in the care of patients which could mean the life or death of the fetus. The resiliency and reserve of the human body are such that subtle pathophysiologic changes can occur without being fully assimilated by the obstetrician. All too frequently, it is only when the cumulative effects of many deviations from normal labor become evident that the doctor is aware of a problem.

With the system's ability to continuously record the fetal heart rate and the uterine contraction pattern, diagnosis of the patient and fetus can be more accurate as events occur. A PDP-8/I (Digital Equipment Corp.) used in the system, gives the flexibility to alter the mode of data analysis and display as it is necessary. Software in the computer also can be changed as experimentation dictates.

Presently, the "front-end" or data acquisition section of the system is an intrauterine catheter and strain gauge for monitoring uterine contractions which feeds into a polygraph. The fetal heart rate is obtained from a skin-clip electrode and a cardiotachometer, which also is fed into a polygraph. One aim of the development plan is to simplify this section so that physicians, nurses, or obstetric assistants can easily use it.

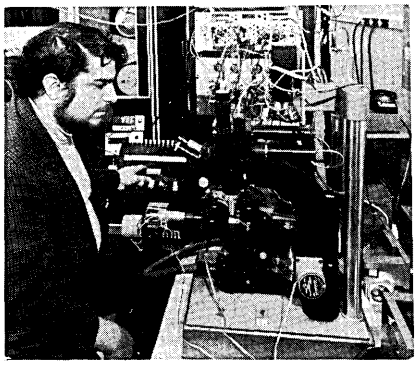
The system also includes a visual display via closed-circuit television in the patient's room. The display is generated by the DEC KV8/I graphics portion of the computer system and a small storage scope, which is slaved off of the main display scope. The small scope is photographed with a closed-circuit television camera.

COMPUTER LOOKS THROUGH MICROSCOPE

The National Bureau of Standards (U.S. Department of Commerce), in a collaborative effort with the National Institutes of Health, has adapted a microscope for use with a digital computer to direct and to record the presence of objects on the slide. The scanning system was designed by Philip Stein (of the Bureau's Center for Computer Sciences and Technology), Dr. Lewis Lipkin (of the National Institute of Neurological Diseases and Stroke) and Dr. Howard Shapiro (of the National Cancer Institute). It will be of use in neuropathological studies, in autoradiograph counting, and as a tool in the design of systems for automating image processing.

The system consists of a microscope, an image plane scanner, a motor-driven stage, a computer, and the necessary interface hardware. It not only scans automatically in the x and y directions on the microscope slide, but can do so repeatedly at sequential z positions to obtain three-dimensional data. Computer control allows the operator to manually position the slide to locate features of interest and to note their locations in the computer memory. When later instructed, the stage can return to within one step in each axis of every position previously noted — the system automatically performs a scan at each.

The scanning microscope was built on an existing special-purpose microscope frame. It offers a choice of either wide-spectrum or monochromatic light, the illumination desired being switched by a mirror. A fixed portion of the light is passed through a special lens system to a photomultiplier tube to provide a reference for specimen illumination.



The scanner is connected in a closed-loop configuration with a small general-purpose computer that controls the scan. The picture shows NBS computer engineer Philip Stein viewing a slide through a computer-controlled microscope that he developed in collaboration with NIH. The scan is manipulated by pressing buttons on the operator's console, which interrupts computer control. The system computer controls the scan but processing the resulting data requires large computers. At present a high speed telephone line is the link with an image processing computer.

EDUCATION NEWS

UNIV. OF PITTSBURGH INAUGURATES NEW PROGRAM IN INFORMATION SCIENCE

A new Interdisciplinary Doctoral Program in Information Science at the University of Pittsburgh (Pa.) is headed by Professor Allen Kent, Director of Communications Programs at the University, and Dr. Anthony Debons, professor of information science. It is supported in part by a contract from the Commonwealth of Pennsylvania Science and Engineering Foundation. The program accepts students with undergraduate majors in almost any discipline, but when they complete their studies in information science they will have well-rounded backgrounds in the behavioral, systems, computing, engineering and basic sciences.

The program is designed to provide the student with a deep appreciation of the role of man in his use of information and communication technology in day-to-day pursuits. How the human will use computer information is an important concept in information science, Professor Kent points out. The program is one of the few information science programs in the country with an interdisciplinary emphasis. Most other academic programs in information science have stressed the technological aspect of the process.

POSTAL CLERKS IN ENGLAND TAUGHT BY COMPUTER

Great Britain's Post Office System plans to integrate a computerized "teaching machine" into its operations that will enable up to 20 operators to be simultaneously taught letter-coding techniques. (The electronic coding and sorting process will be central to the flow of mail through the new post office system.) Using television-like keyboard devices, the Honeywell Model 516 computer will be able to display up to 4,000 different lessons on the screen by selecting specific information stored in its memory. The system also can incorporate remedial lessons to correct continuous errors on the part of the operator.

Operators first will be taught to touch type; then to code groups of letters; and third, read and code two addresses simultaneously. Stations will be monitored by a postal supervisor who can display his comments to trainees via the screen during instruction. The computer itself presents an explanatory text before each lesson, then performs a critique based on a "par" for the course of instruction.

"TYPING CLASS" AT BOWLING GREEN (OHIO) IS COMPUTER LAB

Students preparing for careers in computer science or business "experiment" in an unusual class at Bowling Green State University. Using typewriter-like communications terminals (IBM 2741s) linked to a central computer, undergraduates write their own computer programs and solve complex problems in quantitative terms as part of two major fields of study at Bowling Green. Students majoring in information systems or computer science are provided with "hands-on" experience.

Fifteen terminals are linked to an IBM System/360 Model 50, which serves all terminal users concurrently, while enabling each to proceed through computer-assisted exercises at his own pace. The computer oriented majors at Bowling Green are offered by the College of Business Administration and the College of Arts and Sciences.

IBM MANUFACTURING CAI NETWORK HELPS EMPLOYEES LEARN MORE THAN 50 SUBJECTS

Manufacturing employees at IBM's plant at Poughkeepsie, N.Y., take manufacturing-related courses at

computer terminals in the computer-assisted instruction system. Over 50 courses, ranging from chemical safety to data processing principles are available to IBM employees using this system. An IBM System/360 Model 50 computer located in Poughkeepsie serves terminals at 11 IBM manufacturing plants from coast to coast and in Canada. In addition to Poughkeepsie, the computer-assisted instruction system embraces IBM manufacturing locations at: Kingston, East Fishkill and Endicott, N.Y.; Rochester, Minn.; Boca Raton, Fla.; Boulder, Colo.; Burlington, Vt.; Raleigh, N.C.; San Jose, Calif.; and Toronto, Canada. Other locations are in the process of linking to the system.

COMPUTER SCIENCE OFFERED AS ADULT EDUCATION COURSE BY NEW JERSEY HIGH SCHOOL

Residents of this Philadelphia area community (Cherry Hill, N.J.) will have an opportunity to learn computer science through an adult education course being offered by the school department this fall. The course will be called Computer Concepts. The teacher will be Sidney Rubenstein, a member of the Mathematics Department of Cherry Hill West High School.

A recently acquired PDP-8/L computer (Digital Equipment Corporation) will be used as a demonstration device. Students also will get "hands on" experience with the computer in both the programming and computer operations segments of the courses. "...The adult education course will offer the people of our community the chance to increase their knowledge of a force becoming more and more influential in the business world at a price they can easily afford", remarked Mr. Rubenstein.

RESEARCH FRONTIER

UNIVERSITY OF UTAH SCIENTISTS RESTORE CARUSO RECORDINGS USING DIGITAL COMPUTERS

At the University of Utah, a computer scientist is devising a method of "resurrecting" the voices of recording artists from the muted, hollow-sounding, antique records of the distant past. The technique uses digital computers and already has been dramatically demonstrated on the voice of Enrico Caruso, the great Italian operatic tenor who died in 1921.

Directing the research is Dr. Thomas G. Stockham, Jr., professor of electrical engineering and a leading authority on "computer filtering processes." According to Dr. Stockham, sound waves from recordings can be fed into a computer, converted into numbers and then re-recorded on numerical tapes. "By using a complex, delicate and precise program in the computer, we can manipulate these numbers with the hope of reversing the original recording process and coming back out with sounds that have objectionable resonances removed", the computer scientist said. The process is called "numerical dereverberation". Dr. Stockham believes it holds promise for a wide range of future advances in a variety of scientific areas, as well as in the recording industry.

The Caruso experiment actually developed as a sideline to the primary research Dr. Stockham and his colleagues are conducting on contract with the Advanced Research Projects Agency of the Department of Defense. They are investigating the use of digital computers to process pictures and sound, the basic elements of human communication. Using computers, the scientists can restore photographic images that are blurred, enhance details in pictures, eliminate reverberation in sound, and may be able to improve high frequency radio transmission.

Work on the antique recordings began one night when, while talking about filtering with some friends, one chanced to remark, "Wouldn't it be nice if computers could be used to restore the real voice of Caruso." Dr. Stockham began working with the mechanical problems involved in such a restoration, and was intrigued by the similarity between these problems and others with which he had been previously working. Finally he devised the initial computer program from which Caruso's voice was "resurrected."

While Caruso had a voice powerful enough that it came through the crude equipment of his day, the low and high frequencies were missing. Distortions were so gross there is reasonable doubt today about the most salient characteristics of his voice. Dr. Stockham believes the computer-restored Caruso voice gives a more accurate sound on which to judge its character and quality. He also is working on the elimination of surface noise and other related problems.

Experiments such as the Caruso one, Dr. Stockham says, greatly enhance scientific knowledge about manipulation of pictures and sound. "They are illustrative of how the computer will supplant conventional electronics for the future handling of communications information," he says.

NEW PRODUCTS AND SERVICES

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION
Digital		
Control Data 3170 System	For multiprogramming users / total hardware and software compatibility with CDC's 3300 and 3500 systems / expandable core memory, 49,000 to 131,000 24-bit words / 1.75 usec memory cycle time; 1 usec access time / may be field-upgraded	Control Data Corp. 8100 34th Ave. So. Minneapolis, Minn. 55420 Attn: Kent R. Nichols
PDP-11/15	General-purpose computer designed for original equipment manufacturer (OEM) applications / full compatible with, and has same central processor capabilities as, PDP-11/20 / core memory, 4096 16-bit words (expandable to 32,768); 1.2 usec cycle time; 500 nsec access time	Digital Equipment Corp. 146 Main St. Maynard, Mass. 01754 Attn: Dennis C. Goss
Special Purpose Systems		
PDP-15/35	For use supervising operation of several small dedicated control computers, as second-level computer in hierarchical computer system, and as data gathering system in management reporting network / includes PDP-15 processor, 16,384 words core memory and RSX-15 real-time multiprogramming, executive software monitor	Digital Equipment Corp. 146 Main St. Maynard, Mass. 01754 Attn: Edgar E. Geithner
QUANTA® Analyzer/Computer System	For nuclear research and analytical applications / includes a GEOS single or dual parameter 4096-channel analyzer interfaced to DEC's 16-bit PDP-11/20 computer / system provided with application-oriented software package	Digital Equipment Corp. 146 Main St. Maynard, Mass. 01754 Attn: Howard Steiner
RACE (Random Access Composition Equipment)	Card oriented phototypesetting system / allows access to any point in composed material prior to setting of type / chief components are a typesetting keyboard which is connected to a keypunch, and a card reader which activates a phototypesetter	Warlock Computer Corp. Route 7 Georgetown, Conn. 06829 Attn: Allan Kumble
Memories		
COMFILE® Memory System	Random access system / composed of proprietary COMFILE Data Storage System (storage to 72,000 characters for any mini- to medium-sized computer), a COMFILE plug-in interface; and a COMFILE utility program / average access of 350 msec	Compat Corp. 177 Cantiague Rock Rd. Westbury, N.Y. 11590 Attn: W. Craig Meyer
ICM-161 Core Memory System	Modular system can be altered to produce 60 different configurations / 4096-16,000 word capacities available, lengths in 8, 12 and 16-bit formats / 1.6 usec full cycle time with 650 nsec access time for read/regenerate and clear/write operations	Honeywell Computer Control Old Connecticut Path Framingham, Mass. 01701
NCR 657 Disc Units	For Century 200 computers / direct access files with full track disc capacity of 29.8 or 59.6 million bytes / average access time including latency, 72.5 msec; maximum data transfer rate, 315,000 bytes per second / the 657-101 is a single-spindle disc unit; 657-102, dual spindles	National Cash Register Co. Main & K Sts. Dayton, Ohio 45409
NANOROM 90 READ-Only Memory System	Capacities to 10,240 bits; word lengths to 80 bits per word / 90 nsec access time; 190 nsec cycle time / has nonvolatile form of storage that is mechanically alterable; individual bits, words, or entire memory contents can be modified	Memory Technology Inc. 83 Boston Post Road Sudbury, Mass. 01776 Attn: Paul Rosenbaum
UMACORE Memory	A planar core memory specifically for greater storage capability in N/C systems / for use with UMAC 6 controls, it accepts data in same manner, thus no operator or programmer retraining is required / reported as more economical means for applications requiring over 32 offsets	Vickers UMAC Division of Sperry Rand Corp. 2500 Trans Canada Hwy. Point Claire 730 Montreal, Quebec, Canada
SA 8000 Series Drum	High speed (7200 rpm) provides 4.4 msec access time / stores 5 million to 20 million bits, densities to 1800 bpi / available with 256, 512 or 1024 tracks, each with own read/write flying head / option - controller logic to interface with user's central processor	Systematics/Magne-Head Div. General Instrument Corp. 13040 S. Cerise Ave. Hawthorne, Calif. 90250

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION
(Memories, continued)		
Varian 620 Disc Drives	Four low-cost disc drives, Models 38A, 38B, 38C and 39, for 620 computer product line / storage capacities from 30,000 to 585,000 words / Model 39 (585,000 words) can be expanded with addition of slave for total capacity of 1,170,000 words	Varian Data Machines 2722 Michelson Drive Irvine, Calif. 92664

Software

ACCOUNTPAK	Proprietary installation management package to support IBM System/370 Models 155 and 165 / permits rational cost accounting of multiprogrammed system usage / designed to interface with IBM OS/MVT Control Program / offered on a fully-maintained prepaid lease basis	Systems Dimensions Ltd. 770 Brookfield Road Ottawa 8, Ontario, Canada Attn: N. L. Williams
B2BCONV ("Bits to Bytes Conversion")	Assembly language subroutine / enables COBOL programmer to test and set bits / requires less than 1K of core and relies on register usage for maximum processing speed / distributed on lease basis for one time fee of $595	TriValent Enterprises, Ltd. P. O. Box 654 Greenwich, Conn. 06830 Attn: Norman M. Kittredge
CHURCH CRRS/MMP	For churches and synagogues / Contribution Record Reporting System (CRRS) is designed to provide more frequent and in-depth report to individual giving units / Membership Master Profile (MMP) includes complete demographic, interest, activity and membership information about each individual member of congregation / systems are compatible and provide flexibility to fit requirements in congregations of any denomination and size / written in COBOL / available as a complete software system or as a processing service	Tri-Data Systems 7301 Washing Ave. So. Edina, Minn. 55435
DATAGEN	Automatic test data generator for DOS and OS COBOL programs / generates data by actually reading the COBOL Source Program / runs on IBM/360 with 24K of program core available	Programming Sciences Corp. 6 East 43rd St. New York, N.Y. 10017 Attn: Howard Linzer
FDS	A FORTRAN IV symbolic debugging system / written in AED-0 language for operation in an interactive mode on the IBM 360/67 under the CP-67/CMS operating system / uses symbolic notation of source program during debugging	SofTech, Inc. 391 Totten Pond Rd. Waltham, Mass. 02154 Attn: Alder M. Jenkins
MASTER SERIES	Data Set Dump, Update, and Map utility programs for OS/360 users / eliminates most control card preparation / available for a free 21 day trial evaluation	Infodata Systems Inc. 1901 No. Fort Myer Drive Arlington, Va. 22209 Attn: Donald H. Stromberg
PIPTO	For the trucking industry / a profit improvement program for terminal operations / designed to reduce labor costs and improve productivity	Walter Frederick Friedman and Co., Inc. 280 Madison Ave. New York, N.Y. 10016
TOTAL	An integrated Data Base Management System / manages virtually unlimited number of data sets and allows for entry and association of each of data sets with any other data set in the data base / system is self-optimizing / minimum design level normally 32K	Cincom Systems, Inc., 2181 Victory Pkwy. Cincinnati, Ohio, 45206 Attn: Tom Nies or Tom Richley

Peripheral Equipment

Addo-X Model 25-653-32 Data Input Machine	Produces machine readable tape that can be transferred directly to disc or magnetic tape through reader / has optical character recognition capability, programming features, and optional check digit verification	Addo-X Inc. 437 Madison Ave. New York, N.Y. 10022 Attn: Tom Kibbe
DGC-301 Time-Sharing/Instrument Data Transfer System	Designed for researchers, production test, medical and nuclear analysts, and process control personnel / couples various instruments to remote computer via a time-sharing terminal / accepts BCD data, stores data in memory, decodes data and presents it to terminal / directly compatible with all standard BCD, integrated circuit instruments and most older transistor instruments	Data Graphics Corp. 8402 Speedway Drive San Antonio, Texas 78230 Attn: John Thompson
531 Series Interface Unit	Ties mini- or midi-computer into System/360 / connects IBM 360 Interface Channel-to-Control unit to the minicomputer's standard I/O / minicomputer/531 combination is exact plug-to-plug replacement for IBM 2803 Controller, hence requires no special 360 programming	Datawest Corp. 7503 E. Osborn Rd. Scottsdale, Ariz.

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION
(Peripheral Equipment, continued)		
KI-680 and KI-880 DATA-SCRIBE®/Concentrator	For off-line data acquisition and/or remote batch applications / communicates with Teletype or IBM 2741 data terminal compatible devices / records in computer compatible format on 2400 ft. reels of 7 or 9-track magnetic tape / includes an unattended answering feature	Vanguard Data Systems, Inc. 1642 Kaiser Ave. Irvine, Calif. 92664 Attn: David A. Bowman
Magnafax 860 facsimile telecommunications unit	A two-speed model which offers option of 3 minute or 6 minute transmission for full-page documents through a coupling to the telephone / can send to or receive from majority of facsimile units utilizing the Direct Dial Telephone Network / skilled operator not required	Magnavox Systems, Inc. 80 Park Plaza East Garden State Pkwy. Saddle Brook, N.J. 07662 Attn: Jim O'Malley
Model 9600 Card Reader	For IBM System/3 / 96-column photoelectric device reads cards at rates to 600 cpm / comes complete with transport, power supply, electronics, and skins / desk top sized, weighing less than 50 lbs. / optional field conversion kit gives multiple card capability	Bridge Data Products, Inc. 738 South 42nd St. Philadelphia, Pa. 19104
Optical Mark Reader (OMR 8421)	For daily inventory control applications in department and chain stores / desk top unit reads pencil marked, 3¼ inch wide, fan-fold strip of any length / using inte-data coupler, transmits via dial network to central receiver at effective rate of 400 characters per second	Automata Corp. 1305 Mansfield Ave. Richland, Wash. 99352
SEACO Model 401 COM Recorder	Converts computer output (off-line or on-line) to microfilm at rate of 36,000 characters per second / characters and symbols selected from 70-plus set and printed on pages up to 140 characters per line, 64 lines per page / formatting under complete control of operator / lease and service contracts available	SEACO Computer-Display, Inc. 2826 West Kingsley Rd. Garland, Texas 75040
Typeliner Model III Remote Terminal Printer	For use with CRT terminals with plug-to-plug compatibility and with any modem / 80 colums upper and lower case alphabetic and standard ASCII 64 character set / 100 lpm print speed; printout on pinfeed, fanfold paper in multiple sets up to six and width of 9-7/8"	Data Computing, Inc. 2219 W. Shangri La Rd. Phoenix, Ariz. 85029 Attn: Donald E. Oglesby
Components		
Analog Circuit Modules	Fifteen additions to analog module line includes multiplexers, dual amplifiers, sample and hold modules, D-A and A-D units / all have 12-bit accuracy, are compatible with DTL and TTL circuitry / used mostly for interfacing analog devices to a computer	Digital Equipment Corp. 146 Main St. Maynard, Mass. 01754 Attn: Dennis C. Goss
LSIs for 16-digit desk calculators	Large scale integrated circuits (LSIs) available in 8 types: 2 memory units; five calculation control units; one display control unit / each measures 1½" square / cuts overall size, weight to one-half of current machines	Hitachi America, Ltd. 437 Madison Avenue New York, N.Y. 10022
Data Processing Accessories		
COM Support Equipment	Line of viewer stations and cassette storage equipment for Computer Output Microfilm Systems / includes cantilevered aluminum-frame stations for viewer, and viewer-printer equipment	Tab Products Co. 2690 Hanover St. Palo Alto, Calif. 94304 Attn: Vernon Craig
IBM System/3 Accessories	Coordinated accessory equipment specifically for IBM System/3 / includes small tray to hold 2250 96-column cards; modular cabinets hold to 30 trays and allow front to back or cross access filing, tub file, etc.	Wright Line A Div. of Barry Wright Corp. 160 Gold Star Blvd. Worcester, Mass. 01606
Magnetic Ink Character Tester, Model MCT	Examines, evaluates signal level of printed characters to be scanned on a reader/sorter / tells whether documents are properly encoded according to American Banking Assoc. standards / for printers, banks, utilities, etc.	Kidder Press Co., Inc. 279 Locust St. Dover, N.H. 03820
New Literature		
IEEE Publications Bulletin	Service for libraries and information centers / complete listings and ordering information for Institute of Electrical and Electronics Engineers publications / bi-monthly	IEEE 345 East 47th St. New York, N.Y. 10017
The IBM System/370: an Independent Appraisal	Technical evaluation of IBM's new computer line / emphasizes hardware and software facilities; discusses its degree of System/360 compatibility / $25.00 per copy	Datapro Research Corp. 2204 Walnut St. Philadelphia, Pa. 19103

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Sperry Rand Corp., Univac Defense Systems Division, St. Paul, Minn.	Lockheed-California Co.	Design and development of nine UNIVAC 1832 Multiprocessor computers for the U.S. Navy's S-3A anti-submarine aircraft, and provide all systems software	$40+ million
Collins Radio Co., Dallas, Texas	Litton Industries, Data Systems Division, Van Nuys, Calif.	Design, build, test and deliver automatically-controlled communications equipment for the newly designated class of U.S. Navy ships known as LHA, general purpose amphibious assault ships	$30 million (approximate)
Control Data Corp., Minneapolis, Minn.	The National Center for Atmospheric Research (NCAR), Boulder, Colo.	A CDC 7600 computer system to expand current research activities in such areas as mathematical modeling of global atmospheric circulation patterns and convective storm systems, and global studies of long term climatic changes	$8.6 million
Litton Industries, Data Systems Div., Beverly Hills, Calif.	Naval Electronics Systems Command	Development and production of automated Direct Air Support Centrals (DASC) for the U.S. Marine Corps. DASC will automate control of fighter-bombers and helicopters	$7.2 million
Burroughs Corp., Detroit, Mich.	U.S. Post Office Department	50 letter sorter machines used in high speed processing of mail; ninth in the series of contracts to the Company since 1958 for letter sorter equipment, total value of contracts to date is $46.8 million	$6.1 million
Syner-Data, Inc., Beverly, Mass.	Database, Ltd., London, England	700 computer printing terminals; contract gives Database exclusive rights to sell and distribute Syner-Data's Alpha line printer and Beta serial printer in the United Kingdom, western Europe, Australia, southeast Asia, and Union of South Africa	$5.6 million
Computer Sciences Corp., Los Angeles, Calif.	National Aeronautics & Space Administration (NASA)	Operational support to the Simulation Laboratory at NASA's Ames Research Center near Mountain View, Calif.	$3.3 million
Sperry Rand Corp., Univac Division, Philadelphia, Pa.	Bundeslanderversicherung, Vienna, Austria	A UNIVAC 1106 computer system; use will include retrieval of data concerning insurance contracts, contract processing and control, various mathematical tasks	$3 million (approximate)
URS Data Sciences Co., Falls Church, Va.	U.S. Army	Continued URS support to the U.S. Army Computer Systems Command (USACSC), Fort Belvoir, Va.	$2.4+ million
IBM Corporation, Los Angeles, Calif.	State of California, Dept. of Health Care Services	Design, develop and install a prototype data based, communications system that will improve processing of claims under the State's Medi-Cal program	$2.2 million
Logicon, Inc., San Pedro, Calif.	U.S. Navy	Continuation of work on the TACDEW System (a large digital simulation of the Naval "at-sea" environment) which is used to train Naval personnel in combat direction and electronic warfare	$1.6 million
Philco-Ford Corp., Communications and Technical Services Div., Ft. Washington, Pa.	U.S. Army Electronics Command, Ft. Monmouth, N.J.	A modern telecommunications network expanding communications between Luzon and Cebu islands in the Philippines	$1.5+ million
Stanwick Corp., Washington, D.C.	U.S. Navy	Continuation of data processing services, by Stanwick's Causality Data Company, related to Navy ship scheduling, budgeting, inventory management, etc.	$1.5 million
Peripheral Equipment Corp., Chatsworth, Calif.	Computer Machinery Corp., Los Angeles, Calif.	Model 6000 Series tape transports to be used in the CMC9 KeyProcessing Systems	$1.4 million
Logicon, Inc., San Pedro, Calif.	U.S. Air Force Space & Missile Organization	Missile guidance and control system performance evaluation studies	$1 million
Hazeltine Corp., Little Neck, N.Y.	Jet Propulsion Laboratory, Pasadena, Calif.	Develop a Digital-Video Display System for use in support of planetary missions; will use displays and prints in analyzing mission performance	$849,000
Conrac Corp., New York, N.Y.	Dallas Cowboys Football Club, Inc., Texas	Initial phase of a $1.5+ million scoreboard, scoring and information system	$500,000+
Information Science Industries (Canada), Ltd., Ottawa	Department of Manpower and Immigration, Ottawa, Canada	A computer software system; ISI will provide over-all computerized services	$500,000+
Computer Sciences Corp., Los Angeles, Calif.	U.S. Department of Health, Education and Welfare	A computer-based information system to assist the Rehabilitation Services Administration to increase scope, quality of services, while cutting administrative costs	$350,000
System Development Corp. (SDC), Santa Monica, Calif.	County of Los Angeles, Calif.	Preparing the design specifications for the County's computerized Regional Justice Information System (RJIS)	$308,000
Public Safety Systems Inc., a subsidiary of General Research Corp., Santa Barbara, Calif.	City of Anaheim, Calif.	A computerized traffic records system for use by Police Dept., City Traffic Engineer, county, state, national safety organizations	$91,000
American Regitel Corp. San Carlos, Calif.	American Industries, Salt Lake City, Utah	100 80-column teleprinters (for use in medical data system) for doctor's offices, clinics	—

NEW INSTALLATIONS

OF	AT	FOR
Burroughs B340 system	First National Bank, Indiana, Pa.	Checking accounts, proof and transit, Golden Passbook, stockholder accounting, account reconciliation (system valued at over $180,000)
Burroughs B500 system	City of Columbia, S.C.	Water Department billing, collection, analysis; police court docket; traffic division, ticket enforcement, statistical analysis; City data processing, taxes, etc.; automotive accounting, inventory, analysis, of emergency medical services (system valued at over $430,000)
	First National Bank and Trust Co., Ardmore, Okla.	General banking applications as well as municipal water billing, safe deposit boxes, amortization scheduling; bank is service bureau oriented (system valued at over $500,000)
Burroughs B3500 system	Oak Park Trust & Savings Bank of Illinois	Demand deposit accounts, installment loan, proof/transit, trust, bond portfolio, etc. (system valued at about $600,000)
	Order of the Sisters of St. Joseph, Orange, Calif.	Processing and storing business and scientific data collected from nine hospitals operated by the Order (system valued at over $413,000)
Control Data 3500 system	Hoogovens (the Royal Dutch Blast Furnaces and Steel Works)	Central data base and information systems development; also expansion of its computerized production control system, presently on dual 3300 installation
Control Data 6400 system	IABG, Munich, Germany	Expansion of firm's scientific and technical services to German aerospace industry and government agencies (system valued at $2.5 million)
Honeywell Model 110 system	ALESCO (The American Library and Educational Service Co.), Div. of Paulist Press, Paramus, N.J.	Inventory management, order entry, invoicing and sales information applications
	Cambrian College, North Bay, Ontario, Canada	Instruction in data processing and for administrative applications
	Weber County, Ogden, Utah	Property tax accounting, payroll, budget accounting, voter registration applications
Honeywell Model 115 system	Andover Institute of Business, Andover, Mass.	Computer education applications
	Sterling Computer Systems, Los Angeles, Calif.	Applications including inventory control, accounting services and statistical report preparation
Honeywell Model 1200 system	Dearborn Public Schools, Dearborn, Mich.	Business and school services for the school district, which includes a community college
	Hayes International Corp., Air Force Publications Div., Middle River, Md.	Inventory control and distribution of U.S. Air Force forms and publications
Honeywell Model 3200 system	Refuge Assurance, Manchester, England	All areas of life assurance
IBM System/3	Marvin Windows, Warroad, Minn.	Producing a variety of financial statements and reports
IBM System/360 Model 25	Gym-Dandy, Inc., Bossier City, La.	Provides production control, parts scheduling, sales monitoring, sales forecasting
	First National Bank, St. Joseph, Mo.	Personal trust accounting, certificates of deposit, payroll, etc.
NCR Century 100 system	Garden City Cooperative Equity Exchange, Garden City, Kans.	Blending feed for cattle, billing, grain inventory; also used several hours daily by Garden City National Bank
	Medicenters of America, Inc., Memphis, Tenn.	A patient accounting system for nationwide complex of over 40 recuperative care facilities in 24 states
	Northland Milk, Minneapolis, Minn.	Maintaining route settlement accounts, ice-cream inventory, accounts payable
NCR Century 200 system	Brockton Public Markets, Brockton, Mass.	Order billing, inventory control, automatic reorder, sales analysis, and payroll for 580 employees
	Hertfordshire County Council, Hertford, England	A variety of applications such as costing, stores control, highway design and payroll for 35,000
RCA Spectra 70/35	State Revenue Department, Alabama	Processing state income tax returns, motor vehicle registrations, state sales tax data
RCA Spectra 70/45	American Home Foods, a div. of American Home Products Corp., Milton, Pa.	Chef Boy-Ar-Dee plant customer billing for some 150 warehouses, and general accounting chores (system valued at $1 million)
Univac 9000 Series computers	Westinghouse Tele-Computer Systems Corp., Pittsburgh, Pa. (30 systems)	Serving as remote terminals (at various Westinghouse installations throughout U.S.) to a large-scale computer in Tele-Computer Center in Pittsburgh (systems valued at about $2 million)
Univac 9200 system	Anastasi Bros., Inc., Philadelphia, Pa.	Applications including cost estimating, job cost distribution, payroll and general accounting
Univac 9300 system	B. C. Hospitals Association, Vancouver, B.C.	Expediting operations of 37 hospitals with 16,000 employees
	Vancouver Stock Exchange Ltd., Vancouver, B.C.	Providing instantaneous information on volumes and prices; also prepares statistics and performs accounting operations
Univac 9400 system	Escaut Insurance Company, Antwerp, Belgium	Correlating accident statistics with premiums charged; also developing improved techniques to provide better and faster service to policy holders

MONTHLY COMPUTER CENSUS

Neil Macdonald
Survey Editor
COMPUTERS AND AUTOMATION

The following is a summary made by COMPUTERS AND AUTOMATION of reports and estimates of the number of general purpose electronic digital computers manufactured and installed, or to be manufactured and on order. These figures are mailed to individual computer manufacturers from time to time for their information and review, and for any updating or comments they may care to provide. Please note the variation in dates and reliability of the information. Several important manufacturers refuse to give out, confirm, or comment on any figures.

Our census seeks to include all digital computers manufactured anywhere. We invite all manufacturers located anywhere to submit information for this census. We invite all our readers to submit information that would help make these figures as accurate and complete as possible.

Part I of the Monthly Computer Census contains reports for United States manufacturers. Part II contains reports for manufacturers outside of the United States. The two parts are published in alternate months.

The following abbreviations apply:

(A) -- authoritative figures, derived essentially from information sent by the manufacturer directly to COMPUTERS AND AUTOMATION
C -- figure is combined in a total
(D) -- acknowledgment is given to DP Focus, Marlboro, Mass., for their help in estimating many of these figures
E -- figure estimated by COMPUTERS AND AUTOMATION
(N) -- manufacturer refuses to give any figures on number of installations or of orders, and refuses to comment in any way on those numbers stated here
(R) -- figures derived all or in part from information released indirectly by the manufacturer, or from reports by other sources likely to be informed
(S) -- sale only, and sale (not rental) price is stated
X -- no longer in production
\- -- information not obtained at press time

SUMMARY AS OF AUGUST 15, 1970

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL $(000)	NUMBER OF INSTALLATIONS In U.S.A.	Outside U.S.A.	In World	NUMBER OF UNFILLED ORDERS
Part I. United States Manufacturers							
Autonetics	RECOMP II	11/58	2.5	30	0	30	X
Anaheim, Calif. (R) (1/69)	RECOMP III	6/61	1.5	6	0	6	X
Bailey Meter Co.	Bailey 750	6/60	40-250 (S)	32	3	35	0
Wickliffe, Ohio (R) (6/70)	Bailey 756	2/65	60-400 (S)	13	5	18	1
	Bailey 855	4/68	100-1000(S)	5	0	5	20
Bunker-Ramo Corp.	BR-130	10/61	2.0	160	-	-	X
Canoga Park, Calif.	BR-133	5/64	2.4	79	-	-	X
(A)	BR-230	8/63	2.7	15	-	-	X
(10/69)	BR-300	3/59	3.0	18	-	-	X
	BR-330	12/60	4.0	19	-	-	X
	BR-340	12/63	7.0	19	-	-	X
Burroughs	205	1/54	4.6	25-38	2	27-40	X
Detroit, Mich.	220	10/58	14.0	28-31	2	30-33	X
(N)	B100/B500	7/65	2.8-9.0	-	-	-	-
(1/69-5/69)	B2500	2/67	5.0	52-57	12	64-69	117
	B3500	5/67	14.0	44	18	62	190
	B5500	3/63	23.5	65-74	7	72-81	8
	B6500	2/68	33.0	4	0	4	60
	B7500	4/69	44.0	0	0	0	13
	B8500	8/67	200.0	1	0	1	5
Control Data Corp.	G15	7/55	1.6	-	-	295	X
Minneapolis, Minn.	G20	4/61	15.5	-	-	20	X
(R)	LGP-21	12/62	0.7	-	-	165	X
(9/70)	LGP-30	9/56	1.3	-	-	322	X
	RPC4000	1/61	1.9	-	-	75	X
	636/136/046 Series	-	-	-	-	29	-
	160/8090 Series	5/60	2.1-14.0	-	-	610	X
	924/924A	8/61	11.0	-	-	29	X
	1604/A/B	1/60	45.0	-	-	59	X
	1700	5/66	3.8	-	-	106-180	C
	3100/3150	5/64	10-16	-	-	83-110	C
	3200	5/64	13.0	-	-	55-60	C
	3300	9/65	20-28	-	-	200	C
	3400	11/64	18.0	-	-	20	C
	3500	8/68	25.0	-	-	15	C
	3600	6/23	52.0	-	-	39	C
	3800	2/66	53.0	-	-	20	C
	6400/6500	8/64	58.0	-	-	85	C
	6600	8/64	115.0	-	-	85	C
	6800	6/67	130.0	-	-	1	C
	7600	12/68	235.0	-	-	1	C
							Total: 160 E
Data General Corp.	NOVA	2/69	8.0 (S)	-	-	650	-
Southboro, Mass. (A) (6/70)	SUPERNOVA	5/70	9.6 (S)	-	-	22	-
Datacraft Corp.	6024/1	5/69	54-200 (S)	9	0	9	4
Ft. Lauderdale, Fla. (A) (9/70)-	6024/3	2/70	33-200 (S)	17	0	17	54
Digiac Corp.	Digiac 3080	12/64	19.5 (S)	14	-	-	2
Plainview, N.Y. (A) (2/70)	Digiac 3080C	10/67	25.0 (S)	5	-	-	1
Digital Equipment Corp.	PDP-1	11/60	3.4	50	2	52	X
Maynard, Mass.	PDP-4	8/62	1.7	40	5	45	X
(A)	PDP-5	9/63	0.9	90	10	100	X
(6/70)	PDP-6	10/64	10.0	C	C	23	X
	PDP-7	11/64	1.3	C	C	160	X
	PDP-8	4/65	0.5	C	C	1450	C
	PDP-8/I	3/68	0.4	C	C	2157	C
	PDP-8/S	9/66	0.3	C	C	1020	C
	PDP-8/L	11/68	-	C	C	2350	C
	PDP-9	12/66	1.1	C	C	425	C
	PDP-9L	11/68	-	C	C	41	C
	PDP-10	12/67	8.0	C	C	144	C
	PDP-11	3/70	10.5 (S)	C	C	27	C
	PDP-12	9/69	-	C	C	275	C
	PDP-15	2/16	17.0	6	C	15	C
	LINC-8	9/66	-	C	C	142	C
							Total: 1350 E

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL $(000)	NUMBER OF INSTALLATIONS In U.S.A.	Outside U.S.A.	In World	NUMBER OF UNFILLED ORDERS
Electronic Associates Inc.	640	4/67	1.2	85	35	120	15
Long Branch, N.J. (A) (6/70)	8400	7/65	12.0	19	6	25	2
EMR Computer	EMR 6020	4/65	5.4	C	-	-	C
Minneapolis, Minn.	EMR 6040	7/65	6.6	C	-	-	C
(N)	EMR 6050	2/66	9.0	C	-	-	C
(6/70)	EMR 6070	10/66	15.0	C	-	-	C
	EMR 6120	-	0.8	-	-	-	-
	EMR 6130	8/67	5.0	C	-	-	C
	EMR 6135	-	2.6	-	-	-	-
				Total: 90 E			Total: 30 E
General Electric	58	5/70	1.0	-	-	-	-
Phoenix, Ariz.	105A	6/69	1.3	-	-	-	-
(N)	105B	6/69	1.4	-	-	-	-
(9/70)	105RTS	7/69	1.2	-	-	-	-
	115	4/66	2.2	200-400	420-680	620-1080	-
	120	3/69	2.9	-	-	-	-
	130	12/68	4.5	-	-	-	-
	205	6/64	2.9	11	0	11	-
	210	7/60	16.0	35	0	35	-
	215	9/63	6.0	15	1	16	-
	225	4/61	8.0	145	15	160	-
	235	4/64	12.0	40-60	17	57-77	-
	245	11/68	13.0	3	-	3	-
	255 T/S	10/67	17.0	15-20	-	15-20	-
	265 T/S	10/65	20.0	45-60	15-30	60-90	-
	275 T/S	11/68	23.0	-	-	10	-
	405	2/68	6.8	10-40	5	15-45	-
	410 T/S	11/69	11.0	-	-	-	-
	415	5/64	7.3	170-300	70-100	240-400	-
	420 T/S	6/67	23.0	-	-	-	-
	425	6/64	9.6	50-100	20-30	70-130	-
	430 T/S	6/69	17.0	-	-	-	-
	435	9/65	14.0	20	6	26	-
	440 T/S	7/69	25.0	-	-	-	-
	615	3/68	32.0	-	-	-	-
	625	4/65	43.0	23	3	26	-
	635	5/65	47.0	20-40	3	23-43	-
	655	12/70	80.0	-	-	-	-
Process Control Computers:	4020	2/67	6.0	148	46	194	70
(A)	4040	8/64	3.0	45	20	65	-
(6/70)	4050	12/66	7.0	22	1	23	1
	4060	6/65	2.0	18	2	20	-
Hewlett Packard	2114A	10/68	0.25	-	-	915	-
Cupertino, Calif.	2115A	11/67	0.41	-	-	663	-
(A) (9/70)	2116A, 2116B	11/66	0.6	-	-	1156	-
Honeywell	DDP-24	5/63	2.65	-	-	90	X
Computer Control Div.	DDP-116	4/65	0.9	-	-	250	-
Framingham, Mass.	DDP-124	3/66	2.2	-	-	175	-
(R)	DDP-224	3/65	3.5	-	-	60	-
(9/70)	DDP-316	6/69	0.6	-	-	300	-
	DDP-416	-	-	-	-	225	-
	DDP-516	9/66	1.2	-	-	700	-
	H112	10/69	-	-	-	45	-
	H632	12/68	3.2	-	-	10	-
	H1648	11/68	12.0	-	-	15	-
Honeywell	H-110	8/68	2.7	180	75	255	0
EDP Div.	H-115	6/70	3.5	30	-	30	-
Wellesley Hills, Mass.	H-120	1/66	4.8	800	160	960	-
(R)	H-125	12/67	7.0	150	220	370	-
(6/70)	H-200	3/64	7.5	800	275	1075	-
	H-400	12/61	10.5	46	40	86	X
	H-800	12/60	30.0	58	15	73	X
	H-1200	2/66	9.8	230	90	325	-
	H-1250	7/68	12.0	130	55	185	-
	H-1400	1/64	14.0	4	6	10	X
	H-1800	1/64	50.0	15	5	20	X
	H-2200	1/66	18.0	125	60	185	-
	H-3200	2/70	24.0	20	2	22	-
	H-4200	8/68	32.5	18	2	20	-
	H-8200	12/68	50.0	10	3	14	-
IBM	System 3	1/70	1.1	0	0	-	-
White Plains, N.Y.	305	12/57	3.6	40	15	55	-
(N) (D)	650	10/67	4.8	50	18	68	-
(1/69-5/69)	1130	2/66	1.5	2580	1227	3807	-
	1401	9/60	5.4	2210	1836	4046	-
	1401-G	5/64	2.3	420	450	870	-
	1401-H	6/67	1.3	180	140	320	-
	1410	11/61	17.0	156	116	272	-
	1440	4/63	4.1	1690	1174	2864	-
	1460	10/63	10.0	194	63	257	-
	1620 1, 11	9/60	4.1	285	186	471	-
	1800	1/66	5.1	415	148	563	-
	7010	10/63	26.0	67	14	81	-
	7030	5/61	160.0	4	1	5	-
	704	12/55	32.0	12	1	13	-
	7040	6/63	25.0	35	27	2	-
	7044	6/63	36.5	28	13	41	-
	705	11/55	38.0	18	3	21	-
	7070, 2	3/60	27.0	10	3	13	-
	7074	3/60	35.0	44	26	70	-
	7080	8/61	60.0	13	2	15	-
	7090	11/59	63.5	4	2	6	-
	7094-1	9/62	75.0	10	4	14	-

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL $(000)	NUMBER OF INSTALLATIONS In U.S.A.	Outside U.S.A.	In World	NUMBER OF UNFILLED ORDERS
IBM (Cont'd.)	7094-II	4/64	83.0	6	4	10	-
	360/20	12/65	2.7	4690	3276	7966	-
	360/25	1/68	5.1	0	4	4	-
	360/30	5/65	10.3	5075	3144	8219	-
	360/40	4/65	19.3	1260	498	1758	-
	360/44	7/66	11.8	65	13	78	-
	360/50	8/65	29.1	480	109	589	-
	360/65	11/65	57.2	175	31	206	-
	360/67	10/66	133.8	9	4	13	-
	360/75	2/66	66.9	14	3	17	-
	360/85	-	150.3	0	0	0	-
	360/90	11/67	(S)	5	0	5	-
	360/195	-	232.0	-	-	-	-
Interdata	Model 2	7/68	0.25	-	-	18	0
Oceanport, N.J.	Model 3	3/67	0.4	-	-	230	70
(A) (9/70)	Model 4	8/68	0.6	-	-	175	95
NCR	304	1/60	14.0	15	2	17	X
Dayton, Ohio	310	5/61	2.5	8	0	8	X
(R)	315	5/62	8.7	400	300	700	-
(9/70)	315 RMC	9/65	12.0	125	45	170	-
	390	5/61	1.9	350	600	950	-
	500	10/65	1.5	1100	1550	2650	-
	Century 100	9/68	2.7	600	200	800	-
	Century 200	6/69	7.5	150	50	200	-
Philco	1000	6/63	7.0	16	-	-	X
Willow Grove, Pa.	2000-210, 211	10/58	40.0	16	-	-	X
(N) (1/69)	2000-212	1/63	52.0	12	-	-	X
RCA	301	2/61	7.0	140-290	100-130	240-420	-
Cherry Hill, N.J.	501	6/59	14.0-18.0	22-50	1	23-51	-
(N)	601	11/62	14.0-35.0	2	0	2	-
(5/69)	3301	7/64	17.0-35.0	24-60	1-5	25-65	-
	Spectra 70/15	9/65	4.3	90-110	35-60	125-170	-
	Spectra 70/25	9/65	6.6	68-70	18-25	86-95	-
	Spectra 70/35	1/67	9.2	65-100	20-50	85-150	-
	Spectra 70/45	11/65	22.5	84-180	21-55	105-235	-
	Spectra 70/46	-	33.5	1	0	1	-
	Spectra 70/55	11/66	34.0	11	1	12	-
Raytheon	250	12/60	1.2	155	20	175	X
Santa Ana, Calif.	440	3/64	3.6	20	-	20	X
(A)	520	10/65	3.2	26	1	27	X
(9/70)	703	10/67	12.8(S)	161	20	181	1
	704	3/70	9.8(S)	12	6	18	12
	706	5/69	19.0(S)	40	4	44	10
Scientific Control Corp.	650	5/66	0.5	23	0	23	X
Dallas, Tex.	655	10/66	2.1	137	0	137	0
(A)	660	10/65	2.1	41	0	41	0
(6/70)	670	5/66	2.7	1	0	1	X
	4700	4/69	1.8	16	0	16	1
	DCT-132	5/69	0.7	40	0	40	24
Standard Computer Corp.	IC 4000	12/68	9.0	6	0	6	8 E
Los Angeles, Calif.	IC 6000	5/67	16.0	9	0	9	-
(N) (6/70)	IC 7000	6/69	17.0	3	0	3	10 E
Systems Engineering Laboratories	810	9/65	1.1	24	0	24	X
Ft. Lauderdale, Fla.	810A	8/66	0.9	211	5	216	32
(A)	810B	9/68	1.2	75	1	76	26
(6/70)	840	11/65	1.5	3	0	3	X
	840A	8/66	1.5	36	2	38	X
	840MP	1/68	2.0	31	0	31	2
	Systems 86	-	10.0	0	0	0	2
UNIVAC (Div. of Sperry Rand)	I & II	3/51 & 11/57	25.0	23	-	-	X
New York, N.Y.	III	8/62	21.0	25	6	31	X
(R)	File Computers	8/56	15.0	13	-	-	X
(1/69-5/69)	Solid-State 80 I, II, 90,I,II, & Step	8/58	8.0	210	-	-	X
	418	6/63	11.0	76	36	112	20 E
	490 Series	12/61	30.0	75	11	86	35 E
	1004	2/63	1.9	1502	628	2130	20 E
	1005	4/66	2.4	637	299	936	90 E
	1050	9/63	8.5	138	62	200	10 E
	1100 Series (except 1107, 1108)	12/50	35.0	9	0	9	X
	1107	10/62	57.0	8	3	11	X
	1108	9/65	68.0	38	18	56	75 E
	9200	6/67	1.5	127	48	175	850 E
	9300	9/67	3.4	106	38	144	550 E
	9400	5/69	7.0	3	0	3	60 E
	LARC	5/60	135.0	2	0	2	-
Varian Data Machines	620	11/65	0.9	-	-	75	X
Newport Beach, Calif.	620i	6/67	0.5	-	-	1200	400
(A) (9/70)	R-620i	4/69	-	-	-	30	30
	520i	10/68	0.4	-	-	125	330
	620	11/70	0.5	-	-	-	125
	520/DC	12/69	1.6	-	-	18	25
Xerox Data Systems	XDS-92	4/65	1.5	10-60	2	12-62	-
El Segundo, Calif.	XDS-910	8/62	2.0	150-170	7-10	157-180	-
(N)	XDS-920	9/62	2.9	93-120	5-12	98-132	-
(4/70)	XDS-925	12/64	3.0	20	1	21	-
	XDS-930	6/64	3.4	159	14	173	-
	XDS-940	4/66	14.0	28-35	0	28-35	-
	XDS-9300	11/64	8.5	21-25	1	22-26	-
	Sigma 2	12/66	1.8	60-110	10-15	70-125	-
	Sigma 3	12/69	2.0	10	0	10	-
	Sigma 5	8/67	6.0	15-40	6-18	21-58	-
	Sigma 7	12/66	12.0	24-35	5-9	29-44	-

CALENDAR OF COMING EVENTS

Sept. 1-3, 1970: 25th National Conference, Association for Computing Machinery, New York Hilton, New York, N.Y. / contact: Sam Matsa, ACM '70 General Chairman, IBM Corp., 410 E. 62nd St., New York, N.Y. 10021

Sept. 2-4, 1970: The Institution of Electrical Engineers (IEE) Conference on Man-Computer Interaction, UK National Physical Laboratory, Teddington, Middlesex, England / contact: Roger Dence, IEE Press Office, Savoy Place, London WC2, England

Sept. 14-15, 1970: Society for Management Information Systems (SMIS) 1970 Conference, The Shoreham Hotel, Washington, D.C. / contact: The Society for Management Systems (SMIS), c/o Prof. John F. McCarthy, Jr., P.O. Box 16, Benjamin Franklin Station, Washington, D.C. 20044

Sept. 14-16, 1970: First Canadian Computer Show and Conference, Montreal, Canada / contact: Jack McCaugherty, James Lovick Ltd., Vancouver, British Columbia, Canada

Sept. 14-17, 1970: 15th Annual Technical Symposium of The Society of Photo-optical Instrumentation Engineers (SPIE), Anaheim, Calif. / contact: SPIE, Attn: Symposia Vice President, P.O. Box 288, Redondo Beach, Calif. 90277

Sept. 14-24, 1970: 1970 FID (International Federation for Documentation) Conference and International Congress on Scientific Information, Buenos Aires, Argentina / contact: U.S. National Committee for FID, National Academy of Sciences, 2101 Constitution Ave., Washington, D.C. 20418

Sept. 15-16, 1970: 4th Annual Instrumentation Fair, Washington Hilton Hotel, Washington, D.C. / contact: Norm Ward, AD-TECH, P.O. Box 475, McLean, VA 22101

Sept. 15-17, 1970: 16th Annual Seminar of the American Society for Industrial Security, Sheraton Boston Hotel, Boston, Mass. / contact: Edward G. Goulart, Public Relations Chmn., M.I.T. Lincoln Laboratory, 244 Wood St., Lexington, Mass. 02173

Sept. 16-18, 1970: Digital Equipment Computer Users Society (DECUS) European Branch, Kunsterhaus, Munich, Germany / contact: Martha Ries, DECUS European Secretary, c/o DECUS International Office, 81 Route de L'Aire, 1227 Carouge, Geneva, Switzerland

Sept. 17-18, 1970: Computer Science and Statistics Symposium, sponsored by the Los Angeles Chapter of the ACM, University of California, Irvine, Calif. / contact: Dr. Mitchell O. Locks, C-E-I-R Professional Services Div., Control Data Corp., 6060 W. Manchester, Los Angeles, Calif. 90045; or Dr. Michael E. Tarter, Assoc. Prof., Dept. of Mathematics and Dept. of Medicine, University of California, Irvine, Calif. 92664

Sept. 22-24, 1970: The Computers and Communications Conference (IEEE), The Beeches, Rome, N.Y. / contact: Jerold T. McClure, Conference Chairman, P.O. Box 182, Rome, N.Y. 13440

Sept. 22-24, 1970: Univac Users Association Fall Conference, Roosevelt Hotel, New Orleans, La. / contact: User Group Relations, Univac Division, Sperry Rand Corp., P.O. Box 500, Blue Bell, Pa. 19422

Sept. 28-30, 1970: 6th Annual Meeting of the Association of American Railroads Data Systems Div., Annual Equipment Show, Regency Hyatt House, Atlanta, Ga. / contact: Trade Associates, Inc., 5151 Wisconsin Ave., N.W., Washington, D.C. 20016

Sept. 29, 1970: Symposium on "Present and Future Uses of Computers in the Chemical Industry", sponsored by the Society of Consulting Chemists and Chemical Engineers, White Plains Hotel, White Plains,

CLASSIFIED ADVERTISEMENTS

ADVERTISING INDEX

Following is the index of advertisements. Each item contains: Name and address of the advertiser / page number where the advertisement appears / name of the agency, if any

N.Y. / contact: Association of Consulting Chemists and Chemical Engineers, Inc., 50 East 41st St., New York, N.Y. 10017

Oct. 5-7, 1970: 1970 Symposium on Feature Extraction and Selection in Pattern Recognition, Argonne National Laboratory, Argonne, Ill. / contact: David Jacobsohn, Argonne National Laboratory, Argonne, IL 60440

Oct. 5-9, 1970: Computer 70—International Computer Exhibition, Olympia, London, England / contact: M. F. Webster, Leedex Limited, 100 Whitechapel Road, London, E.1., England

Oct. 7-9, 1970: American Production and Inventory Control Society 13th Annual International Conference, Ohio Convention Exposition Center, Cincinnati, Ohio / contact: APICS National Office, Suite 504, Watergate Bldg., 2600 Virginia Ave., N.W., Washington, D.C. 20037

Oct. 11-14, 1970: 33rd Annual Meeting of the American Society for Information Science (ASIS), Sheraton Hotel, Philadelphia, Pa. / contact: ASIS 1970 Convention Chairman, Dr. Eugene Garfield, Institute for Scientific Information, 325 Chestnut St., Philadelphia, Pa. 19106

Oct. 12-13, 1970: Sixth National Data Processing Conference of the Information Processing Association of Israel, Tel Aviv Hilton Hotel, Tel Aviv, Israel / contact: S. Shalish, Chmn., Information Processing Association of Israel, P.O.B. 3009, Jerusalem, Israel

Oct. 12-14, 1970: SIAM (Society for Industrial and Applied Mathematics) 1970 Fall Meeting, Hotel Lenox, Boston, Mass. / contact: General Chairman, SIAM 1970 Fall Meeting, 33 South 17th St., Philadelphia, Pa. 19103

Oct. 12-16, 1970: USE Fall Conference, Sheraton-Biltmore Hotel, Atlanta, Ga. / contact: User Group Relations, Univac Division, Sperry Rand Corp., P.O. Box 500, Blue Bell, Pa. 19422

Oct. 13, 1970: Second Annual TDCC (Transportation Data Coordinating Committee) Seminar on the Computerization of Transportation Data and Information Systems, Presidential Ballroom, Statler Hilton, Washington, D.C. / contact: Transportation Data Coordinating Committee, 1101 Seventeenth St. NW, Washington, D.C. 20036

Oct. 14-16, 1970: ADAPSO's 30th Management Conference & 9th Annual Meeting, Paradise Island Hotel, Nassau, Bahamas / contact: ADAPSO (Association of Data Processing Service Organizations, Inc.), 551 Fifth Ave., New York, N.Y. 10017

Oct. 14-16, 1970: IEEE Systems Science & Cybernetics Conference, Webster Hall Hotel, Pittsburgh, Pa. / contact: Prof. A. Lavi, Carnegie-Mellon Univ., Pittsburgh, Pa. 15213

Oct. 14-16, 1970: International Conference on Management Information Systems, Copenhagen, Denmark / contact: Harald Josefsen, Program Committee Chmn., The Danish EDP Council, Vesterbrogade 1, DK-1620 Copenhagen V, Denmark

Oct. 14-16, 1970: Conference on Earth Station Technology, London, England / contact: Helen Kaye, The Institution of Electrical Engineers, Savoy Place, London WC2, England

Oct. 14-17, 1970: International Symposium on Digital Computer Applications in Engineering Sciences, Technical University of Istanbul, Turkey / contact: F. A. Akyuz, I.T.U. Hesap Merkezi (Computation Center), Taskisla 114, Istanbul, Turkey

Oct. 15-16, 1970: 1970 Atlantic Div. of Assoc. for Systems Management Eighth Annual Atlantic Systems Conference, New York Hilton, New York City, N.Y. / contact: Malcolm B. Foster, A.S.C., Box 461, Pleasantville, N.Y. 10570

Oct. 19-20, 1970: 5th Annual Conference, Digitronics Users Association (DUA), Ambassador Hotel, Chicago, Ill. / contact: Executive Secretary, DUA, Box 113, Albertson, L.I., N.Y. 11507

Oct. 19-21, 1970: 11th National Meeting of The Institute of Management Sciences, Los Angeles Hilton Hotel, Los Angeles, Calif. / contact: Gene Saxby, Security Pacific National Bank, P.O. Box 2097 Terminal Annex, Los Angeles, Calif. 90054

Oct. 20, 1970: Division 11 Fall Conference of the Pittsburgh Chapter of the Data Processing Management Association, Pittsburgh, Pa. / contact: James J. Dean, P.O. Box 2004, Pittsburgh, PA 15230

Oct. 26-28, 1970: Data Processing Supplies Association, Fall General Meeting, The Park Sheraton Hotel, 7th Ave., and 56th St., New York, N.Y. / contact: Data Processing Supplies Association, 1116 Summer St., P.O. Box 1333, Stamford, Conn. 06904

Oct. 26-28, 1970: Forum of Control Data Users (FOCUS) Regional Conference, Statler Hilton Hotel, Washington, D.C. / contact: William I. Rabkin, FOCUS Exec. Sec., c/o Itek Corp., 10 Maguire Rd., Lexington, Mass. 02173

Oct. 26-29, 1970: 25th Annual ISA Conference & Exhibit, Civic Center, Philadelphia, Pa. / contact: K. F. Fitch, Meetings Coordinator, Instrument Society of America, 530 William Penn Place, Pittsburgh, Pa. 15219

Oct. 26-30, 1970: 12th Annual BEMA Business Equipment Exposition, New York Coliseum, New York, N.Y. / contact: Business Equipment Manufacturers Association (BEMA), 1828 "L" St. NW, Washington, D.C. 20038

Oct. 27-29, 1970: 12th Annual BEMA Management Conference, American Hotel, New York, N.Y. / contact: Business Equipment Manufacturers Association (BEMA), 1828 "L" St. NW, Washington, D.C. 20038

Oct. 27-30, 1970: Midwest Power Systems Conference and Symposium (IEEE co-sponsor), Iowa State University, Ames, Iowa / contact: H. K. Baker, Engineering Extension, 110 Marston Hall, Iowa State University, Ames, Iowa 50010

Oct. 29-30, 1970: IEEE Joint Engineering Management Conference, Drake Hotel, Chicago, Ill. / contact: AIIE Headquarters, 345 E. 47th St., New York, N.Y. 10017

Nov. 10-12, 1970: National Symposium on Criminal Justice Information and Statistics Systems, Sheraton-Dallas Hotel, Dallas, Texas / contact: Project SEARCH, 1108 14th St. Fifth Floor, Sacramento, Calif. 95814

Nov. 12-13, 1970: Canadian IEEE Symposium on Communications, Queen Elizabeth Hotel, Montreal, Quebec, Canada / contact: IEEE Headquarters, Technical Conference Services, 345 E. 47th St., New York, N.Y. 10017

Nov. 12-13, 1970: CAST '70 Conference (AIIE), The Americana Hotel, Miami Beach, Fla. / contact: Joseph P. Lacusky, American Institute of Industrial Engineers, Inc., CAST '70, P. O. Box 1081, Miami, Fla. 33148

Nov. 12-13, 1970: 11th IEEE Symposium on Man-Machine Systems, Langford Hotel, Winter Park, Fla. / contact: The Institute of Electrical and Electronics Engineers, Inc., 345 East 47th St., New York, N.Y. 10017

Nov. 16, 1970: ACM Computer Graphics Workshop, Houston, Tex. / contact: Jackie Potts, ACM, SIGGRAPH, Box 933, Blair Station, Silver Spring, MD 20910

Nov. 17-19, 1970: Fall Joint Computer Conference, Astro Hall, Houston, Tex. / contact: L. E. Axsom, IBM Scientific Ctr., 6900 Fannin, Houston, Tex. 77025

Nov. 19-21, 1970: DECUS (Digital Equipment Computer Users Society) 1970 Fall Symposium, Shamrock Hilton, Houston, Texas / contact: DECUS, Digital Equipment Corp., Maynard, Mass. 01754

Dec. 2-3, 1970: Conference on Display Devices, United Engineering Ctr., New York, N.Y. / contact: Sam Stone, Gen'l Tel. & Elec., 208-20 Willets Pt. Blvd., Bayside, N.Y. 11360

Dec. 7-9, 1970: 9th IEEE Symposium on Adaptive Processes: Decision and Control, Univ. of Texas, Austin, Tex. / contact: Prof. D. G. Lainiotis, Engineering Science Bldg., 502, Univ. of Texas at Austin, Austin, Tex. 78712

Dec. 7-9, 1970: 26th Annual National Electronics Conference and Exhibition (NEC/70), Conrad Hilton Hotel, Chicago, Ill. / contact: NEC, Oakbrook Executive Plaza #2, 1211 W. 22nd St., Oak Brook, Ill. 60521

Dec. 9-11, 1970: Fourth Conference on Applications of Simulation, Waldorf-Astoria, New York, N.Y. / contact: Association for Computing Machinery, 1133 Avenue of the Americas, New York, N.Y. 11036

Jan. 31-Feb. 5, 1971: IEEE Winter Power Meeting, Statler Hilton Hotel, New York, N.Y. / contact: IEEE Headquarters, Technical Conference Service, 345 E. 47th St., New York, N.Y. 10017

THE MAY ARTICLE

THE ASSASSINATION OF PRESIDENT JOHN F. KENNEDY:

THE APPLICATION OF COMPUTERS TO THE PHOTOGRAPHIC EVIDENCE

Computers and Automation, published in its May issue a 32-page feature article, "The Assassination of President Kennedy: the Application of Computers to the Photographic Evidence".

In this article, Richard E. Sprague, President, Personal Data Services, Hartsdale, N.Y., states that analysis of the evidence proves:

- that the Warren Commission conclusions (that Lee Harvey Oswald was the sole assassin, and that there was no conspiracy) are false;
- that there were at least four gunmen firing from four locations, none of whom was Oswald;
- that the conspiracy to kill Kennedy involved over 50 persons (of whom several are identified in the article) including members of the Dallas police, and elements of the Central Intelligence Agency of the United States; etc.

The evidence published in this article includes eleven important photographs. One of them shows Jim Hicks, who admitted he was the radio communicator among the firing teams at Dealey Plaza, with his radio transmitter in his back left pocket. The article includes a tabulation of over 500 photographs (counting a movie sequence as one photo) taken in and around Dealey Plaza, Dallas, Texas, Nov. 22, 1963, at the time of President Kennedy's assassination and shortly thereafter. Both a spatial chart and a timing chart of the events and the photographs are included in this article.

Sprague, a computer professional for over 24 years, has as an avocation, studied the old and the new evidence for over 6 years, and has analyzed over 400 of the 500 photographs.

The work in computerized analysis of over 300 still photos and over 25,000 frames of movie sequences has been started.

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An excerpt from the May article

Part 2. The Photographic Evidence

The assassination of President John F. Kennedy was the most photographed murder in history. Approximately 75 photographers took a total of approximately 510 photographs, either before or during or within an hour after the events in Dealey Plaza, and either there or nearby or related to those events. The word "photograph" in this context includes both still photos and movie sequences. The number of frames in a movie sequence ranges from about 10 to about 500; and in the count of 510 photographs given above, the 10 to 500 frames of a single movie sequence are counted just as one photograph. The total number of frames is over 25,000.

The Warren Commission examined 26 photographs, about 5 percent of the 510. The FBI examined about 50 photographs, or about 10 percent. The most famous of all the photographs is the Zapruder film, which had over 480 frames.

Many of the photographs were taken by professional photographers. About 30 of the photographers were professionals who worked for newspapers, television networks, and photographic agencies.

The Warren Commission did not interview a single one of the professional photographers, nor did the Warren Commission see any of their photographs.

Fifteen of these professionals were actually in the Kennedy motorcade, no further than 6 car lengths behind the Kennedy car. Five of these photographers were television network cameramen. The Warren Commission looked at none of their photographs.

Two of the photographers were from the White House. One of these men (Thomas Atkins) was the regular photographer for the White House. He made a special film for Lyndon B. Johnson. Atkins used his own film plus some footage obtained from the television photographers. Johnson looked at the film and then put it away. This film is now stored with the Kennedy Memorial Library materials in a warehouse in Washington, D.C.; it is stated to be "unavailable" to researchers. The Commission did not see this film, nor did they interview Atkins.

Because the professionals used movie cameras of professional quality, their films are exceedingly revealing and valuable as primary evidence. The Warren Commission looked at none of these films.

Chart 2 of this article shows the times of about 50 of the photographs taken in Dealey Plaza during Kennedy's passage through it.

Table 3 of this article lists over 510 photographs so far identified and known to exist or to have existed — with possibly a few borderline cases.