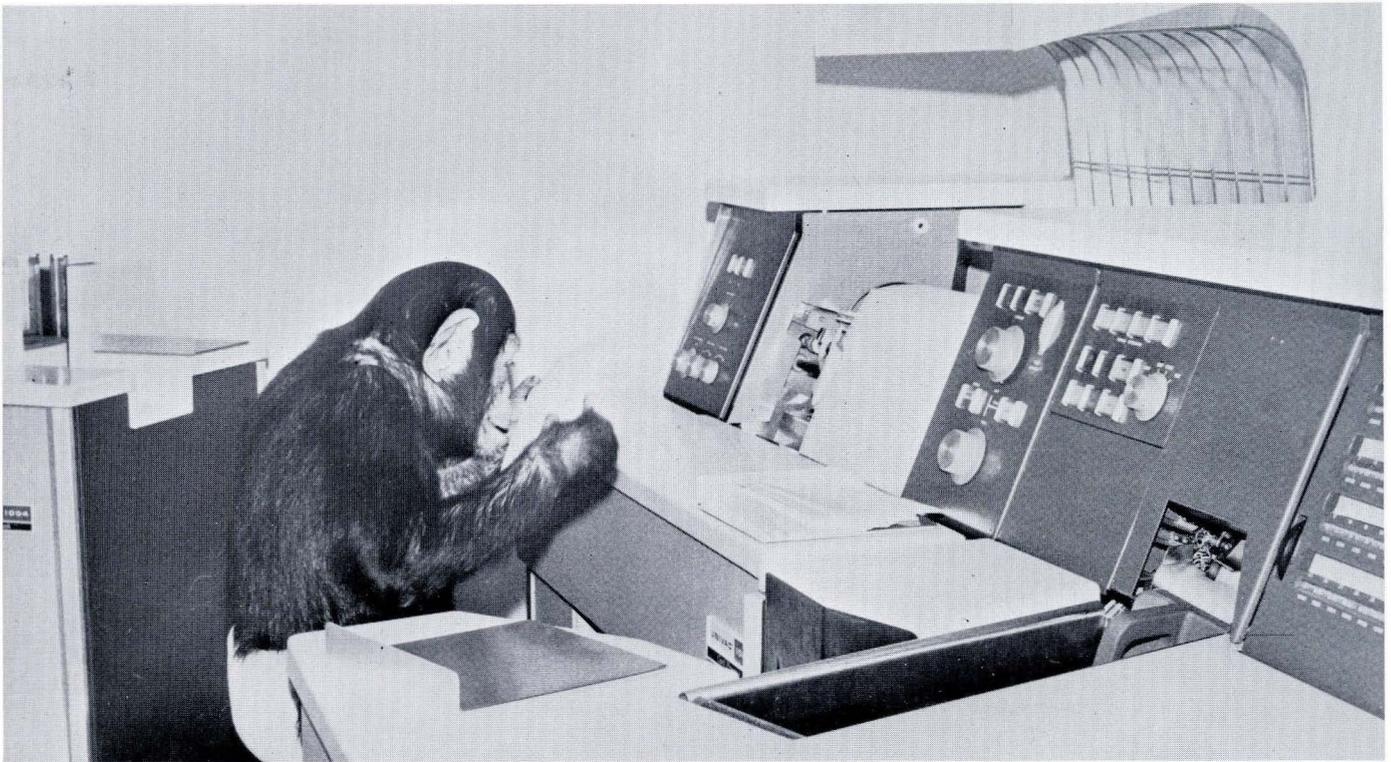


November, 1972

Vol. 21, No. 11

computers and automation



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— TITLES AND SUMMARIES

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9. False Premises, Valid Reasoning, and True Conclusions
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12. Common Sense — Questions for Consideration
13. Falling 1800 Feet Down a Mountain
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16. The Stage of Maturity and Judgement
17. Doomsday in St. Pierre, Martinique — Common Sense vs. Catastrophe
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18. The History of the Doasyoulikes
19. Individuality in Human Beings
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Common Sense, Elementary and Advanced
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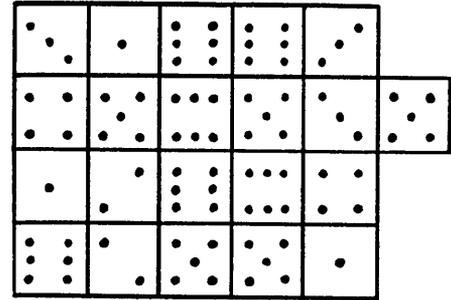
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ZINGO —

A New Game for Computers and/or People



"Dice in quantity, instead of just singles or pairs, provide an exciting 'learn-as-you-play' introduction to probability and statistics. They are much more interesting and much easier to toss, than pennies in quantity."

From time to time computer people hunt for games that are fun to investigate, fun to play with another person, and fun to play with a computer, which should be rather easily programmed to play the game.

Such a game is Zingo. The rules for playing it are as follows:

Rules of Zingo

- 1. Number of Players.** There are two or more players, each using 21 dice (or some other chosen number of dice).
- 2. Choices.** The players agree on a NUMBER to be PRODUCED from a throw of the dice and the allowable arithmetical operations to produce it.

For example, in Advanced Zingo, the number to be produced might be 35, and the allowable operations might be addition, subtraction, multiplication, division, raising to a power, and factorial. In Elementary Zingo, the number to be produced might be 2, and the allowable operations might be addition and subtraction.

- 3. Throw.** Each player then rolls his 21 dice, and obtains a THROW.
- 4. Production.** Each player then arranges his dice in allowed arithmetical COMBINATIONS to PRODUCE the agreed NUMBER.

Thus in Advanced Zingo, suppose the NUMBER to be produced is 35. If a player's THROW of 21 dice included a two, a three, and a five, he could use those 3 dice to PRODUCE 35 because of the COMBINATION $2^5 + 3 = 35$.

In Elementary Zingo, suppose the NUMBER to be produced is 2. Then the player could use the two by itself to PRODUCE one 2, and the three and the five to PRODUCE a second 2 because of the COMBINATION $5 - 3 = 2$.

- 5. Scoring.** If a player uses up all the outcomes shown by his dice in his throw, by making combinations that produce the agreed number, he scores 2 points, for "going out". If the number of his combinations exceeds the number of combinations of the other player (or all the other players), then he scores 3 additional points.

Thus there is a premium on using all of the dice in one's throw, and a premium on making more combinations than the other player (or players).

Incidentally 35 is a particularly interesting number to produce because it cannot be produced by

two dice, but it can be produced by about 10 or 11 or 12 combinations of 3 of the numbers 1 to 6 using addition, subtraction, multiplication, division, raising to a power, factorial, and square root. If a player finds that he cannot produce 7 combinations making 35, each of them using 3 dice, he is compelled to drop back to 6 combinations and is very likely to lose.

The Working Out of a Throw

For example, suppose a throw of 21 dice is as follows:

1 1 1 2 2 3 3 3 4 4 5 5 5 5 5 6 6 6 6 6 6

and the Agreed Number to be produced is 35. The possible combinations of "least cost" (which is 3) are shown in the following table:

USE OF THE THROW TO PRODUCE 35

(1) <u>Formula</u>	(2) <u>Combination</u>	(3) <u>Amount of Use</u>	(4) <u>Total Dice Used Up</u>
$(6 \times 6) - 1 = 35$	1, 6, 6	3	9
$4! + 3! + 5 = 35$	3, 4, 5	2	6
$2^5 + 3 = 35$	2, 3, 5	1	3
$(2+5) \times 5 = 35$	2, 5, 5	1	3

Count, 7 Cost, 21

For more information — especially on the computer program — see the article "Zingo — A New Computer Game" starting on page 33 of the February 1972 issue.

Any reader interested in obtaining scores of dice for use in Zingo (and similar games and statistical experiments) at a moderate price, may use the coupon below.

----- (may be copied on any piece of paper) -----

To: Computers and Automation
815 Washington St., Newtonville, MA 02160
() Yes, please send me _____ package(s) of 100 small dice (about 3/8-inch on an edge) for playing Zingo, and making other statistical investigations.

For each package, I enclose \$4.70 plus 30 cents for handling (a total of \$5.00 per package).

Total enclosed \$ _____ (Prepayment is necessary.)

Name _____

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The Computer Industry

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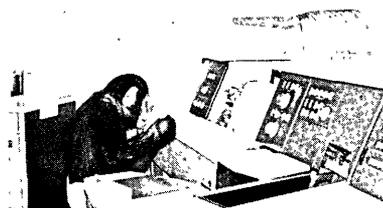
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Front Cover Picture

The front cover shows a 2½ year-old chimpanzee named "Epulu" seated at a UNIVAC 1004 processor in the Technical Academy, Wuppertal, Germany. Trained by Dr. Hans Hass, Director of the Wuppertal Zoo, Epulu "proved his ability as an assistant operator", on one day – "April 1" only.

NOTICE

*D ON YOUR ADDRESS IMPRINT MEANS THAT YOUR SUBSCRIPTION INCLUDES THE COMPUTER DIRECTORY. *N MEANS THAT YOUR PRESENT SUBSCRIPTION DOES NOT INCLUDE THE COMPUTER DIRECTORY.

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COMPUTERS AND SPELLING

The interactive computer is a very real and now widespread convenience. And part of getting a computer to do what you want it to do is for you to type in correctly spelled words so that it won't reply "?", as my computer often replies to me!

There are two parts to this problem: (1) correctly spelled according to the computer program; and (2) correctly spelled according to the rules of English.

Let's begin discussion with a portion of this second topic: "The Exasperation of Correct Spelling in English".

Correct English spelling is often a troublesome nuisance:

1. More and more young people who apply for jobs cannot spell correctly. Just as good secretaries are becoming scarcer and scarcer, so are good spellers. If we cannot fight this, why not join it?

2. Already good English allows a large number of words to have variant spellings that are recognized in the dictionary, and few people are disturbed by the variations. See the examples in Table 1 opposite. With this breach in the walls, why not make a wider breach?

3. Historian friends of mine have told me that George Washington varied the spelling of his words from the start to the finish of the same letter. Yet he wrote good English and no one failed to understand what he said. If varying spelling was perfectly acceptable in his time, why should it not become acceptable in our time?

4. The spelling "-our" as in "honour" and "labour" is an English spelling; the spelling "-or" as in "honor" and "labor" is an American spelling. Whenever we receive an article by an English author, we accept the spelling of those words with a "u"; when we receive an article by an American author, we accept the spelling of those words without a "u". And in 21 years of publishing this magazine, not one reader has written to us to complain about spelling variations.

5. It happens that I enjoy spelling and spelling games, and always have ever since I can remember. The reason is simple: I was good at it! Over and over again when I was young I could photograph a word in my mind's eye and just read off the letters. But even if spelling correctly is not difficult for me, shouldn't I be sympathetic towards other people's difficulties?

So let us consider the question: Should we insist on the rigid principle:

There is exactly one way to spell English words.

Or shall we adopt a leaky principle:

There is exactly one way to spell most English words, but let us accept a number of reasonable misspellings, continuing to reject unreasonable misspellings.

Reasonable misspellings, for example, include "inevitable" instead of "inevitable", "embarass" instead of

"embarrass", "logicly" instead of "logically". See Table 2 opposite.

An unreasonable misspelling is George Bernard Shaw's famous example, "ghoti" for "fish" — using "gh" from "enough", "o" from "women", and "ti" from "nation". To use a rare spelling instead of a common spelling for a speech sound (phoneme) is a silly distortion of what could otherwise be progress.

The sensible thing to do, it seems to me, is to stop caring about many difficult or tricky or etymologically correct spellings, and relax. Time is short and life is full; and there are more important things to do than fuss over reasonable misspellings.

As long as we can find a reasonably misspelled word when looked up in the dictionary, and as long as the misspelling can convey phonetic and visual recognition of meaning as well or better, I think we should permit reasonable variations in spelling.

How shall we separate between reasonable and unreasonable misspelling? First, I would advocate that the three or four letters (or so) that begin the word should remain unchanged (so as to make dictionary lookup easy). Second, the misspelling must not produce another and different word: "principal" is not an acceptable misspelling for "principle" and vice versa. Third, beyond the beginning of the word, if a speech sound (phoneme) of English is being spelled by an uncommon or irregular spelling, I believe that a common or regular spelling substituted for that sound should be acceptable. For example, take the word "acquiesce". The letters "sce" are a clumsy and difficult spelling for a soft "s" as in "princess"; therefore, the reasonable misspelling "acquies" should be fully acceptable.

In Table 2 is a collection of some 30 reasonable misspellings. We plan to accept these henceforth when offered in articles submitted to this magazine. This will make a beginning.

Even a small amount of moderation and flexibility in applying a very rigid spelling rule, can produce increased comfort and relaxation — and give people more time to do better work on more important things.

To open a valve by a few small turns to admit a trickle of changes for the better — is very different from discarding the valve entirely and admitting a flood of chaos and confusion.

Edmund C. Berkeley

Edmund C. Berkeley
Editor

Table 1
SOME ACCEPTED VARIANT SPELLINGS – "THE VALVE IS LEAKING"

acknowledgment	acknowledgement	interpretive	interpretative	muzhik	muzjik
aerie	aery	inventer	inventor	muskrat	musquash
analog	analogue	jinni	jinnee	mustache	moustache
analyze	analyse	jinricksha	jinrikisha	"	mustachio
Betsy	Betsie	judgment	judgement	nankeen	nankin
cabala	cabbala	kale	cole	OK	okay
"	cabbalah	"	kail	OK'd	okayed
"	kabala	kaolin	kaoline	organize	organise
"	kabbala	kayak	kaiak	pajama	pyjama
caliph	calif	kermis	kermess	peddler	pedlar
"	khalif	"	kirmess	preempt	pre-empt
calk	caulk	kerosene	kerosine	preventive	preventative
camomile	chamomile	kidnaped	kidnapped	program	programme
carat	karat	kiltie	kilty	programming	programming
catalyze	catalyse	kris	creese	quay	quai
catchup	catsup	kumis	koumis	rigor	rigour
"	ketchup	"	koumiss	scepter	sceptre
center	centre	"	koumyss	skeptical	sceptical
chaperon	chaperone	kyanite	cyanite	Steven	Stephen
computer	computer	labdanum	ladanum	storey	story
cooperate	co-operate	labor	labour	strychnine	strychnin
crematory	crematorium	lanolin	lanoline	subtle	subtile
cummerbund	kummerbund	largess	largesse	succor	succour
dependence	dependance	libelee	libellee	sulphur	sulfur
dextrous	dexterous	license	licence	taboo	tabu
dialog	dialogue	lickerish	liquorish	technique	technic
dispatch	despatch	licorice	liquorice	terrificly	terrifically
doggie	doggy	likable	likeable	theater	theatre
dogie	dogy	linage	lineage	thorough	thoro
eerie	eery	lissom	lissome	thru	through
envelop	envelope	litchi	lychee	traveler	traveller
eolian	aeolian	liter	litre	vigor	vigour
eon	aeon	loath	loth	vitamin	vitamine
estivate	aestivate	logarithmic	logarithmical	whimsy	whimsey
franticly	frantically	loony	lunny		
frowzy	frouzy	lotus-eater	lotos-eater		
"	frowsy	lovable	loveable		
fulfil	fulfill	luster	lustre		
gasogene	gazogene	medieval	mediaeval		
gasoline	gasolene	misjudgment	misjudgement		
gage	gauge	mitzvah	mitsvah		
gray	grey	mold	mould		
honor	honour	monolog	monologue		
inquiry	enquiry	moslem	mussulman		
instalment	installment	muzhik	moujik		

Suggestions, additions, and contributions for both tables are invited from all our subscribers and readers.

E. C. Berkeley
Editor

Table 2
SOME PROPOSED VARIANT SPELLINGS – "LET'S OPEN THE VALVE A LITTLE WIDER"

acquies	acquiesce	exceed	excede	irritable	irritible
antediluvian	antedeluvian	harass	harrass	precede	preceed
argumentative	argumentive	illogicy	illogically	proceed	procede
begger	beggar	inconceivable	inconceivable	receive	recieve
ceraceous (=waxy)	ceracious	"	inconcievable	sorrowful	sorrowfull
conquerer	conqueror	"	inconcievable	succeed	succede
consensus	conconsus	inevitable	inevitable	supersede	supercede
deceive	decieve	invisible	invisable	surveyer	surveyor
"embarass	embarrass	ipecacuana	ipecacuanha		
erasable	erasible	irascible	irassible		

BENCHMARKING vs. SIMULATION

Fred C. Ihrer, President
COMRESS
Two Research Court
Rockville, Md. 20850

"Computer systems selection and performance should never be based on a narrow range of criteria of performance."

The reason for this article is a decision that was made by the General Services Administration of the Federal Government, taken in June, that benchmarking is to be "preferred" to simulation as a method for evaluating computer systems performance.

This article has three main parts:

- (1) the restrictions alleged by GSA;
- (2) the question "Is benchmarking to be preferred to simulation as a method of evaluating computer systems performance?" and;
- (3) the accuracy and validity of simulation.

The "Restrictions"

On June 6, 1972, the GSA issued a Temporary Federal Property Regulation, No. E-23. The careful reader of this document, the teeth of which are reprinted below, will be struck by a curious note: the regulation in no way prohibits the use of simulation in evaluating computer performance for procurement purposes. Rather, it restricts the exclusive use of simulation for such purposes, and it forbids solicitation documents to require vendors to use a specific simulator in preparing bids. We quote these "restrictions":

- a) "A simulation input definition shall not be used as the only means of describing data processing requirements in solicitation documents. Such format shall be accompanied by a narrative description of the ADP objectives and the general logic diagrams when available.
- b) "Solicitation documents shall not be construed in such a way as to require offerors/bidders to use a specific computer system simulator in order to offer/bid.
- c) "Generally, offers/bids shall not be construed to be nonresponsive or not acceptable solely on the basis of simulation results."

We find nothing alarming about these requirements. Certainly not the use of "narrative descriptions of ADP objectives" and "general logic diagrams". Certainly not the admonishment to refrain

from stipulating the use of a particular simulator program in preparing bids. Certainly not the injunction against the use of simulation results as the only criteria for making purchase decisions.

To amplify this last point, there are many, many factors facing the buyer which do not lend themselves to simulation, nor to any form of quantitative analysis: service record, maintenance record, equipment reliability, application support, quality of documentation, training, upwards-compatibility of product line, difficulty of conversion from present to proposed system, delivery time, special price adjustments and rebates, leasing terms and equity conversion schedules, financial stability and reputation of vendor, buyer loyalty to or confidence in a particular vendor ... These are but a few of the factors which, by their very nature, remain within the realm of human assessment and evaluation.

These are perfectly consistent with GSA's broad responsibilities, and would seem to be the minimum guidelines GSA would set forth to federal agencies regarding the use of any performance evaluation technique for computer systems.

Benchmarking

We have always endorsed the intelligent use of management tools in computer performance evaluation. In fact, were there really no need for such tools, our SCERT program would not have received the marketplace acceptance it did when first introduced some ten years ago. We have always maintained, however, that the right tool should be used for the right job. We take strong exception to the pronouncement that benchmarking, as a method of evaluating computer systems performance, is to be preferred to simulation.

Benchmarking works something like this. The buyer selects some small number of programs he feels are representative of his workload along with a representative sample of data. He then submits the programs (program specifications) to selected vendors via requests for proposals (RFP's). The bench-

mark programs, designed and programmed by the vendors, are then timed by the buyer on the vendors' equipment. If the benchmark meets the throughput time constraints imposed by the buyer, that system is considered eligible for selection. The selection decision is subsequently made, presumably on the basis of lowest cost or, if two competing systems are very close in price, on the basis of better comparative benchmark performance. No doubt, certain embellishments now enhance the "objectivity" of this approach. In a nutshell, however, this is the basic concept of benchmarking.

Now, in an earlier time when a computer was an advanced card sorter, when computer applications were processed in a serial, predictable sequence, when new applications were rare, and when there were only two or three manufacturers to choose among, benchmark timings might have been sufficient reason to choose one system over another.

Not so any more. In terms of the sophistication of computer technology, we're at least one computer generation removed from those times.

What Benchmarking Doesn't Do

The buyer can tell from a benchmark timing how long a program will run on a particular configuration. But it doesn't tell him why it runs that long — it contributes nothing to his understanding of the throughput dynamics of that program on that configuration. Benchmark timing can't tell the buyer how long it will take to process any portion of his workload other than the benchmarked portion. It won't permit the buyer to predict how long a single program will run if that program were combined with other runs.

Benchmark timings tell the buyer nothing about system utilization: CPU usage, data channel utilization, peripheral utilization, communications network loading, or memory utilization.

It can't tell the buyer **anything** about reserve system capacity or peak load-handling capability — how much additional work the user can present to the system without reducing response to unacceptable levels.

It tells him nothing about queuing delays or the effects of multiprogramming on individual job turnaround, or system resource bottlenecks.

It yields no analysis of individual program execution: internal processing time, I/O processing time, channel time, sort time, paging time, operating system overheads, memory requirements, or buffer sizes.

It provides no estimates of optimum blocking factors, optimum file assignments, optimum multiprogramming schedules, extra-use charges, or application implementation costs.

Benchmarking does none of these things because it does not take into account the powers of third-generation computer systems.

The buyer doesn't really want to know how fast a system will process x benchmark programs. What he really wants to know is something else:

- "How well will the proposed system react to the dayshift workload?"
- "Can the system deliver required job turnaround times?"

— "Can the system complete the production analysis by 3:00 in the afternoon so that the evening shifts can be scheduled?"

— "What would be response times for my real time applications on this system?"

Computer performance evaluation means the analysis of time: turnaround time, clock time, throughput time, response time — the ability of a proposed system to meet the constraints of time imposed by the buyer's workload. And there is no way — for reasons already discussed — to extrapolate this information from knowledge of how long it took a system to complete benchmark program A.

The Validity of Simulation

Having looked at benchmarking, now let us turn to simulation.

Computer systems simulation is a technique developed for the purpose of projecting the performance of a specified configuration in the execution of a defined workload, such "performance" including measures of systems response and utilization, as previously described.

To accomplish this, a mathematical model of the user's workload is created, based upon definitions of the processing requirements furnished by the simulation analyst. A mathematical model of the performance characteristics of a specific configuration is then constructed, with the help of a "performance factor library" which is part of the simulation package. The throughput and utilization dynamics of the "execution" of the workload model by the configuration model are then resolved by means of timing and simulation algorithms (representing the logic of computer processes) in the simulator program itself.

Let us first consider precision in timing. As a tool for the evaluation of alternative computer systems configurations and application designs, absolute 100% precision in timing projections is neither necessary nor desirable,¹ and a precision of $\pm 10\%$ is fully acceptable.

Two reasons may be cited:

In the first place, just as there are cost-performance tradeoffs in the design of computer systems configurations and applications, so there are tradeoffs in the design of computer systems simulators. To raise the current level of accuracy of simulators today to the 99% plus range, would require simulation at the instruction level. And because of the accounting overhead associated with instruction-level simulation, such a simulator would require so much memory and so much running time as to forbid its general use. The simulation of one day's workload, for example, could easily take several days' running time. Needless to say, the price of perfection in computer systems simulation — as in many things — is more than the market will presently bear.

More important than this, however, is the fact that computer systems selection and design decisions should never be based on too narrow a range of performance criteria. Common sense dictates to the systems planner the allowance of a comfortable margin of error in the evaluation of systems performance. Not only can simulator timing projections never be 100% accurate, but manufacturer specifications can be — and frequently are — inadequate,

wrong, or undefined. Data volumes, which have a dynamic impact on throughput and turnaround times, are a function of future levels of business operations and can never be estimated exactly. Workload requirements can — and frequently are — underestimated.

On the whole, the computer selection process is loaded with unknown quantities, hidden costs, conflicting reports, and subjective variables. It doesn't lend itself to a nice, neat, utopian solution — no matter how accurate. Where vital information on performance is missing, the precise measurement of inconsequential is largely misdirected effort.

In performance evaluation, what is really needed is a tool that can furnish thorough, comprehensive analyses of competing systems in order to reduce the number of equipment alternatives to two or three systems which will process the buyer's current (and projected) workloads, with adequate capacity for growth, within specified constraints of time.

For this task, 100% precision in measurement is not nearly as important as the assurance that when management sits down to make the final decision on cost and other management criteria, the "eligible-for-selection" systems are indeed the most suitable proposals — based on a comprehensive, detailed, and thoroughgoing analysis of all the factors relative

Table 1

(Continued on page 13)

BENCHMARKING VS. SIMULATION — For the Performance Evaluation of Different Computer Systems

(1) <u>Parameter</u>	(2) <u>Benchmarking</u>	(3) <u>Simulation</u>
1. Predictive capability and accuracy:		
a. Program run times	100% accurate for benchmark programs only	±10% for all programs simulated
b. Total job mix elapsed time	None	±10%
c. Individual job turnaround times	None	±25%
d. Real time response times:	No accuracy if queuing delays will exist	
- Average	-	±10%
- Maximum	-	±25%
e. Clock times for workload completions	None	±10%
f. Unused capacity	None	±10%
g. System bottlenecks	Limited	Easily identified
2. Evaluation flexibility:		
a. Workload and data volume variations	Virtually none	Unlimited
b. System design variations	None	Unlimited
c. Hardware configuration variations	Limited	Unlimited
d. System software variations	Virtually none	Unlimited
e. Scheduling variations	None	Unlimited
f. Communications network variations	None	Unlimited
3. Evaluation objectivity:		
a. Programmer variations	Very subjective	Completely objective
b. Optimistic hardware/software specifications	Insensitive to subjectivity	Sensitive to subjectivity
c. Hardware manipulations by vendor	Possible	Impossible
4. Evaluation reliability:		
a. Potential for selection with inadequate hardware capacity	Frequent	None
b. Potential for selection with too much capacity	Possible	Rare
5. Evaluation Utility:		
a. Future (growth) planning	None	Existence of workload models (Analyst-defined or hardware-generated) provide an excellent vehicle for planning experiments
- Saturation analysis		
- New application feasibility		
b. Systems tuning	None	Excellent for fine-tuning of cost effectiveness of hardware/software/workload mix
c. Establishment of performance goals and guidelines	None	Throughput times, turnaround times, response times, and implementation target dates

(please turn to page 13)

Undergraduate Mathematics Training in 1984 —

Some Predictions

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"Central to the applications of applied mathematics in 1984 will be the use of the computer, the finger on the controls of which most likely will be female."

Future undergraduate mathematics programs will be molded in part by three of the strongest forces in modern society: economics, computers, and women. From the present vantage point, the effect of economic factors seems gloomy indeed; how one views the computer depends largely in one's own prejudices, while the impact of women on mathematics in the next decade and a half will, I suspect, be most beneficial. Before giving my predictions about the future of mathematics programs, I want briefly to discuss how these three forces will shape it.

Cost of Education

The United States has become a society in which over 50% of the Gross National Product consists of services, and amongst the most costly of these services is education. The cost per unit of manufactured goods can be lowered in the face of rising wages by using sophisticated machinery. There is no similar way to increase the productivity of those who provide services. In the foreseeable future one can expect that every economy will be used in undergraduate teaching. These economies will be of two sorts. First, the cost of teaching each student will be lowered by teaching for the most part only through large lectures. These will continue to be supported by smaller recitations given by graduate assistants whose slave labor as always keeps the whole program afloat. The proliferation of specialized undergraduate courses taught to classes of five or seven will of necessity disappear. In order to get a respectable turnout, there will be, for example, only one standard undergraduate course in linear algebra taught to a minimum of 30 and to perhaps as many as 150 students, depending on the size and nature of the school. The vast expansion of college faculties in the decade 1957-67 is a thing of the past. In fact, in the next few years most private schools, under inexorable economic pressure, will contract their faculties. The same will be true of state universities in those states where economic policies or even blatant political consider-

(Based on a talk given at the meeting of the Mathematical Association of America at University Park in September, 1971)

ations result in a diminished flow of funds into higher education. Those deans who survive will describe this reduction in faculties euphemistically as a "judicious pruning". In the face of this, the only way to keep alive a program with the rich diversity of undergraduate courses which one has seen in the past would be to have many faculty members voluntarily increase the number of courses which they teach, an unlikely prospect, in view of the already overwhelming increase in the number of students which they service in each course.

Economic Value of Courses

Second, there will be pressure to increase the economic value to the student of each available undergraduate course. The majority of students seen in undergraduate mathematics courses will be destined either for industrial careers or for careers in those fields which are only beginning to be quantified, like economics, biology, psychology, sociology and even law. From this list I have deliberately excluded physics, chemistry and engineering. The declining enrollments in those fields have left the departments teaching them with more faculty than they can justify. Some of these excess faculty members will be used to teach the necessary basic mathematics to their own students. The official reason to be given the dean for this undertaking of their own mathematical services will be dissatisfaction with the "excessively theoretical" approach of the Mathematics Department, while, in fact, the pressure of economic necessity on the students will be making the Mathematics Department increasingly practical.

Mensuration and Trigonometry

In this connection it is amusing to trace some historical examples of the effect on mathematics programs of economic necessity which generally tends to force economically valuable subjects down from college to secondary school to grade school level. Samuel Pepys records that as a purchasing agent for the crown he was obliged to learn mensuration, a subject he was never required to know in college. Economic necessity has forced this basic skill to be

taught ever earlier until it is now an essential part of the grade school program. Surveying was once a most practical art for a gentleman landowner in this country, and its theoretical basis, trigonometry, was a standard college offering. As the natural tendency, once a course is established, is to teach it to ever younger students, it made its way into the secondary schools, but very likely is now making its way out altogether since it responds to very little in the way of either economic or scientific needs. The "new math" whose descent into the grade school was much heralded has faded.

Computers

The second of the major forces that will shape future undergraduate mathematics programs is the computer. Future students may face computers in one of two ways. The computer may be a teacher-surrogate, a mindless teaching assistant who can coach, reward, and perhaps gently chide the student into perfect performance of purely routine tasks. This may be fine in a language laboratory, but concepts are not instilled by rote. Moreover, as the classic cartoon described the computer, "To err is unlikely, to forgive unnecessary". And one might add, to empathize is absolutely out of the question. The live master at the head of even a very large class, can generate vibrations which his electronic image, be it video tape or computer program, cannot. He is irreplaceable, as tests of student recall have shown. The other way in which students will face the machine is as a beast to be subdued, a role in which the student becomes the master of a perverse device of overwhelming power. Since the statistical ecologist, the mathematical economist and the urbanologist will all have to extract significant information from mountains of data, economic necessity will force basic programming techniques, like arithmetic in the past, to be taught even earlier. Most college freshmen of 1984 will already have learned the essentials in high school. Indeed, as one of my friends has put it, programming, like chicken pox, is best caught young. But some college department will have to give the earliest serious introduction to the art particularly to those students with no prior experience. While it is true that the pure mathematician generally has no need of a computer, the Mathematics Department nevertheless will in most colleges be the department that provides this basic training. It may use the programming lessons wisely, by letting the student's computer experience refine his mathematical concepts like those of limit and integral, or it may emphasize proficiency by running the programming courses like a language laboratory. But the Mathematics Department will be the natural home for basic programming because it will also be a shelter for the largest single group of future computer users, namely women. For this we shall have to thank both women's lib and that rock on which women's lib arguments frequently founder, women's biology.

Women's Opportunities

With the blessings of women's lib, not only will more women go into the traditionally male bastions of the physical sciences, but even larger numbers will go into psychology, sociology, urbanology, and other fields which are only recently undergoing mathematization.¹ Students in those fields will be precisely the ones which Mathematics Departments will be training in the future. But women in science or indeed virtually any profession suffer a very serious handicap — the early family years interrupt their professional growth. In these days of rapid change, even a few years separation from

the source of new ideas, be it the laboratory or library, may make retraining a virtual necessity when the woman whose youngest is finally of school age is able to return. Now a young mother's separation from the laboratory is generally virtually complete. But a woman with a B.S. or M.S. in say sociology or urbanology whose principal expertise consists in using a computer cleverly, will, by 1984, never be too far from a terminal. Provided that she can communicate with her colleagues, which women seem to accomplish well by telephone, she need suffer no very serious interruption in her career. Thus the coed of 1984 who studies mathematics because she wants to be a sociologist will also be highly motivated to master computing and it will be natural for the Mathematics Department to integrate her computer training with the teaching of the mathematical techniques which she will need to know. The net effect of this will be that in a decade the majority of undergraduate mathematics students will be women.

Omitting Demonstrations

As professional mathematicians and teachers, how would we react to this apocalyptic convergence of economics, computers and women? In the only way possible — by omitting proofs.² The freshman course will be taught like arithmetic in grade school, where one is not concerned with proving the commutativity or associativity of arithmetic. Beyond that we shall have to create havens for those gifted students and diligent scholars whose task it will be to keep mathematical research alive. Tucked away amongst the large lecture sections will be some small honors classes, the students in which will be urged to enroll in graduate courses as soon as their proficiency allows.

Choice of Response

Of the combined forces of economics, computers and women, the only one to which Mathematics Departments will have any genuine choice of response will be computers. At most schools the average faculty member is not proficient at the use of the computer but there is generally at least one sufficiently skilled to be able to lead the others. Such a department, if it elects to integrate computer instruction into its basic program, will find that it is not difficult in the course of one to three years for enough members to become sufficiently skilled to cover the "computer assisted" sections of freshman mathematics.³

Departments will also have to decide whether they wish to offer computer instruction to those students who take a basic mathematics course not with a view to future applications, but as a cultural achievement. Since the dangers in misapprehending the potentialities of the computer are as great as those in underestimating the catastrophic effects of ecological damage, I think that the decision must be affirmative.⁴

Dark Outlook

The outlook for undergraduate mathematics in 1984 is not nearly so bright as we would have imagined it but five years ago when the condition of American higher education as a whole was far more hopeful. Many of us looked forward then to the calm — and well supported — pursuit of mathematical knowledge unaffected by the storm gathering over many universities. The physical violence that intervened on some campuses for the moment at least is over but greater dangers have revealed themselves, not the

least of which is the rising tide of red ink in the financial office. While this affects every department of a university, mathematics is also increasingly subjected to pressures generated by a restless and changing society whose very complexity has made mathematics one of the most "relevant" of subjects. Enrollments in mathematics have, in some schools, already reached record proportions and threaten to make Mathematics Departments amongst the most over-worked on campus.

But Not a Gloomy Outlook

Nevertheless, as I remarked at the start, the outlook is hardly gloomy. Increased enrollments, including a large influx of women, will force some further growth of faculties. More important, the discipline itself will grow through involvement in new areas. By 1984 the larger part of "applied" mathematics will be not in the physical sciences, but in biology, sociology, law, and other areas which today seem very remote to the mathematician. Central to these applications will be the use of the computer, the finger on the controls of which most likely will be female.

These are my predictions about the shape of undergraduate mathematics in 1984. They are made in good faith, but with a knowledge of the ever-present possibility of serious error. Time will tell. □

Notes

1. For evidence of the statistical trend in the enrollment of women in mathematics, cf., for example, F. E. Terman, Supply of Scientific and Engineering Manpower: Surplus or Shortage?, Science, Vol. 173, No. 3995 (30 July 1971) 399-405.
2. If for "omitting proofs" we read "omitting demonstrations" then this method of teaching is common in all the sciences. Most students in physics and chemistry, for example, seldom perform the basic experiments which support modern theory. The analogy to mathematics is not precise, since to the practicing mathematician the method of proof is frequently as valuable as the final result. But the non-mathematical scientist generally must know only when to apply certain mathematical techniques. Here an intuitive understanding of the rationale without precise demonstrations will go a long way towards satisfying his needs.
3. There are several good examples of such "boot strap" operations of which the University of Pennsylvania is one. Starting with one experimental computer-assisted section serving approximately 10% of the freshmen, it has become possible to offer integrated calculus-with-computer courses to all who desire it, and these are in the majority. The main difficulty is not in professors learning to program — enough will volunteer — but in getting enough teaching assistants to correct the students' mistakes.
4. Some view the computer as the greatest single emerging threat to civil liberties. There is little possibility of turning computers off. Intelligent regulation of their use will require a body of informed citizens who understand what they can do. Some instruction in the use of computers is probably therefore in order even for pre-law students. For a well-documented account of present dangers see the work of Professor Arthur Miller of the University of Michigan Law School, "The Assault on Privacy — Computers, Data Banks, and Dossiers", University of Michigan Press, Ann Arbor, 1971.

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to performance dynamics. And in this, there is no process that can approach simulation.

Table 1 summarizes — as we see them — the relative merits and demerits of benchmarking and simulation as computer performance evaluation tools.

Conclusion

In urging anyone to adopt benchmarking in preference to simulation, a person may possibly be confusing measurement with simulation.

Measurement is a precise science. Simulation is the recreation, by artificial means, of actual (real world) phenomena under controlled, laboratory conditions, for testing or experimentation purposes. Simulation is the only way of "observing" the future behavior of complex, interactive phenomena — in anticipation of their actual occurrence. It permits the experimenter to duplicate (model) a set of conditions (e.g., a corporation's cash flow, the functioning of the economy, or the performance of a specific computer system), and to manipulate key variables so as to observe the impact of such manipulation on the behavior of the entire model.

The object of simulation is to extend the decision-maker's knowledge in areas where the number of variables is too large — and their interrelationships too complex — to yield satisfactory results through intuition or other simplistic, deductive approaches. Predictive management science techniques seek — through modeling — to reduce the level of risk and uncertainty in matters where decisions may be critical to the financial success of the organization.

To measure is not the purpose of simulation. If it were possible, say, to cause the next six month's stock market activity to transpire today — or if it were possible to pick computer systems on a 30-day trial basis, then the most effective course of action could be chosen based on measured performance, and there would be no need for sophisticated analytical tools such as computer systems simulation.

The "validity" of an evaluation tool is a function of the adequacy of its performance in fulfilling its stated functions. Measurement and simulation are as different as apples and oranges. Criteria used to judge the effectiveness of one may not necessarily apply in judging the other. Each has its unique function, characteristics and limitations.

We have no animosity against benchmarking as a measurement tool — nor, for that matter, against any measurement or evaluation tool. We believe benchmarking, for example, can play an important role in validation of simulation models, for example.

But benchmarking is one thing, and analysis is another. On the whole, as the answer to the evaluation of computer systems performance, benchmarking is outdated, simplistic, and hopelessly inadequate. It is clearly and unmistakably no substitute for simulation. These, we think, are inescapable conclusions.

It is true that simulation is not an easy tool to use in evaluating computer system performance. It requires proficiency in its use and a fair amount of computer know-how. It is no "quick-and-dirty solution". But it is clearly the best thing so far available for the task of computer performance evaluation. □

The Cashless, Checkless Society: On Its Way?

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"Banks are being forced to find more lucrative investments and sources of profits."

Banks have been part of American development since the formation of the central bank under President Washington in 1790. Since that time banks have made their profits from the difference between the interest paid, demand deposits, and the interest received from loans.

At one time in American history, this was quite a profitable venture, as corporate controllers would gladly deposit capital surplus in banks as demand deposits bearing no interest rather than chance embezzlement by corporate raiders. Banks in turn would reinvest the funds in needy corporations at competitive interest rates.

The situation has changed slightly as corporate controllers must be encouraged to invest their unused capital in banks as certificates of deposit paying 4 to 6 percent per annum. Bankers, in turn, now must compete with finance companies and other corporations for short term loans and for terms on long term notes.

In light of the current trends, banks are being forced to find more lucrative investment and sources of profits. To many bankers this means the individual and the services he demands — trusts, travel insurance, personal loans and credit cards.

The Cashless Society in Operation

Such services will require the use of a highly integrated and sophisticated money transfer system which would be realized under a "Cashless, Checkless Society". Such a society would utilize a complex of computers and computer subsystems to transfer money from account to account via electronic impulses. In such a society money, per se, would not exist. Rather, a complex of debits and credits will determine how much an individual can spend and replace money as a medium of exchange.

A transaction in this system might be typified by the following example: Samuel Smith might walk into a jewelry store to buy an engagement ring for his fiancée. He searches through the jeweler's selection and finds just the right thing. The jeweler then removes the item from his stock and both of them move up to the store's terminal. Smith reaches into his pocket and produces his identification card, which the jeweler inserts in the terminal. The jeweler then punches the identification number (the consumer's social security number with one number added for identification purposes) into the computer along with the price of the item. Smith then punches in his special identification number used to detect stolen cards. This number is checked with the number magnetically and invisibly inscribed on the back of the card. If these numbers match, the transaction then goes to the computer bank for a reading on Smith's balance. Normally, Smith only maintains a balance of \$250 in his account; however, he was paid today and his balance has increased to \$950 — just enough to cover the purchase of the ring. The computer reads this, transfers the funds into the account of the jeweler and indicates that the transaction was completed.

If Smith was lacking in funds, the computer may yet complete the transaction if Smith's credit rating is high enough to merit a short term loan. The computer would have evaluated his credit this way. It would have checked Smith's record of past payments, Smith's occupation, his earnings, his spending habits, if available, and his criminal record. If the matter of a loan were borderline, the facts pertaining to the case would be displayed on a cathode ray oscilloscope for a bank loan officer to review. Depending upon the judgment of the official, the loan would either go through or be rejected. Also, if Smith were under twenty-one he could, with the consent of his parents, have their account debited for the excess of the purchase over his balance.

How Near Are We?

As few as four years ago many bankers believed that this system would be in effect as soon as 1973. The hardware does exist today in the form of electronic transfer systems within banks and the touchtone telephone with its improved data transmission capability. You may then ask, why not now?

In the words of an official of the Fort Worth National Bank, "We spent 75 to 90 years gaining public acceptance for checks as a medium of exchange." Many bankers also agree that the check has several widely acknowledged advantages: checks serve well as a record of transaction, are simple, and are widely accepted.

Other bankers feel that the public has not yet accepted the computer and fears it. This arises because many individuals do not understand the working of the computer and look upon it as being some sort of mysterious force. This problem has widely plagued business since business decided to use the computer in the business environment; but business has found that many of the systems installed are being quietly sabotaged by many trusted and respected employees simply because they fear the impact of the computer on their job and in their world.

Fear has also been expressed over the type of knowledge that may be required to be stored in a computer if such a system were to be introduced into operation. Suppose the computer may in the future be required to grant loans. In order for a computer to do this, it will be necessary to store all pertinent information in the computer regarding the individual to be considered; this would include all available personal data bearing on ability to pay. For example, the computer may have on store that individual A gambles heavily on horses. Such information, if it should fall into the wrong hands, would have a very damaging effect.

In addition, if banks were to develop such an automatic loan system, over wires, they might be regulated as a common carrier, and this might give the U.S. government virtually unlimited access to the private lives of many Americans. One might indeed feel as if "Big Brother" were looking over his shoulder.

The Bankers Viewpoint

Bankers themselves are very pessimistic over the future of such a system. They see no incentive for it. As the Chairman of The Philadelphia First Pennsylvania Banking and Trust Company has stated, "We can do everything we did before computers and do it just as well."¹ Other bankers feel that such a system would create more paper work instead of reducing it. As an example they point to the credit card. Still other bankers feel that much time has been spent talking about such a society, but little or no progress has been made toward it.

In addition, current economic conditions have forced many banks as well as other corporations to limit the number of computer services performed for internal as well as external use. According to Charles E. Carpenter of the operational research department of Weyerhaeuser:

We took the position that in a business as large and complex as this you had to have computers. Now we must justify each new project

or system the same way you justify capital investment in a plant.²

What We Will Need To Do

Such a system might also require the banning of private credit card companies such as American Express, Diner's Club and similar cards, in addition to such institutional cards as Sears, Montgomery Ward and Shell credit cards. These companies would then lose 4 to 5 per cent on all receivables given up to the "Cashless Society". Also, the cashless system might necessitate the reorganization of financial service institutions such as Household Finance, Allied Finance and others, because the short term loan, the bread and butter of the finance corporation, would be handled by the bank's computer in a central location.

Banks also might be up in arms, as they would find the "float" within the banking system reduced tremendously if not eliminated.

The Current State of Affairs

In spite of opposition to the "Cashless, Checkless Society", banks find themselves drawn inevitably closer to the point where they will have to adopt (1) the computer as a medium of exchange and (2) electronic transfer of funds within their system. Banks today have the means to transfer funds electronically within banks. For example, should Houston First Savings require several thousand dollars to be transferred to their account from the First National City Bank of New York, all that would be required would be a phone call from Houston First Savings to First National City Bank informing them of this and then several depressed keys on a computer console crediting Houston First and debiting First National City.

As early as 1958, the American Bankers Association was considering rules for use of Magnetic-Ink Character Recognition on checks for computer processing. Gradually, more and more banks have switched to Magnetic-Ink processing of checks by computer. The number of checks passed has increased so much that MICR is becoming more and more necessary.

Many banks are in the process of using their computer to not only process checks but to help the bank plan for rising volume of loans, to improve present services, and to create new services. Still other banks have sold computer time to outside organizations: to process accounts receivable; to plan for changes in profits; earnings and sales; to compare the operation of one company to another in the hope of correcting a difficult situation; etc. Many banks take on the job of processing accounts for their clients. So does the First National City Bank of New York, and they have found that in some instances they have been able to double the size of the account of their depositors.

More and more banks are viewing their role as marketing agents of the finance industry rather than corporate financiers. In some banks in Pittsburgh there has been a trend towards free checking accounts. Pittsburgh National Bank has started the process of mailing monthly interest checks to the homes of depositors. In Ohio and in several other states, banks have begun to deal with the youth market by reducing the cost of checking accounts and introducing credit standards for youth. In New York, First National City and Bankers Trust have

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Chinese Computer Science: A Visit and a Report

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"I do not think we are going to sell them much computer equipment . . . they are not going to let themselves be put in a position of dependency upon outside suppliers."

Even after only a three-week visit to mainland China, I can assert that Chinese computer science is far more advanced than American experts had thought.

We saw an operational, third generation computer using integrated circuits, all home-built. This really astonished us. It puts them ahead of the Russians in this technology, for the Russians have to import their integrated circuits.

I was in China from July 10 to July 28 with Severo Ornstein of Bolt, Beranek and Newman, Inc., Professor Wesley Clark of Washington University, Professor Alan Perlis of Yale University, Professor Herbert Simon of Carnegie-Mellon Institute of Technology, and Dr. Anatol Holt of Massachusetts Computer Associates, Inc.

The third-generation machine was working at a Research Institute of the Chinese Academy of Sciences in Peking, the key center for computer research in China. The roughly 1,000 members of the Institute cooperate closely with the staff of Hsinghua University, the leading technical university in the country, and local factories.

It was a fairly large machine — 32,000 48-bit words of core memory, 256 18-bit words of very fast thin-film memory, fixed-point addition time of two microseconds; it was supported by a host of peripheral equipment, including a controlled-beam cathode-ray tube display, drums, magnetic and paper tapes, printers, and so on. Its architecture was very clean and simple.

At one factory, I saw an assembly line of second- and third-generation computers. They did not want to tell us how many computers they had; and we didn't want to ask embarrassing questions. But I would estimate that that factory could turn out from 100 to perhaps as many as 300 machines a year.

That factory had partially automated its assembly

of the core memory units and had many devices for automatic and semi-automatic component testing.

The same factory makes telephone exchanges. Our Chinese hosts both there and elsewhere, expressed great interest in the technique of tying computers together through broad-band communications links — something apparently not yet done in China.

The advanced Chinese machines are programmed in a modification of ALGOL/60, a well-known computer language widely used in Europe. The Chinese are building a FORTRAN translator (a translator, in this sense, takes a program written in quasi-human language — quasi-English for ALGOL/60 and FORTRAN — and translates it into the binary numbers of machine language). FORTRAN is more widely used in this country and is beginning to displace ALGOL in Europe.

The Chinese are quite a way behind the U.S.A. in certain peripheral equipment — discs and drums. Their output printers run at about 600 lines per minute compared to, say, 1,000 lines for ours. But their vacuum-controlled tape drives seem very nearly as good as ours.

They have completely skipped the punched-card stage, and use paper tape for input.

Their emphasis has been on big scientific machines — number-crunchers — as opposed to data-processing machines such as a bank would use. They have not yet felt the need to miniaturize. They do not pack their chips (integrated circuits) very tightly. This makes maintenance simpler.

None of us were experts in applications, but we did see a smaller computer for numerical control of machine tools. We were told of work on engineering calculations for bridges and dams, on weather forecasting, and on speech recognition.

Their next big push, I believe, will be toward time-sharing as their peripheral equipment gets better.

All members of our group gave lectures at the institute in Peking, each lecture attended by more than 100 persons. Additionally, we took part in small-group discussions of a dozen or so.

The Chinese have kept up amazingly. There on display in their library were the latest issues of the world's leading computing journals. They can get an article, if they don't have it, in two days.

I had to discard my lecture on general subjects. They wanted to hear about what we were doing now, what hadn't been published yet. They didn't want to "waste the channel" on something they could read.

One man told me he had read all my papers. I thought he was just being nice, but in our conversation it soon became obvious he indeed had read them all — and not just in preparation for our visit, but as they had come out. He knew them too well for me!

Our visit was not confined to computers and Peking. At Shanghai, we toured the Shanghai Industrial Exposition and the Institute for Research in Computing Technology, and saw a ballet and a gymnastic exhibition. In Peking we visited the Great Wall, the Ming Tombs, the Forbidden City, the Summer Palace, and other tourist sights. A number of banquets were given in our honor, climaxed by one hosted by Kuo Mo-Jo, President of the Chinese Academy of Science, given in the Great Hall of the People. Earlier, in Canton, we saw two surgical operations using acupuncture.

It was amazing. One operation was a thyroidec-tomy, and the patient, a girl, drank a glass of milk when it was over and walked out of the operating room under her own steam.

We also visited a boarding kindergarten for children 3-1/2 to 6 years old. The children were happy and enthusiastic and seemed more developed than ours at that age. We saw six-year-olds playing basketball.

The idea for the trip came from Mr. Ornstein, stimulated by the visit of the U.S. Table Tennis team to China in the Spring of 1971. Ornstein organized a group of 15 experts who wanted to go, and he and I visited Chinese diplomats in Ottawa in August, 1971, to solicit an invitation. Eight months later, with no contact in the interval, there arrived a short invitation — for a group of six, accompanied by their wives.

The five to accompany Ornstein were selected by vote. Each of the 14 remaining ranked all 14, with himself ranked first, in the order of desirableness to him of going. The five with the highest combined rank scores made the trip, as official guests of the Chinese Tourist Bureau.

We had a most friendly and gracious reception and absolutely first-class treatment. We felt that almost all our questions were answered candidly.

China is a fantastic country; it has pulled itself up by its bootstraps most astoundingly.

I do not think we are going to sell them much computer equipment. They're making their own integrated circuits. They cite Mao's teachings on self-reliance. They are just not going to let themselves be put in a position of dependency on outside suppliers. □

Wetterhuus — Continued from page 15

set up "mini branches" to handle installment loans and the routine services that account for the majority of these banks' business.

The bank's role in the future, as viewed by Economist Nadler, is one of dynamic change. In his words:

If banks don't make the mistake of the railroads, if they recognize that they're financial services, not just banks, they have a hell of a future.³

Several banks around the country have tested the feasibility of a Checkless, Cashless Society by running pilot studies. One bank in Delaware has placed several computer terminals in thirty retail establishments and distributed to forty of their better customers plastic identification cards for use in these stores. Other pilot studies are under way in New York, Chicago, Los Angeles and Dallas.

However, the cashless, checkless society is still a long way from being a practical, liveable, and profitable system. According to Joseph Bailey of the University State Bank of Fort Worth, "This type of society is at least 10 to 15 years away." □

Footnotes

1. "Cashless Society Isn't Here". Business Week, June 5, 1971, p. 105.
2. "Business Takes a Second Look at Computers". Business Week, June 5, 1971, p. 62.
3. "Banking at the Crossroads, Can Become a Growth Industry". Forbes, June 15, 1968, p. 23.

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The Dvorak Simplified Keyboard: Forty Years of Frustration

Robert Parkinson
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Mississauga, Ontario, Canada

"The existing keyboard was designed experimentally by Christopher Sholes, the inventor of the typewriter, to slow the typist down, because the keys in his 1873 machine fell back into place by gravity."

It is often frustrating to see all of the supposed emphasis that the U.S. and Canadian economies are putting on productivity. Over the past year, BUSINESS WEEK magazine has had many articles and even one entire issue devoted to the problems of productivity. I have written them several letters, pointing out where the Dvorak Simplified Keyboard could be of real benefit. None were published. Instead, I received a letter stating that they had gotten my letters, but could not publish them because "we receive so many letters from readers ... etc." I found this hard to understand. The DSK offers an increase in productivity of 30% to 50%, while the articles in BUSINESS WEEK were making a big fuss over any businesses that were able to achieve an increase of 10%!

The internal combustion engine is not the only sacred cow that's giving us trouble these days. In 1962, when I was in Seattle for the World's Fair, I called up Dr. August Dvorak, the inventor of the Dvorak Simplified Keyboard for typewriters. This keyboard (called the DSK for short) is a scientific rearrangement of the letters on the typewriter keyboard which allows efficient and speedy typing. (See Figure 1) When I called Dr. Dvorak, I was somewhat surprised to find out that I was talking with a bitter man:

"I'm tired of trying to do something worthwhile for the human race," he said. "They simply don't want to change!"

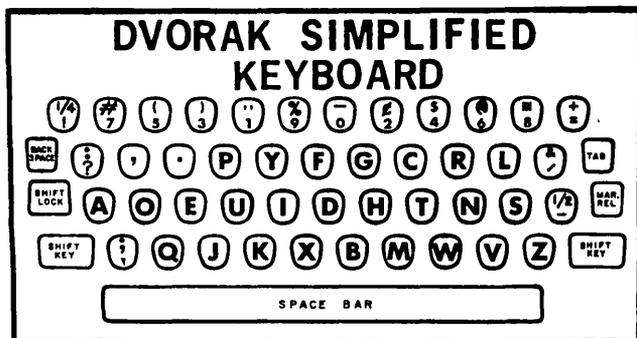


Figure 1

He told me that he'd been trying to introduce his keyboard for 30 years, and had been blocked at every turn. At the time, he was already 68 years old, had retired from the University of Washington in Seattle where he was a professor of education for many years, and had evidently given up all hope of his invention ever gaining acceptance.

This conversation with Dr. Dvorak sparked my interest. I eventually converted my own typewriter to his keyboard, and learned his system myself.

Background On Keyboard Design

Before going on with the history of Dr. Dvorak's struggle to have his invention accepted, we should look at how the typewriter keyboard most in use today came about. It turns out that this keyboard was designed experimentally by Christopher Sholes, the inventor of the typewriter, to SLOW THE TYPIST DOWN. The keys on the early machines hung down in sort of a basket arrangement, and pivoted up to strike the platen (roller) from underneath. (See Figure 2) see what you had typed, you had to lift up the roller so you could look at the paper. Since the keys had no springs on them, they fell back into place by gravity. This meant their action was very sluggish,

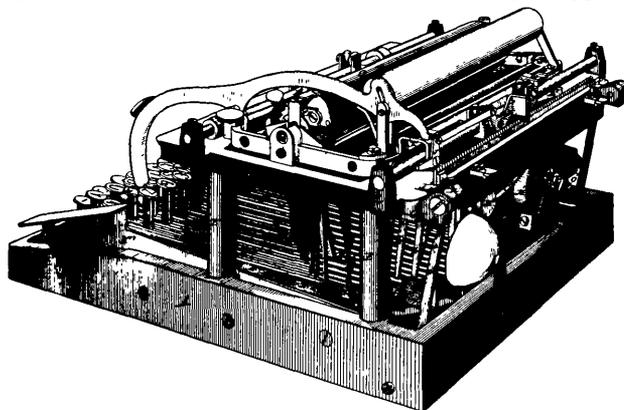


Figure 2

and if two keys that were close together in one quadrant of this "basket" were struck rapidly, one after another, they would jam. To overcome this problem, Sholes moved the keys around experimentally until the machine seemed to operate with a minimum of jamming. What he actually did was to make many commonly-used letter sequences awkward and slow to execute. Thus, by "anti-engineering" his typewriter from a human factors point of view, he was able to slow it down so it would function to his satisfaction. Now, when we have typewriters that are mechanically quite responsive, we are still bound by the old keyboard found on those first (1873) machines. What an irony!

Defects

Upon analysis, Dr. Dvorak found that the "standard" keyboard had several defects. These can be summarized as follows:

Hand Overload: This occurs when more than one character has to be typed by the fingers of the same hand. The longer the string of characters that one hand or the other has to type without a brief rest period (provided by a letter being struck by

the other hand), the slower and more uncertain the typing becomes. The fastest and easiest strokes occur for characters on the home (or finger rest) row and on opposite hands.

During periods of hand overload, typing speed is drastically reduced, and errors are more likely to occur. The hand overload problem is highlighted by the fact that over 3,000 entire words are typed by the left hand alone on the standard keyboard, with another 300 being typed only by the right hand.

Unbalanced Finger Loads: The standard keyboard overworks certain fingers and underworks others, all out of proportion to their capabilities (taking into account strength and dexterity of each finger).

Excess Finger Movement: Because of the way the characters are spread out over the keyboard, fingers must reach from and jump over the home row far too often. This results in much wasted motion and fatigue. Indeed, on the standard keyboard, the "home row" is not really a home row at all since only 32% of all typing is done there. The real home row is the third row from the bottom which accounts for over 50% of the work. This is why a typist's hands may unconsciously "hover" over the third row instead of over the home row (containing the letters "asdfghjkl") between strokes.

Awkward Strokes: Obviously, some movement off of the home row would be required whatever the keyboard arrangement. However, on the standard keyboard, many high frequency letter combinations are unnecessarily complex and difficult to execute (just try typing "December" or "minimum pumpkin" without looking!). These awkward stroking patterns account for many errors, and also tend to lower overall typing speed.

Research

After several years of intensive research, during which hundreds of keyboard arrangements were studied

and rejected, Dr. Dvorak received a patent for his DVORAK SIMPLIFIED KEYBOARD (DSK) arrangement in 1932. The DSK solves the basic problems inherent in the standard keyboard.

Better Hand Alternation: The Hand Overload problem is solved by maximizing alternate hand stroking. This is particularly important in maintaining rhythm. As much as possible, successive strokes should fall on alternate hands. This allows what is called "play for position". That is, while a finger on one hand is in the process of stroking a key, another finger on the opposite hand can be getting into position to stroke the next key — and so on. The longer such alternation keeps up, the more even the typing rhythm. Dr. Dvorak solved this problem by putting the vowels (which comprise 40% of all typing) on the left hand side of the keyboard, and the major consonants which go along with those vowels on the right hand side. This guarantees good hand alternation since most syllables are made up of vowel-followed-by-consonant-followed-by-vowel letter sequences.

Figure 3 shows a short selection from a story called Fraser Street. This text is made up almost entirely of one hand words on the standard keyboard. Made into a typing test, Fraser Street is extremely difficult for a normal typist. Only exceptionally good typists (in the 80-word-per-minute-and-up range) can even be expected to finish the test at all in the standard time.

For our purposes, Fraser Street becomes an illustration of how the DSK guarantees good hand alternation by putting all of the vowels on the left hand side. In Figure 3, all of the left hand strokes are shown by white letters on a black background, while the right hand strokes are printed in the normal "black letter on white background" manner. It can be seen how the DSK automatically breaks words up into left-right vowel-consonant sequences, thereby insuring superior rhythm.

FRASER STREET ANALYSIS

TYPED ON THE STANDARD KEYBOARD

Notice many left hand strokes.

TYPED ON THE DVORAK SIMPLIFIED KEYBOARD

Here the strokes alternate back and forth between the left and right hands.

Fraser Street was in West Everett. Westward of Fraser Street was the great vast sea. Awed, we gazed seawards, attracted by crested waves which raced and ebbed. Children were scattered on the beach edged and strewed with seaweed. They waded in water as the sea surged in and retreated. They bagged crabs as eagerly as beavers saw trees. Brave crews, seafarers in fact, steered sea craft far away. The site of Fraser Street was not overrated.

Few vegetated in Fraser Street. Nobody wasted time abed. "Acts test the breed," was ever the sacred adage. Varied crafts and trades were represented. There was a caterer, a barber, a weaver, a cabaret, and a garage. Attracted, we started to see several scenes. We were greeted as friends.

The barber catered to a varied trade, representing diverse careers and different creeds. Saturday drew the best crowd. All were seated, relaxed, aware of fewer cares, less fagged. There we saw a few starved tattered beggars who bragged of "bracers" served at cafes after a wee meal of beef stew and cabbage. A better fare was reserved for those reared on earth's greater swards.

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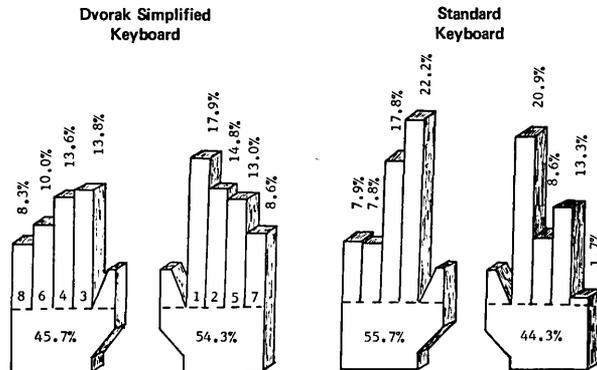
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LEFT-HAND STROKES = white letters on black background. RIGHT-HAND STROKES = black letters on normal white background.

Figure 3

Better Finger Loads: The "dactylographs" shown in Figure 4 illustrate, by the lengths of the fingers, the relative work done by each finger on the Dvorak and on the standard keyboards. The bold numbers 1, 2, 3, 4, 5, 6, 7, and 8 are placed on the fingers to indicate the relative abilities (combination of strength and dexterity) of each. Thus, the right index finger (number "1") is the ablest, while the



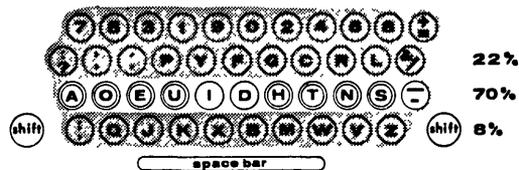
In this figure, the lengths of the fingers are proportional to the work each one does. Notice how the DSK evens up the finger loads.

Figure 4

left little finger is the weakest. Note how the DSK arrangement precisely divides the finger loads according to relative finger capabilities. On the standard keyboard, the finger loads are nowhere near being properly distributed.

More Work (70%) Done On Home Row: To minimize Excess Finger Movement, the most frequent letters and letter sequences were placed on the home row of the Dvorak arrangement where 70% of the typing is then concentrated. One can compare where the same 70% is done on both keyboards by looking at Figure 5.

DVORAK SIMPLIFIED KEYBOARD



CONVENTIONAL KEYBOARD

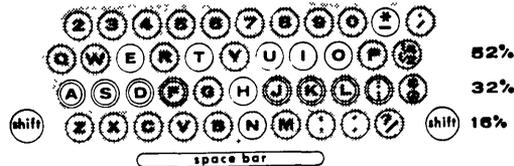


Figure 5

The effect of placing the most frequently used letters and letter-sequences on the home row is illustrated in Figure 6. In this example, the "Gettysburg Address" was typed with all off-home-row strokes shown by white letters on a black background, while the on-home-row letters are printed in the normal "black letter on white background" manner. The preponderance of off-home-row strokes on the standard keyboard is dramatically evident in the left hand diagram of Figure 6 while on the DSK, there is almost the exact opposite situation with 70% of the work being done on the home row.

Awkward Strokes Minimized: The rest of the characters, comprising the typing that has to be done off

GETTYSBURG ADDRESS ANALYSIS

TYPED ON THE STANDARD KEYBOARD

Note large number of off-home-row strokes.

Four score and seven years ago our fathers brought forth on this continent, a new nation, conceived in liberty, and dedicated to the proposition that all men are created equal.

Now we are engaged in a great civil war, testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battle-field of that war. We have come to dedicate a portion of that field, as a final resting place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this.

But in a larger sense, we cannot dedicate -- we cannot consecrate -- we cannot hallow -- this ground. The brave men, living and dead, who struggled here, have consecrated it, far above our poor power to add or detract. The world will little note, nor long remember what we say here, but it can never forget what they did here. It is for us the living, rather, to be dedicated here to the unfinished work which they who fought here have thus far so nobly advanced. It is rather for us to be here dedicated to the great task remaining before us -- that from these honoured dead

TYPED ON THE DVORAK SIMPLIFIED KEYBOARD

On the DSK, most of the work is concentrated right on the home row.

Four score and seven years ago our fathers brought forth on this continent, a new nation, conceived in liberty, and dedicated to the proposition that all men are created equal.

Now we are engaged in a great civil war, testing whether that nation, or any nation so conceived and so dedicated, can long endure. We are met on a great battle-field of that war. We have come to dedicate a portion of that field, as a final resting place for those who here gave their lives that that nation might live. It is altogether fitting and proper that we should do this.

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OFF-HOME ROW STROKES (which should be minimized) = white letters on black background.

ON-HOME-ROW STROKES = black letters on normal white background.

Figure 6.

the home row, are placed on the DSK in positions on the remaining rows according to how hard it is to strike the keys in those rows. This is done such that the total number of Awkward Strokes is minimized (the "awkwardness" of various types of strokes was determined using high-speed time-and-motion movies). The effect of this can be seen in the diagrams in Figure 7. Since awkward strokes are sometimes slower by a factor of THREE TO ONE, and since the DSK reduces the number of these strokes by a factor of TEN TO ONE, one can see how it is possible to achieve a faster typing rate on this keyboard (and why Dr. Dvorak's students hold 12 out of 15 unbeaten world typing records).

Results

With all these design improvements, it thus becomes easy to believe (a belief which has been proven experimentally) that the DSK is:

- Easier to learn (takes less time, easier to remember the key locations, etc.)
- Easier to operate (it is less fatiguing since the stroking is simpler)
- More accurate (you make 50% fewer mistakes)
- Faster (demonstrated nicely by all the typing records that Dvorak's students made ... in actual use, the DSK improves productivity by some 35% to 100%)

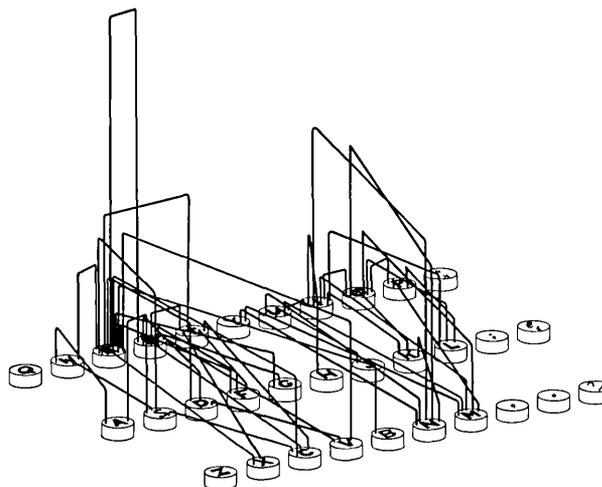
If It's So Good, Why Is Nobody Using It?

At this point, a quote from Dr. Dvorak himself might prove enlightening:

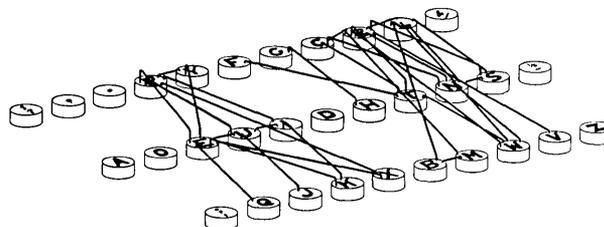
"The reason the DSK, patented in 1932, is not generally used today is the same reason that it took 35 to 70 years for the railroads, steamships, radio, telephone, telegraph, airplanes, and yes, even the automobile to gain general acceptance after they were invented and/or developed. Each required implementation — investment of time, money, and effort. Each was opposed by those who had investments in the status quo, e.g., the canal and barge owners, the pony express, the stage coach operators, etc. The general public shies away from "new-fangled" things and ideas, especially when they are given a strong negative sell by dealers in what was good for their grandfathers. Incidentally, standard keyboard typists, remembering their laborious and frustrating travail in learning to type, worry about "unlearning" the old keyboards and "won't go through that again". . . . I'll venture that if I could give you a Rolls-Royce car with a seven forward, two reverse gear shift, you'd learn to use it, with no concern about unlearning your present car's shift. In Africa," the Doctor says, "I learned to drive on the left side of the road and streets with a fouled up gear shift with little strain."

Vested Interests

Let's look at some of the problems that Dr. Dvorak encountered when he brought out his new keyboard. First, in 1932, the year his keyboard was patented, the country was in the depths of the Great Depression. The typewriter companies were almost broke; so naturally, they didn't take too kindly to an inventor coming to them and saying, "If you put my keyboard on your typewriters, you will be able to do twice as much work with the same machine." The manufacturers took this to mean, "Oh, you mean we will sell half as many typewriters?! Well, than you very much. Don't call us — we'll call you."



AWKWARD STROKES on the Standard Typewriter Keyboard. The height of each crossbar joining two keys is proportional to the number of high-frequency awkward strokes between the two keys



The DVORAK SIMPLIFIED KEYBOARD reduces the relative number of awkward strokes by a factor of ten to one!

Figure 7

This feeling seemingly was passed over to the typewriter dealers. If you went into a shop then (and in many cases even today) and asked for a typewriter with the DSK, they would almost always try to talk you out of it. The reasons were always similar:

- You would not be able to use any other machine.
- Nobody else uses the DSK, why should you?
- The standard keyboard is good enough. Typing speed is not really that important in comparison to the other skills necessary to office production. And, besides that, the world's typing record is almost 150 w.p.m. on the standard. Isn't that good enough?
- The Simplified Keyboard is not really any better ... regardless of what anybody tells you.

Certainly it is easy to understand that the typewriter companies were concerned with what they would do with their current stock of machines if a change were made to the new keyboard. They probably just felt they were protecting their investment.

In a letter from a typewriter head office to one of their branches, they pointed out that "The Dvorak keyboard is not new ... has not been commercially accepted by the public ... for the reason that the present so-called standard keyboard has considerable merit and that typists for years have been taught the touch system on that keyboard. To introduce a keyboard with the alphabet keys rearranged in as radical a matter as the Dvorak keyboard would cause considerable confusion. ... If a school trained its typists on the Dvorak keyboard, they would have difficulty in locating a position where the machines were in use equipped with that keyboard. ... There is no definite evidence that the Dvorak keyboard

will increase the speed of a typist regardless of statements to the contrary. Our most expert typists are able to write over 150 five-stroke words in a single minute, which means that they are able to hit over 750 keys in 60 seconds. A keyboard that is capable of being operated at that high rate of speed cannot be so badly arranged after all."

Before continuing, some of the above arguments ought to be answered:

1. One reason that the Dvorak keyboard was never accepted was because the manufacturers never advertised that it was available, never gave any demonstrations of its advantages, etc. Obviously, if the public did not know the DSK existed, they would not demand it.
2. The standard keyboard definitely does not have "considerable merit". Indeed, it can be shown by analysis that the arrangement of the standard keyboard is worse than if the keys had been pulled out of a hat, and distributed at random!
3. As to confusion, mass conversion is not recommended. However, a DSK typing element for the IBM Selectric (TM) typewriter would allow instant interchangeability of keyboards and would minimize any problems an office might have in switching back and forth between the two keyboard arrangements.
4. If manufacturers and schools were to cooperate with business, there would be no real difficulty in placing students. A businessman would doubtless be happy to lease a DSK typewriter, if he could then hire a 100-w.p.m. typist to operate it.
5. There is very much evidence that the DSK is vastly superior to the standard keyboard. This evidence is just not well known ... having been made unavailable or suppressed for various reasons.

Another company commented openly in their advertising: "No one has ever studied typewriting without worrying about the madly inconvenient arrangement of the keys ... (produced) to avoid jamming keys and similar problems. ... From very early in typewriter history, the idea of changing Sholes' nonsensical keyboard has been hopeless. Typist opinion was against change, and all of the companies that tried to prove that a more sensible key order was desirable, have long since departed! Typewriter buyers of the country know how to typewrite by "touch" and don't want to learn a different system. And before you invest time or money in a keyboard-reform scheme, consider the facts. If people would buy it, [name of company] would be selling it!"

It is interesting that here, the company has actually recognized that the standard keyboard arrangement is bad, but then proceeds to tell us why we should still not try to change it!

One could agree that typist opinion would likely be against the DSK. But, MOST PEOPLE DON'T TYPE. Many of them would like to. Why should they be forced to learn an old (1873) and awkward keyboard, when a more modern and scientifically designed one is available. That's as if the world's typists all belonged to a huge union which says: "To join our most-esteemed group, you must learn to practice our trade exactly the way we learned to do it. No matter that you think you have discovered a better (faster, easier to learn) way. We are against your way." One can hardly argue that that makes any sense.

International Typing Competition — Proving Grounds for the DSK

From 1906-1932 — 26 years — typewriter manufacturers used annual World Professional and Amateur Typewriting Contests to prove the merits of their machines and for advertising. For the professional contests, manufacturers maintained "speed stables" of outstanding typists whose duties were to practice speed typing (while under full pay from their sponsoring company) and periodically demonstrate the superiority of their employers' machines. Some professional typists practiced up to 25 years to improve their speed and accuracy, which were widely advertised as "World Records".

Outstanding student typists from high schools and colleges, usually winners in state typewriting contests, competed in the "World Novice and Amateur Contests". A student with one school year of typing instruction who could type at 60 net words per minute (n.w.p.m.) for 15 minutes frequently was the "world novice champion". A student with two years' instruction with 70 n.w.p.m. frequently became the "world amateur champion".

Eventually, these contests were combined and included in the "International Commercial Schools Contest" (I.C.S.C.) to be held each year. The I.C.S.C. also included categories for shorthand, machine calculation, and dictating machine transcription, in addition to the typing events. The extent to which the equipment manufacturers and publishers of shorthand materials subsidized I.C.S.C. was not widely publicized.

Beginning in 1933, Dr. Dvorak started entering his DSK-trained typists in the I.C.S.C. His students began "sweeping the field". Ten times in 1934-41 DSK typists not only placed first in their class events, but also placed first in events for contestants with much more training. In the 1935 Contests, nine DSK typists won twenty awards. The contest officials became more and more upset. In 1937, after Dvorak spent \$1,600 bringing nine contestants to Chicago, the I.S.C.S. Committee informed him that DSK typists were to be disbarred from competition because they were "unfair competition".

However, Dr. Dvorak was not one to be bullied. He hinted that the newspapers might find the disbarment of his students most interesting ... especially since the Contests were supposed to be held to advance the skill of typing, not hold it back. The Committee reconsidered, and Dr. Dvorak's students were allowed to remain in competition.

After these events, however, Dvorak and his students were not received in a friendly sportsmanlike manner in the interest of commercial education. Standard keyboard typists objected to being placed near DSK typists because the noise of their high rates was disconcerting. One year, Dvorak's machines were even sabotaged before the contests began.

Someone reset the margin stops on all of their machines by just enough to cause line length and paragraphing errors. Many typists were disqualified because of this. In the following years, Dr. Dvorak had to hire security guards to watch his typewriters prior to the start of competition.

Another interesting thing was the way they reported the winners. The score would be given, along with the brand name of the typewriter they used (e.g., IBM Electromatic, etc.). However, when Dvorak's students began winning with quite superior scores, there was no mention that they had used the DSK ... only that they had used a machine produced by such-and-such manufacturer (after all, the real

purpose of the contests was to prove the superiority of each manufacturer's machines ... not the keyboard used on the machines).

During World War II, the I.C.S.C. were cancelled. In 1946, when they started up again, Dr. Dvorak had no students ready to compete because he had been serving in the armed forces. With no DSK typists in the contests, the performances on the standard keyboard were so dismal (at least one contestant won a third place with a zero net score) that they did not bother to announce the winning scores of each winner at the awards ceremony, as had been the case in previous years. After that, they decided to cancel the competition altogether because they "proved nothing" (except perhaps the superiority of the DSK?).

What About Running Some Experimental Classes?

Many persons have suggested proving the worth of the DSK by running experimental classes. The question is: What will be done if the experiments show that the DSK is indeed all that it is claimed to be? The plain facts are that the DSK has been proven experimentally, but those in power in each case chose to disregard the results of the experiments and everyone just went on using the standard keyboard arrangement.

Some examples would be helpful here:

Tacoma Schools Experiment: During the depression of the 1930's, an experimental program in personal typing was instituted by the school district in Tacoma, Washington. Great care was taken to choose students who wanted to use the typewriter for personal use, rather than in a business environment. Parents understood that they would have to purchase DSK typewriters for their children to use after finishing these experimental classes.

Two thousand seven hundred students were put through the various courses in DSK typing. These classes showed that senior high school kids could learn the DSK in 1/3 the time it took to learn the standard keyboard. For junior high school, the same progress was made in one semester as was normally made by these kids in a full year on the standard keyboard. The program was an outstanding success, and was reported in various educational publications.

But, then came a school board election. And typing in the schools became a political issue ... whether or not they should allow the Simplified Keyboard classes to continue, etc. The man who was against the new keyboard won the election. So, what did he do? He ran a survey. He asked businesses in the area how many DSK machines they had in their offices. Answer: NONE. Then, he asked how many regular standard keyboard typewriters they had. Answer: Why all of them, of course. On these grounds, he closed down the personal typing classes (regardless of the fact that these students were not planning to go into office typing, but wanted the typewriter for their own personal use). It's amazing what one man can do to help "shoot down" a good idea.

U.S. Navy Department Report: One of the most interesting experiments was conducted by a group of management engineers in the U.S. Navy Department in 1944. In this test, they retrained a group of standard keyboard typists on the DSK in a period of about 2 1/2 months. The trainees' progress was also compared with that of a group of standard keyboard typists who were given some additional training on the regular keyboard. The results, together with the data supporting them, were most conclusive. The DSK retrainees increased their productivity by an average of 74%! Not only that, the total cost of retraining was completely amortized in only 10 days after the tests were finished.

The improvement in the comparison group was much less dramatic, amounting to only about 28% increase — and the comparison group took twice as long to acquire their slight increased performance!

On the basis of this test, the Navy Department issued a request for bids for 2,000 DSK-equipped typewriters. They figured that the amount of money that would be saved during the war effort would be tremendous. But, the request was turned down by the Procurement Division of the U.S. Treasury Department (which was responsible for all government purchases of typewriters at the time). No satisfactory reason was given (at least from the viewpoint of the Dvorak proponents). The request was simply denied!

Later on, Dr. Dvorak heard over the "grapevine" that the reasoning went something like this:

1. There are over 800,000 typewriters in the government.
2. It will cost \$25 each to convert them to the DSK. (They were not manufacturing any typewriters at the time — all the typewriter companies were making war goods instead.)
3. It will therefore cost \$20,000,000 to convert all of the typewriters in the government.
4. But, what if the DSK does not work out? Then, all of those machines will have to be converted back again. And, that's another \$20,000,000!
5. So, that's a total of \$40,000,000 — just because some people ran a study in the Navy Department: Are you sure we should approve that order for 2,000 DSK machines? What will people think if it doesn't work out?

Although it would probably be very hard to prove whether or not this rumor was in fact true, one can nevertheless ask: "If this is not the case, then why was the order turned down by the Treasury Department Procurement Division?" Surely they must have had some reason for the rejection. If it was not political, then what was it?

The report is in two parts:

- I. A Practical Experiment in Simplified Keyboard Retraining — A Report on the Retraining of Fourteen Standard Keyboard Typists on the Simplified Keyboard, July, 1944, and
- II. A Comparison of Typist Improvement from Training on the Standard Keyboard and Retraining on the Simplified Keyboard — A Supplement to "I" above, 18 October, 1944. Prepared by Training Section, Department Services, Division of Shore Establishments and Civilian Personnel, Navy Department, Washington, D.C.

(If you are not able to get a copy from the Navy, you can get one from Motivational Communications Corp. Ltd., P.O. Box 544, Mississauga, Ontario, Canada.)

Another interesting thing about this report was that after it was completed, it was given a security classification by the Navy ..., which again meant that an ordinary citizen could not gain access to it. What a report on typewriters could have had to do with "endangering the national defense" was never quite explained. This classification was lifted later on; but, nevertheless, it still happened!

"Unbiased Test" by the General Services Administration: What really almost killed the DSK was a test conducted by the U.S. General Services Administration (GSA) in 1956, under the direction of Dr. Earl P. Strong. If you ask anyone in the U.S. Government about the DSK, they will invariably say that the GSA

test "proved" that the Simplified Keyboard wasn't any good. The conclusions of this study state, in part: "... the Standard Keyboard results are better ... recommendation for the adoption of the Simplified Keyboard for use by the Federal Government cannot be justified based upon the findings of this experiment."

However, some old correspondence which has recently come to light seems to indicate that Dr. Strong might not have been the "impartial researcher" he claimed. In a letter dated September 13, 1949, Dr. Strong states: "... I have developed a great deal of material on how to get this increased production on the part of typists on the standard keyboard. Consequently, I am not in favor of purchasing new (i.e., Dvorak) keyboards and retraining typists on the new keyboard, and I am out to exploit it to its very utmost in opposition to the change to new keyboards." This seems to indicate that the U.S. Government ought to conduct some new, more objective tests, and that the data and results of these tests ought to be made freely available to the public for open discussion.

If new tests are to be run, they ought to be run on a strictly scientific basis, and the testing should be carried out over a period of at least a year in order to allow proper evaluation. At least four groups of students should be provided for:

1. A class of students who do not know how to type, and who will start out learning the DSK.
2. A control class of students who will start out at the same time as class No. 1 above, using the same methods, etc., but who will type on the standard keyboard.
3. A class of typists who already use the standard keyboard, and who agree to be retrained on the Dvorak arrangement (nobody should be forced to learn the DSK against their will).
4. A control class of standard keyboard typists who will be given additional training on the regular keyboard, and whose progress will be compared against that of typists in class No. 3 above.

Most importantly, provisions should be set up to insure that all of the experimental data (including test papers, progress records, etc.) are saved and made available to the public (or to qualified researchers). It seems this was not done with the GSA tests, much of the class material evidently having been either lost or destroyed at the end of the trial.

The importance of typist efficiency can be understood when you stop and think that there are, at present, several million people who earn their living wholly, or in part, with typing. What would be the value of a 50% increase in stenographic production (which the DSK could provide) to business and government? For 2 million workers earning \$5,000 a year, it would be \$5 billion annually! And the increased cost to typewriter manufacturers of assembling type for the DSK arrangement? Relatively, very small.

In case you want to write the GSA itself, you can ask for: "A Comparative Experiment in Simplified Keyboard Retraining and Standard Keyboard Training, Sponsored by General Services Administration, Washington, D.C., 1956". Otherwise, the report is available from Motivational Communications Corp. Ltd.

The evidence all seems to indicate that the Simplified Keyboard is really better. Many people may ask: "Surely we are much more progressive today. Don't you think the DSK will catch on now?"

Unfortunately, this is not necessarily the case. It seems that there are still many forces around that have an interest in the status quo ... in "preserving the sacred cows".

Take the American National Standards Institute, for example (abbreviated ANSI). This organization is responsible for determining various standards needed in business and industry today in the U.S., and includes a committee which recommends keyboard standards. In a recently published article in DATA-MATION, a well known computer journal, the ANSI keyboard Committee proposed a keyboard standard based exclusively on the old layout that is on most of our typewriters today.

Let me quote one of the reasons given for this proposed standard:

"... Research consistently revealed that the overriding criterion for continued use (of the Standard Keyboard arrangement) was the millions of people already familiar (and those trained annually in schools) with this arrangement."

No thought is given to those people who don't know the type, but might like to learn if only it weren't so hard and time consuming to do so. It looks like preservers of the status quo are at it again! And who are the members of the Keyboard Committee? As you might think, there are many representatives of manufacturers of keyboard devices ... most of whom, it might be said, have heavy investments in the status quo. The membership list seems to indicate that there might be a "slight bias" for this committee to choose the normal keyboard layout over any other that might come up. The percentage of "users" on the committee does not constitute a majority of the voters. Thus, the manufacturers can always have their way by voting together. (I have heard there are other ANSI committees with a similar balance of power in the hands of the manufacturers/suppliers).

The ANSI Keyboard Committee certainly can't feign ignorance of the DSK. One of their members has for some years been trying to get them simply to include a mention of the DSK arrangement in their standards — to define a "family of standards", so to speak. Then, let people choose which member of the family best suits their needs.

As a matter of fact, the DSK has been before the standards organization for many years.

In the October, 1943, issue of Industrial Standardization, published by the American Standards Association (predecessor of ANSI), there was a discussion of the Simplified Keyboard. One member of the current committee has frustratedly written:

"There are good reasons for asking for delay in the case of the X4.7 typewriter keyboard standard, in that the proposal was arrived at without laboratory research and without consultation with qualified research engineers, psychologists, or specialists in education and training."

I, for one, hope this is not the way our standards organizations are being run. Were it true, I would question whether we could really trust a

PROBLEM CORNER

Walter Penney, CDP
 Problem Editor
 Computers and Automation

PROBLEM 7211: MONTE CARLO

"I hate to Monte Carlo something when there's probably a nice analytic approach," said Harry. "But I haven't been able to figure it out."

"What is it you haven't been able to figure out?" George asked.

"In this SALES DENSITY program we're going to have a lot of numbers in binary plus the total number of 1's. We have to make some estimate of the value of these numbers."

"Why don't you calculate the average value of one and multiply by the number. This may be way off, but I don't see how you can do any better if that's all you know."

"Well, actually, we'll know a little more. We'll know the maximum length of the binary numbers."

"That should make things easier, shouldn't it?" asked George. "Just round out the short vectors with initial 0's until they're all the same length and calculate the expected value."

"That's what I was thinking of doing via Monte Carlo. But we have two variables, the number of vectors and the total number of 1's. We'd have to take every combination of these two variables."

"I don't see why you have to consider the number of vectors in the set. Won't the number of 1's tell the whole story?"

"I don't think so. If we're dealing with 10-bit numbers, for example, and the total number of 1's is three, we might have just one number, 7 say, or we may have three, 512, 256 and 128, perhaps; then the total would be 896. Or we might get all sorts of other combinations." Harry looked skeptical.

"Yes, but if you're interested only in the expected value, you'd have to average this over all possibilities. I still think all you need is the total number of 1's and not the number of members in the set."

How about it?

Solution to Problem 7210: *Billet-Doux*

If ESTHER is assumed as the beginning of the message, the numbers representing the amounts the letters are advanced are found to be 3 1 4 1 5 9. These are recognized as the first six digits of π . Continuing with 2 6 5 3 5 8 9 7 9 3 2 3 8 4 6 2 8 4 3 3 8 3 2 7 9 0 2 8, we read:

MEET ME AT FIVE IN THE LIBRARY. PETE

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.

vested-interest-laden committee to make very important decisions for everyone else in the country. Such decisions should not be based largely on "tradition".

The Machine Conversion Problem

One thing that is holding back wide-scale training efforts on the DSK is a way of converting a typewriter easily back and forth between the standard keyboard and the DSK. IBM is currently evaluating the potential uses of the DSK on their Selectric Typewriters (Selectric is a trademark of the IBM Corp.), which utilize removable typing elements. Unfortunately, IBM wants to charge \$20,000 for the initial tooling of the first DSK element. Few organizations, outside of the government, have operations large enough to justify an expenditure of this size.

The DSK Would Mean
Increased Sales of Typewriters

Perhaps the typewriter companies should follow the example of Xerox Corp. Xerox designed their machines so that all you had to do was to press a button to get a copy. This greatly simplified the entire process, and the copiers caught on like mad. In a similar way, you can make typing simpler. Then, more people will use the typewriter. Besides the benefits of increased productivity in business and government, the DSK conversion would mean increased sales of typewriters to the public. Because typing would suddenly become easy to learn, many more people would decide they wanted to learn to type, who would never have considered doing so before. After all, most people do recognize that typing is a valuable skill — they just figure it's too hard, or they don't have the time. Undoubtedly, many of the new machines sold would go to people who don't type now (a market the manufacturers have been after for many years, without much success.) The end result would be beneficial to us all.

Henry Ford is said to have remarked, "Hire the best engineers you can find to build a car that morons can drive." I think it's safe to say, "He did, and they do!"

Imagine how many people would be driving today if it took three full years (the time it takes to gain an "acceptable" skill, on the average, with a standard keyboard typewriter) to learn how to operate a car.

Also, Dr. Frank Gilbreth (under whose direction Dr. Dvorak began the research that led to developing the DSK), the father of time and motion study, said, "It is cheaper and more productive to design machines to fit men rather than try and force men to fit machines." The U.S. space program strives to apply this principle, as its importance becomes more obvious under stressful conditions. Why can't we give the millions of typists in the country the same considerations?

We are attempting to face the problems created by the internal combustion engine, and have recognized the need to convert to the Metric System of weights and measures. Since more people use the typewriter to make a living than any other single business machine in the world today (as was pointed out by Dr. H. Forkner, the inventor of Forkner Shorthand), isn't it only fair to examine needed improvements in this area too? I think the answer is YES! □

Bernard L. Barker : Portrait of a Watergate Burglar

Edmund C. Berkeley, Editor
Computers and Automation

"You work, you help because you're supposed to help, because you're needed. And when you're not needed, then you forget about it."

Bernard L. Barker was one of the five men with connections stretching to the Republican Party and President R. M. Nixon who were arrested in the Watergate Hotel offices of the Democratic National Committee on June 17, 1972, at 2:30 in the morning. He was wearing rubber surgical gloves and was unarmed. He and his colleagues had with them extensive photographic equipment and electronic surveillance devices.

In the article "The June 1972 Raid on Democratic Party Headquarters" by Richard E. Sprague, published in the August issue of "Computers and Automation", the following paragraph appeared:

Bernard L. Barker

Bernard L. Barker, alias Frank Carter, is a wealthy Cuban-born Miami businessman in the real estate business. His code name was "Macho" during the Bay of Pigs planning operation in 1961. He worked for E. Howard Hunt in the CIA, and was a business partner of Miguel R. Suarez in Miami. He established secret Guatemalan and Nicaraguan invasion bases. He is closely associated with Manuel Artime Buesa, military leader in the Bay of Pigs invasion. He is President of Barker Associates, Inc., a Miami real estate co.; he was a principal link between CIA headquarters and the Cuban exile army during the pre-invasion period.

Interview with Barker

In "The New York Times", September 12, 1972, appeared a long and significant interview with Bernard L. Barker (by Walter Rugaber), entitled "Barker Admits Raid Role But Won't Involve Others". Excerpts from that interview follow:

Barker acknowledged his role in the aborted break-in. "I was caught in national Democrat [headquarters] at 2:30 in the morning," he said at one point. "I can't deny that."

He praised the three men from Miami who were arrested with him and said that his main regret was that "those people that I have motivated to work under me" had been caught with him.

He also spoke highly of a onetime White House consultant who has been linked to the raid, E. Howard Hunt, Jr. He said he had "never known anybody who this country is so indebted to as Howard Hunt," but he declined to elaborate.

He maintained that he had little involvement in politics. "I don't even trust the politicians, to be quite frank with you," he said.

Socialism

He asserted that most Cuban refugees, himself included, "believe that an election of McGovern would be the beginning of a trend that would lead to socialism and Communism, or whatever you want to call it."

Elaborating on his refusal to implicate others, Mr. Barker said:

This is the way these things are. You know it before you get there. You work, you help because you're supposed to help, because you're needed. And when you're not needed, then you forget about it.

It's the way it is. Everybody that does it knows about it. It's just that if they want to cry in their beer later on and think that people owe them something, that's their own hard luck.

Threats

He said that after his arrest, but before he could secure his release on bail, Government prosecutors had said they would "keep me in that jail and (let me) rot in there until I talked."

"I said, 'This was tried by Nazi interrogators (during World War II) with a hell of a lot more going for them than you have.' I said, 'This has been tried by experts, and it just doesn't work.' I don't talk, period."

Mr. Barker has much of the bearing of an Army master sergeant. He is a short, stocky, powerfully built man with a squarish face, a high forehead, and very fine brown hair that is beginning to thin and turn gray.

He is an American who was born in Cuba.

Enemy of Castro

He says he is a passionate, unrelenting enemy of Fidel Castro. The subject brings a flash of fire to the eyes behind the outsized horn-rimmed glasses.

Mr. Barker suggested that he tries to behave like the men he seems to admire most: Men he has known in one covert operation or another over the years, men whom he says this country "can't pay" for their services.

Anonymity

"They're anonymous men," he said. "They hate publicity; they get nervous with it. They don't want to be spoken of. They don't even want to be known or anything like that."

The men who sneaked into the office building in the Watergate complex with cameras and microphones did so, he suggested, not for money or security but for "something else": A case they considered righteous.

"For a man to enter a place in the dark of the night is very risky," Mr. Barker said. "I know, because I have gone through a lot of experiences in my life and I know how scared a man can be. But he does it anyway."

Burglar

"I've never looked at myself as a burglar," he remarked at another point in the interview. "It is very repulsive to me when I read [about myself as] the 'alleged burglar' — this gripes me.

"I think more as a cop and not as a burglar. I'm of that formation. I have been a police officer, and I can't conceive of myself as a burglar. But I just have to live with that phrase, and that gripes me."

Imprisonment

"I've always thought, though — I'm 55 years old, I'm old enough to know what I am doing, and I have always faced up to all my responsibilities. And when the time comes, I will face up to whatever responsibility I have, and I won't cry in my beer and that will be the end of it. And, like I said, if I have to go to jail and so forth — well, I did 16 months in a German prison camp and this sure as hell isn't going to be as bad as that."

Mr. Barker's grandfather was a potato farmer from Columbia, Tenn., who went to Cuba as a supplier for Theodore Roosevelt's Rough Riders. The family remained in Cuba after the Spanish-American War.

Mr. Barker was born in Havana on March 17, 1917. His American father and Cuban mother (who became an American citizen and who died in this country) were divorced and he was raised by aunts on a farm near Mariel Bay.

He attended Roman Catholic schools in Cuba. Later, he went to live with his mother on Long Island and graduated from the high school in Farmingdale in 1936.

He worked in a steel mill in Baltimore for two years, then entered the University of Havana as a civil engineering student. He was a sophomore when the Japanese attacked Pearl Harbor.

"I was the first volunteer from Cuba into the United States Army," he said. "... [as] an American, I guess I was teed off at Pearl Harbor just like everybody else. So I just joined."

Bombardier

He went into the Army Air Force and flew his first mission as a bombardier ("I was a pretty good bombardier") over Germany on Christmas Eve in 1943. On his 12th flight a fighter shot down his B-17 and he bailed out over German territory. He was imprisoned for 16 months.

His Nazi interrogators threatened to have him executed as a spy, he recounted.

They sent me back to a cell the second day and they just said, 'Well, we're just going to have you executed.'

The Germans marched him to the end of a long corridor, Mr. Barker related, but there was no execution. He said he supposed "a lot of guys broke" under the pressure.

Liberated by Russians

Mr. Barker was liberated by the Russians toward the end of the war and he left the Army late in 1946. He married the daughter of a Cuban senator, and his wife's "very well-to-do" family presented the newlyweds with a home.

Double Master

For about a year in 1947 or 1948, Mr. Barker served in the Cuban national police. He said he had joined this agency "with the full consent and the cooperation" of the Federal Bureau of Investigation.

I did an awful lot of work in cooperation with the F.B.I. Most of my cases involved Americans. I was personally in charge of the group that escorted Mrs. Truman and Margaret down there.

There were a variety of other jobs, he said. He spent about a year with his wife on her farm, then worked for a number of years as a "typewriter salesman".

When Fidel Castro came to power early in 1959, Mr. Barker said, he was a housing inspector in the Havana suburb where he and his wife lived. When the revolution occurred, "I just left and went home."

This exchange followed:

Q: When did you leave Cuba? A: I — about a year — let's see, it took me about a year.

Q: So, late fifty-nine or very early sixty? A: Right, late fifty-nine, early sixty.

Q: What had you done in the course of fifty-nine, just stayed at home? [Mr. Barker smiled.] A: I'm entering a sensitive area.

Involuntary Departure from Cuba

Q: You left involuntarily, more or less? A: Oh, quite involuntarily, yes. As a matter of fact when I left Cuba they had been looking for me to execute me for quite some time.

Q: So you had been living underground for some time? A: Oh, yes, for quite some time.

Q: Did you get out by boat, or —. A: I can't say.

Q: The people for whom you were engaged in this last period in Cuba were unwilling to aid and abet you after you got out by the skin of your nose? A: Well, this is the way these things are. I've always been able to make a hell of a lot more money outside of that [whatever secret work he was doing] than I did inside of that. So it didn't bother me too much. And as a matter of fact that's how you become involved again. It seems like it's a current that takes you. You think, 'Well, I'm finished,' and then you never are. And a little of it gets in your blood, in a way.

Q: What did you do after the window-making and car-parking [in Miami]?

Bay of Pigs

A: There's a lacuna in my life there until after the [1961 Bay of Pigs] invasion.

Q: Let's go back to this sensitive area ... about 1961 ... everybody keeps saying that you played a role in the Bay of Pigs. A: Yes, well, you see there's — I just don't know my grounds on that. Not only that but like, for instance, you know when you leave certain intelligence organizations you state — they make you sign statements and try to —

Did Not Land

Q: Well, you didn't land at the Bay of Pigs. You were not in the landing? A: No, I never got to the landing. No, No. I was turned back. [It has been reported many times that Mr. Barker was an employee of the Central Intelligence Agency who served during the invasion as paymaster, handling huge sums of currency].

Taxpayer's Money

Q: I guess generally in Miami that you impressed a lot of people by the fact that so far as anyone ever told not 10 cents of the money that you handled ever went [astray]? A: Yes. I've always made an effort in everything I've always done to give a good accounting of money. I believe that when you are handling taxpayers' money without being required to give an account of it you are then placed on some degree much worse, you know ...

After the ill-fated invasion, Mr. Barker worked for a variety store and for two real estate firms in Miami. Then in June, 1971, he established his own real estate company, Barker Associates, Inc.

Nixon's \$114,000

It was through this company's trust account in the Republic National Bank of Miami that Mr. Barker passed \$114,000 in checks that had been intended for President Nixon's campaign treasury.

Some of the money, in the form of \$100 bills, was found in Mr. Barker's possession when he was arrested. The Republicans have asserted that most was returned before the break-in, but the details are not clear.

Before the break-in, Mr. Barker employed 10 salesmen. Now he has only five, and he is facing a felony charge which, if he is convicted, could cost him his license to do business in Florida.

Mr. Hunt, the former White House consultant, is a former C.I.A. agent who played a major role in the planning of the Bay of Pigs landing. He has also been connected with the arrested men on the one hand and with the Nixon Administration on the other.

Mr. Barker also talked at some length about the three Miami men who were arrested with him, Frank A. Sturgis, Eugenio R. Martinez, and Virgilio R. Gonzalez, all anti-Castro partisans. Mr. Barker said:

I had three men with me, and I know that these men are only motivated by certain things — and not money — that is not a motivation. These are people who have been involved in the liberation of their country for years.

Mr. Barker is a registered Republican in Florida, and he made it clear that one of the main reasons was the party's opposition to Castro and its nonrecognition of the Cuban Government.

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: Andrew M. Langer, Newton High School, Newton, Mass.

NUMBLE 7211

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      F R U I T
    x F A L L S
    -----
    U F D H I T

      D D R H D T
      D D R H D T
      U I D H F T
      T D D I D T
    -----
    T A D R U L S E D T      6128 4508 5488

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Solution to Numble 7210

In Numble 7210 in the October issue, the digits 0 through 9 are represented by letters as follows:

S = 0	R = 5
H = 1	L = 6
I, T = 2	F = 7
E = 3	A = 8
N = 4	O = 9

The message is: In Hell there are no fans.

Our thanks to the following individuals for submitting their solutions — to Numble 729: A. Sanford Brown, El Paso, Tex.; T. P. Finn, Indianapolis, Ind.; Elwyn Smith, San Diego, Calif.

Dictatorship

He also applauded the "Republican concept of a strong state government" as opposed to "a centralized government", and he favored "the approach to a man going out and working".

Nobody owes nobody nothing. You go out and you work for it. [People] should take as an example what the Cuban people have done, who came here with nothing. They got two jobs and they worked their rear ends off. □

Walter Sheridan — Democrats' Investigator? or Republicans' Countermeasure?

Richard E. Sprague
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"The NBC broadcast of June 19, 1967" put on by Walter Sheridan "will probably stand for years as a symbol of the lengths to which some powerful outside interests will go in order to interfere with state government."

Walter Sheridan has recently been hired by the Democratic National Committee to head their investigation of the Watergate bugging caper. In view of the importance of this assignment, it would seem worthwhile to examine Mr. Sheridan's performance in past investigations.

"Getting" Hoffa, and False Testimony

Walter Sheridan first came into national prominence in 1961 when he spearheaded Robert Kennedy's drive against Jimmy Hoffa, during Robert's tenure as Attorney General. Sheridan pursued a relentless, no mercy shown, course of action to "get Hoffa", and get him he did. In the course of this crusade, some rather dubious techniques were used, which later

came back to haunt Mr. Sheridan. The prime example was the "uncovering" of a key witness against Hoffa, one Grady Partin of New Orleans and Baton Rouge, Louisiana. Partin was some years later accused by a grand jury of giving false testimony against Hoffa.

"Getting" Garrison

Mr. Sheridan's most notable performance came in 1967 and '68 when he was an executive producer for NBC-TV news. Sheridan produced a one-hour NBC special on Jim Garrison's investigation of the assassination of President Kennedy and the trial of Clay Shaw for conspiracy to murder the President. The program, broadcast on June 19, 1967, was a highly biased, provably dishonest, personally vindictive, attack on Garrison defending Shaw. The Shaw trial did not take place until February, 1969, a year and a half later.

Arrest by Garrison and Indictment by Grand Jury

Walter Sheridan was arrested by Garrison on July 7, 1967, following the NBC Special, and indicted by a grand jury on two counts. The first was attempted bribery and intimidation of a witness. Rick Townley of station WDSU, the NBC affiliate in New Orleans, was arrested and indicted with Sheridan on the same charges. The federal government, especially the Justice Department, made sure that Garrison was never able to bring Sheridan and Townley to trial. The indictments are still open.

If the Sheridan trial ever does take place, the conviction should not be too difficult. Here are the facts, as reported by both New Orleans newspapers, the Times Picayune and the States Item, in 1967 and summarized in "The Kennedy Conspiracy" by Paris Flammonde, Meredith Press, 1969.

Sheridan and Townley, having been assigned by NBC to cover the Garrison-Shaw case, became personally and directly involved. The indictments for bribery, suppressing and altering evidence, and interfering with the trial, did not begin to tell the entire story. NBC top management, Frank McGee, the narrator of the special, and others at NBC, fully

The Watergate Incident

On June 17 at 2:30 a.m., five men were arrested in the offices of the Democratic National Committee in the Watergate Hotel, Washington, D.C. They had broken into the office, and were found with electronic surveillance devices, cameras for photographing documents, etc; they were wearing surgical rubber gloves. They were arrested by police.

These five men were James W. McCord, Jr., Bernard L. Barker, Frank Sturgis, Eugenio R. Martinez, and Virgilio R. Gonzales.

Their connections reach to the Republican Party, the Committee to Re-Elect the President, President Richard M. Nixon, the Central Intelligence Agency, and other persons and organizations.

Beginning in August 1972, "Computers and Automation" has been publishing articles on the Watergate Incident and its ramifications, because of the threat that this incident represents to democracy in the United States, and the importance of seeking the truth about it and pinning down the responsibility for it.

backed up Sheridan, until some of the lies, bribes and fakes in the program were revealed.

Apology by NBC for Lies Told by Two "Witnesses"

Frank McGee later had to apologize on NBC for lies told by two of Sheridan's "witnesses" on the special. Sheridan and Townley paid them to give statements against Garrison. The FCC ruled that NBC had to give Garrison equal time after Garrison made an appeal, because the special had not been a news program, but an NBC-Sheridan vendetta against Garrison. NBC did give Garrison 30 minutes (the special was one hour) to respond at a later date in 1967.

To illustrate Sheridan's and NBC's techniques in the case, at one point the President of NBC helped in the bribery efforts by calling Mr. Gherlock, head of Equitable Life Insurance Co. in New York. Gherlock was asked for assurance that Perry Russo, who worked for Equitable in Louisiana, would cooperate with NBC on the Garrison special. Russo was the key witness in the Shaw trial whom Sheridan and Townley tried to bribe.

To remind the reader about the Shaw trial, Jim Garrison opened an investigation into the assassination of President Kennedy in late 1966. Senator Long of Louisiana had convinced Garrison that a conspiracy had existed. Lee Harvey Oswald's activities in New Orleans prior to the assassination, along with the strange actions of David Ferrie, on the day of the assassination, attracted Garrison's attention. He had not made his investigation public, but a curious newspaper reporter named Rosemary James broke the story after a few months of effort. Clay Shaw's other identity, Clay Bertrand, had already been uncovered by Garrison, and his involvement in the planning for the assassination had already been suspected by early 1967.

Party in David Ferrie's Apartment

Perry Russo attended a party in David Ferrie's apartment where Clay Bertrand, Ferrie, someone resembling Lee Harvey Oswald and others had discussed the possibility of assassinating President Kennedy. He became the key witness when Garrison arrested Shaw on March 1, 1967, and a grand jury indicted Shaw on March 22 following two hearings on March 14 and March 17 by a three judge panel and a four judge panel, recommending that Shaw be held for trial.

Effort to Have Russo Change His Testimony

Sheridan and Townley both made up their minds, along with most of the news media and the Justice Department, that Garrison had to be stopped at all costs. They decided to really go to work on Perry Russo, since his testimony was all important.

Townley tried to get Russo to change his testimony at the Shaw trial to make it seem that Garrison had hypnotized him and had then asked him leading questions to get Russo to testify against Shaw. Townley and Sheridan went to Russo's house, his office, and met him at other places. They badgered him and attempted to bribe him. They pressured and threatened him. They used every trick in the book to try to get him to change his testimony.

They threatened him with being discredited, made to seem insane, and perhaps fired from his job. They offered him a chance to work closely, for high rewards, with NBC in Sheridan's all-out effort to get Garrison. Sheridan told Russo, "We're going to de-

stroy Garrison and his case along with him." Townley told Russo that he could get Shaw's lawyer, Dymond, to go easy on him at the trial, if he would alter his testimony. He told Russo that his employer had promised NBC that no retaliation would be taken against Russo if he cooperated with NBC. However, he might be fired if he didn't cooperate.

Sheridan told Russo that NBC could set him up in California where Russo always wanted to live, if he helped bust up the Garrison probe. Sheridan said NBC would pay his expenses to California and to live there, would protect his job, would get Russo a lawyer, and would guarantee that Garrison would never extradite him back to Louisiana.

Gordon Novel, Worker for the CIA

Another important witness in the Shaw trial was Gordon Novel, a bugging and electronics expert who worked for the CIA. Garrison tried to subpoena him, but he left New Orleans and fled to Ohio. Garrison was never able to extradite Novel from Ohio to Louisiana in spite of Novel's public statements that he knew who had killed David Ferrie. (Ferrie died mysteriously shortly after Garrison's probe became public knowledge.)

Walter Sheridan told Perry Russo that NBC had helped Novel escape Garrison's clutches by flying him out of Louisiana to McLean, Virginia (home of the CIA). NBC paid for a lie detector test to be administered to Novel in McLean. The test was supposed to prove that Novel was telling the truth when he said he knew nothing about the Kennedy case. Sheridan told Russo that NBC would do the same thing for him that they had done for Novel, namely, make sure that Novel would never be extradited to Louisiana to testify. Since Novel never was extradited and since Governor Rhodes of Ohio blocked his extradition making Governor McKeithen of Louisiana extremely angry, it would seem that Sheridan was right. NBC did possess a lot of clout.

Sheridan and Townley also went to work on Gordon Novel's former wife, Marlene Mancuso. She was another important Shaw trial witness, because of her knowledge about Novel's CIA activities and a burglary of a munitions dump in Houma, Louisiana. Townley called her and tried to convince her to grant a taped interview for use on the NBC show. He said Garrison was going to be destroyed and that she should cooperate with NBC.

The NBC Special on June 19, 1967

The NBC-Walter Sheridan special on June 19, 1967, titled "The JFK Conspiracy — The Case of Jim Garrison", was packed with Sheridanese. Here are the principal examples:

1. A lawyer named Dean Andrews in New Orleans had played a key role in the Shaw trial because Clay Bertrand had telephoned him in a hospital shortly after the assassination and asked him to represent Lee Harvey Oswald. Andrews told so many different stories about Clay Bertrand that the truth was difficult to determine.

Frank McGee asked Andrews on the program about Clay Bertrand and whether he was Clay Shaw. Andrews said Bertrand was actually Eugene C. Davis, a bar owner in New Orleans. Sheridan's coup quickly blew up in his face when Davis denied the whole thing. When the trial finally took place, Shaw was pegged as Bertrand by a woman who saw him sign his name as Clay Bertrand.

Bundy Lying

2. Sheridan's second attempt was to attack the credibility of Vernon Bundy, a witness for the prosecution who had seen Oswald and Shaw together on the New Orleans lakefront (Lake Pontchartrain). Sheridan cooked up two "witnesses" against Bundy. NBC presented John "the Baptist" Cancler, a burglar and Miguel Torres, also a burglar, who had been acquainted with Bundy.

Sheridan paid Cancler and Torres to make statements on the program. Cancler said that Bundy had indicated to him that his story regarding Oswald and Shaw was not true. Torres asserted that Bundy's testimony was "an out-front lie". Cancler said he had been approached by members of Garrison's staff to "plant" something in Shaw's house. Torres claimed that he had been asked (by Garrison) to testify that Shaw had made homosexual advances toward him and also that Shaw was Bertrand.

Frank McGee reported that NBC had discovered Bundy was lying during his polygraph test and Garrison knew it but let him testify anyway.

Cancler Sentenced to 18 Years

Following the TV show, Cancler was called before the Orleans Parish grand jury and asked to repeat his accusations under oath. Cancler took the fifth amendment, refusing to reiterate his TV charges. The jury foreman immediately took Cancler before a judge and asked him to repeat. Cancler again took the fifth and was found guilty of contempt of court and fined \$500 or one year. Apparently Sheridan had paid him a lot more than \$500. Two weeks later Cancler was handed a third conviction and sentenced to eighteen years as a multiple offender.

Miguel Torres was also brought before a grand jury and took the fifth when he was asked, "Were the statements you made on national television on NBC in June 1967, concerning the district attorney, true?"

James Alcock, Garrison's assistant district attorney who handled the Shaw trial, said to the judge, "Torres and Cancler just tell the television and Walter Sheridan about it. When they have an opportunity to do something they take the fifth amendment."

Sheridan Could Not Get Russo to "Cooperate"

3. Sheridan himself appeared on screen to discuss Perry Russo. He could never get Russo to change his mind and cooperate, so Sheridan interpreted for the audience what Russo had told him. He stated that Russo told him that his testimony against Shaw may be a combination of truth, fantasy and lies.

Andrew Sciambra, Garrison's assistant district attorney who interviewed Russo, delivered a memo to Garrison, detailing Walter Sheridan's efforts to bribe and threaten Russo. The statements made by Russo to Sciambra were very incriminating about Sheridan. The net result of all Sheridan's efforts were that Russo stuck to his story at the trial.

Fred Leemans, "Witness"

4. Sheridan's last "witness" on the show was Fred Leemans, another bar owner (Sheridan seemed to specialize in bar owners) and former Turkish bath operator. Leemans said that his original statements given to Garrison about Clay Shaw were not true and that his psyche began to trouble him. The morality

of his actions began to weigh upon his mind. Perhaps a little of Sheridan's green stuff weighed even more heavily. At any rate he recanted his claim that Clay Shaw had come to the Turkish bath, that he (Leemans) had associated the name Bertrand with Shaw, and that on occasion he had been accompanied by a young slightly-bearded man whom he called "Lee". Leemans said on TV that Garrison had offered him \$2500 for his testimony.

The New York Times telephoned Leemans following his appearance for an interview. He refused to speak about his NBC bit, conceding that he had arranged to give the Associated Press the exclusive story. He said, "After all, I have to get something out of all of this." On hearing this line, one of Garrison's staff smiled and said, "Ah, now that's the Fred Leemans we all recognize."

Bribing and Attempting to Bribe Witnesses

In addition to bribing and attempting to bribe witnesses, Sheridan also had meetings with one of Garrison's part-time investigators, William Gurchich. Garrison found out about the meetings and did not give Gurchich all of the information he wanted.

Jim Garrison said about Sheridan and the NBC broadcast, "Aside from the fact that it insulted the intelligence of every American, it was a very clear attempt to prejudice in advance possible jurors in the case. This program will probably stand for years as a symbol of the lengths to which some powerful outside interests will go in order to interfere with state government." □

Unsettling, Disturbing, Critical . . .

Computers and Automation, established 1951 and therefore the oldest magazine in the field of computers and data processing, 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 and truth 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, Computers and Automation publishes 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 seek to publish 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.

The Central Intelligence Agency: A Short History to Mid-1963 — Part 1

James Hepburn

"I never had any thought . . . when I set up the CIA, that it would be injected into peacetime cloak-and-dagger operations. Some of the complications and embarrassment that I think we have experienced are in a part attributable to the fact that this quiet intelligence arm of the President has been so removed from its intended role . . ."

— Harry Truman, President of the U.S.
quoted at the start of the chapter

Introductory Note by the Editor

The book "Farewell America", by James Hepburn, was published in 1968 in English by Frontiers Co. in Vaduz, Liechtenstein; 418 pages long, including 14 pages of index. James Hepburn is a pseudonym; the book is reputed to have been written by the French Intelligence, in order to report to Americans what actually happened in the assassination of President John F. Kennedy. Copies of the book may be purchased readily in Canada, and at one or two addresses in the United States. No bookstore in the United States that I know of will order and sell copies of the book. (Inquire of the National Committee to Investigate Assassinations, 927 15th St. NW, Washington, D.C. 20005, for ways to purchase the book.) The twenty chapters are absorbingly interesting.

Information about secret intelligence services and the way they operate is of course not in the open literature. In the two and a half years, since I read the book, I have seen no demonstration that any of the information contained in the book is false — and the information does tie in with much else that is known. Perhaps more than 90% of what is in the book is true.

The following article is based on Chapter 15, "Spies", of "Farewell America".

Everywhere — and the United States is no exception — there are criminals who will do anything for money. But it is one thing to murder a creditor, a Senator or a jealous husband, and quite another to assassinate the President of the United States.

Hired Killers

Hired killers are rarely employed by a parapolitical or paramilitary group. They are much too dangerous. Their connections, their morals, and their insatiable avarice pose too many problems for a responsible organization. On the other hand, a number of individuals active in groups like the John Birch Society, the Patrick Henry Association, and the Christian Crusaders would be only too happy to volunteer for an ideological crime. But, although successful assassinations have on occasion been the work of fanatics, serious-minded conspirators would prefer not to rely on idealists. History tells us why.

Fanatic Assassins

The Tsar's Prime Minister, Stolypin, was shot to death in 1911 during a performance of Rimsky-Kors-

kov's "Tsar Saltan" at the Kiev Opera.¹ The assassin, a lawyer named Dimitri Bogrov, was convinced he had acted in the cause of freedom, and many others before him had sacrificed themselves in the struggle against the Tsars. But fanatics like Bogrov who are prepared to die for a cause are few indeed, and the nihilists lost more men than the imperial families.

Professional Soldier Assassins

Today, professional soldiers and guerilla warriors have taken up where the nihilists left off. They are just as courageous, but often less successful. In Germany, in 12 years of Nazism and 5 years of war, despite the Kreisau Circle and the numerous groups that claimed in 1946 to have belonged to the underground, despite the work of the Allied intelligence services and the plots hatched by several high-ranking officers of the Wehrmacht and the OKW, Hitler was never assassinated. Two officers, however, tried.

The first planted a bomb on one of Hitler's aides, claiming it was a bottle of cognac. The bomb was due to go off in the plane carrying the Fuehrer to the eastern front, but it failed to explode. The assassination attempt was never discovered. It was publicized later by its author, who meanwhile had recovered his "bottle of cognac".

Colonel Von Stauffenberg Against Hitler

The second, more serious attempt was the work of Colonel Klaus Von Stauffenberg. His failure dealt a deathblow to the plot of July 20, 1944. Stauffenberg either didn't dare or didn't care to shoot Hitler.² Instead, he placed his briefcase, containing the equivalent of a pound of TNT³, under the conference table where Hitler was sitting and left the room, claiming he had to make a phone call. The TNT was set off by a detonator a few minutes later.

But Colonel Von Stauffenberg, while a brilliant cavalryman, was a poor saboteur. His bomb would have killed Hitler, and probably most of the other officers present, if the conference had been held, as was usually the case at Rastenburg, in the case of a cement blockhouse. The closed quarters would have magnified the compression, and the explosion would have proved fatal. On that hot July day, however, the conference was held instead in a wooden barracks with the windows open. Hitler was only knocked to the floor and slightly wounded by the explosion.

Colonel Von Stauffenberg was mistaken in his choice of an explosive. TNT is excellent for blowing up railroad lines and bridges, but for this type of operation Von Stauffenberg should have used a defensive grenade of the type used by the German

Army, along with a phosphorous grenade and, as an additional precaution, a bottle containing about a pint of gasoline. The explosive power of the blasting agent would have been amplified by bits of flying steel and the heat from the phosphorus and the gasoline. Regardless of where the meeting was held, the explosion would have done its work. Those officers who weren't killed immediately would have been burned alive. But despite their small chance of survival, it would nevertheless have been wise to verify the success of the operation before giving the signal for a revolt that resulted in hundreds of executions, including that of Von Stauffenberg, about whom any biographer is forced to conclude that he was a total failure as an assassin. His technical incompetence caused the collapse of the German resistance and probably cost the Allies several more months of war.

Colonel Bastien Thiry Against De Gaulle

Another Colonel, the Frenchman Bastien Thiry, attempted in 1962 to avenge the honor of the French Army by assassinating General De Gaulle. He set up an ambush using submachine guns at an intersection in the suburbs of Paris one evening when the General's car was due to pass on the way to the airport. The car, an ordinary Citroen, was going about 40 miles an hour. On a signal from the Colonel (a brandished newspaper), the gunmen fired more than 100 rounds, but neither the General nor his wife nor the driver nor the security agent accompanying them was hit. The tires were shot out, but the driver accelerated immediately, and the General disappeared over the horizon.

Colonel Thiry was a graduate of the foremost scientific school in France, the Ecole Polytechnique, the students of which are renowned for their reasoning power. Moreover, he was a leading aeronautical specialist and, like Von Stauffenberg, a disinterested patriot. But, as far as assassinations were concerned, he too was a failure.⁴ Like Von Stauffenberg, he was executed, and from a technical point of view his failure is understandable. He was an amateur, and assassinations are not for amateurs. His plan was of interest to the men at Dallas because its target was a moving vehicle. An attack on a moving target presents special problems which we shall examine later. In any case, these are problems that can only be solved by a specialist.

The Committee of Dallas Against President Kennedy

The Committee needed professionals who were accustomed to planning clandestine and risky operations, and who had the proper mentality — in other words, professionals who had not lost their amateur standing. The men best qualified for this type of job are undoubtedly the specialists of the intelligence services like the Soviet KGB and the CIA, which have a special section for assassinations. It is safe to assume that nothing is impossible or surprising in the world of espionage, in the widest sense of the term. Obstacles that would hamper organized criminals or conscientious conspirators can be overcome or avoided more easily by those who are known as "spies".

Spies! The spy trade has come a long way since A. Curtis Roth wrote in the Saturday Evening Post in 1917:

Twenty-five years later, Winston Churchill described it as "plot and counterplot, deceit and treachery, double-dealing and triple dealing, real agents, fake agents, gold and steel, the bomb and the dagger."

Scientific spying knows no ethics, owns no friendships and enjoys no code of honor. It delights to operate through degenerates, international highbinders and licentious women. It shrinks before no meanness or blackguardism to

attain its ends, even callously conducting official houses of prostitution for the entrapment of the unwary.

Cloak and Dagger, plus Science and Management

Today, the cloak and the dagger have been replaced by scientific administration. Intelligence organizations, be they American or Russian, direct activities that run from routine murders to full-scale revolutions. The necessary technicians are trained and available. They can be used for official ends, but they may also be corrupted and their abilities exploited for more questionable purposes. Once we step into the world of these organizations and the individuals who work for them, it is no longer possible, as we have done in preceding chapters, to set out and analyze the facts in logical order. Espionage activities know no logic, nor is it possible to learn the entire truth. If the Warren Commission devoted several thousand pages to Oswald, it did so not only to conceal the nature and the origins of the plot, but also because Oswald, immersed in the muddy waters of the intelligence world, had anything but a simple life. The object of this book is not to study his short and picturesque history, which in the end has little significance, nor to provide a detailed description of the organization and activities of the CIA in the period between 1960 and 1963.⁵ But it is necessary to know something about the CIA in order to understand the Oswald affair, and to draw together all the threads that lead to the 22nd of November, 1963, when President John F. Kennedy was professionally assassinated in Dallas.

Creation of the CIA

The CIA celebrated its twentieth anniversary in September, 1967. It was created on September 8, 1947 by the same law that instituted a unified Defense Department and established the National Security Council.⁶ Its mission was the coordination and evaluation of intelligence information, but it immediately branched out into special operations, which took on such importance that the Plans Division was organized in 1961 to plan and carry them out.⁷ In 1949 a law was passed exempting the CIA from disclosing its activities, the names and official titles of its personnel, their salaries, and the number of persons it employed. The Director of the CIA was authorized to spend his entire budget⁸ on the strength of his signature, without ever having to account for the way in which it was spent.

CIA Foreign Interventions

This provision enabled the CIA to become, during the Fifties, a sort of "invisible government" which expanded its authority when Allen Welsh Dulles became Assistant Director in 1951, then Director on February 10, 1953.⁹ Six months later, in August, 1953, the CIA proved to the world just how powerful it had become when General Fazollah Zahedi replaced Mossadegh as Prime Minister of Iran. In 1951, Mossadegh had nationalized the Anglo-Iranian Oil Company and confiscated the Abadan refinery with the support of Tudeh, the Iranian Communist Party. The CIA succeeded in having Mossadegh arrested, and the leaders of Tudeh were executed. A consortium of the major oil companies thereby signed a 25-year agreement with Iran granting 40% of the shares in the former Anglo-Iranian to Standard Oil of New Jersey, Gulf Oil, Standard Oil of California, Socony Mobil and Texaco. A few months later, in April, 1955, nine other independent American companies were given a share in the operations. The CIA man who directed the operation was Kermit Roosevelt¹⁰, a State Department consultant for Middle Eastern and Communist affairs since 1947. When "Kim" Roosevelt left the CIA in 1958, he was hired by Gulf Oil as its "director for governmental relations". He be-

came vice-president of Gulf in 1960 (he is also a consultant for Socony Mobil).

Its Iranian success consolidated the power of the CIA, which in the years that followed multiplied its interventions and carried off some brilliant operations, the best-known of which took place in Guatemala and behind the Iron Curtain, where the CIA attempted to split up the Communist Bloc. It was the West German intelligence service, a step-child of the CIA, that set off the East German revolt of June 17, 1953 that was checked by Soviet intervention and caused 2,000 dead or wounded in East Berlin alone. In 1956, the CIA was behind the Hungarian uprising, which proved even more costly to the Hungarian people.

The CIA established several intelligence rings in the USSR and multiplied its special missions. Between 1956 and 1960, its U2 spy planes furnished valuable intelligence on airfields, the locations of planes and missiles, rocket experiments, special ammunition dumps, submarine production and atomic installations.¹¹

In Egypt the CIA, under the cover of Ambassador Jefferson Caffrey, who was acting on instructions from John Foster Dulles, played an important role in the 1952 overthrow of King Farouk and the seizure of power by Colonel Neguib, and later in the latter's overthrow by Colonel Nasser.

In 1954 the CIA overthrew the Guatemalan regime of President Jacob Arbenz Guzman because of his "Communist leanings" and replaced him with one of their puppets, Colonel Castillo-Armas, who immediately denied illiterates (who made up 70% of the population) the right to vote and returned to Fruter¹² the 225,000 acres of land that President Arbenz had confiscated. One million acres which had already been distributed to the peasants were taken back, and a committee was created to fight communism in the country.¹³

The CIA also suffered failures — in Indonesia against Sukarno in 1958, in Laos with Phoumi in 1960, in South Vietnam with Ngo Diem between 1956 and 1963¹⁴, or partial successes, as in West Germany.¹⁵

Nor did the CIA confine its activities to the hot-spots of the world — the Middle East, Southeast Asia, the Central and Latin American "protectorates", and the Iron Curtain countries. The CIA was naturally strongly established in the socialist countries such as Yugoslavia, and in neutral states like Austria and Switzerland, but it was also active, for economic and political reasons, in zones of international tension throughout the world. In some cases, for example in Algeria, these reasons were directly opposed.¹⁶ In 1955, the CIA intervened in Costa Rica, one of the most stable and democratic of the Latin American nations, where it tried to overthrow the moderate socialist government of President Jose Figueres.

Under Eisenhower: the CIA a World Power

Thus, endowed with complete autonomy, a virtually unlimited budget, and a *de facto* co-directorship under the Eisenhower administration, the CIA in the period between 1953 and 1960 developed into a world power.¹⁷ The CIA was represented in 108 different countries, commanded submarines and jet planes, and controlled 30,000 agents under the cover of diplomatic, commercial, industrial, journalistic, military, technical, labor, university and secret activities.

The Soviet KGB: Competition

The CIA, of course, had competition. The Soviet KGB has been described by Allen Dulles as a "multi-purpose, clandestine arm of power, more than a secret police organization, more than an intelligence

and counterintelligence organization. It is an instrument for subversion, manipulation and violence, for secret intervention in the affairs of other countries" (a definition that seems equally applicable to the CIA). Apparently, the budget of the KGB is about the same as that of the CIA, which means that it employs many more agents, since a Russian costs far less than an American.¹⁸ Most of the agents employed by both organizations are "legal", which means that they have a diplomatic cover job abroad. According to Colonel Oleg Penkovsky, who was executed by the Russians in 1963 for espionage activities in favor of the United States, three-quarters of all Soviet diplomats abroad, and all of the consular personnel, are members of the KGB.

This percentage is far lower in the United States; about one-third of all American embassy and consular personnel belongs to the CIA, although the figure varies widely from country to country.¹⁹ When Kennedy became President, an American Ambassador had no more authority over the CIA "Station Chief" in his embassy than a Soviet Ambassador had over the KGB "resident".

Infiltration of International Organizations

The CIA had infiltrated all the international organizations of which the United States was a member, even UNESCO and the FAO, and its agents operated in all the NATO centers in Europe. In 1961 the CIA was represented in every country in the world, even Iceland (where it had 28 agents and two offices, one at the U.S. Embassy at Reykjavik and the other at the military base at Keplavik), Uganda, Surinam, the Ryukyu Islands, and Sierra Leone. Photographs and reports from its agents poured in from all over the world to Langley²⁰, where they were analyzed by photo-interpretation experts and fed into Walnut, the CIA's electronic computer.

Propaganda Control

In addition, the CIA controlled the most colossal propaganda apparatus of all times, concealed behind the names of more than 600 different companies. Hundreds of organizations were financed wholly or in part by the CIA.²¹ The CIA controlled, directly or through subsidies, radio stations, newspapers, and publishing houses in the United States and throughout the world.²² Some, like Praeger, Doubleday, and Van Nostrand, agreed to publish propaganda works such as *Why Vietnam?* Its influence even extended to television and the motion picture industry. Until 1956, it controlled the Near East Broadcasting Station, with the most powerful transmitter (located on Cyprus) in the Middle East, and a newspaper chain in Beirut run by a double agent for the CIA and the British Secret Service, Kamel Mrowa, that published the dailies *Al Hayat* and *Daily Star*. In 1958 it installed seven clandestine radio stations based in Aden, Jordan, Lebanon and Kenya to counter Radio Cairo and defend the "independence" of Irak (sixth largest producer of oil in the world, and the only Arab state that is a member of the pro-Western Bagdad Pact). In North America, the CIA operated a short-wave radio station, WRUL, used to broadcast coded messages to its agents, and it had an interest in the gigantic Voice of America transmitting complex located at Greenville, North Carolina, the most powerful radio station in the world. In Europe, Radio Liberty (transmitters at Lampertheim in West Germany and Pals in Spain) employed 12,000 persons in its offices in Paris, Munich and Rome, and Radio Free Europe had 28 transmitting stations in West Germany (at Frankfurt and Munich) and in Portugal. The principal radio stations operated by the CIA in the Far East were located at Taipeh, Formosa, Seoul, Korea, and at three places along the coast of Japan. It also controlled stations in Australia and in the French-owned islands of the Pacific. (continued in Part 2)

Notes

1. He succeeded in his attempt even though he himself had warned the police that someone would try to kill Stolypin that night. As a sign of their gratitude, the police sent him an invitation to the opera. Bogrov was hung two months later, still attired in evening dress.

2. He declared before and after the assassination attempt that he was willing to take the risk, but that he considered himself indispensable to the conspiracy, the members of which were waiting for him in Berlin. Despite a radio signal announcing the success of the operation sent with the help of General Fellgiebel, Chief of Signals, who was also mixed up in the plot, the General Staff in Berlin postponed the insurrection until Von Stauffenberg's return to Berlin. The success of the conspiracy depended on a single man, who tried to do too much and blundered.

3. Trinitrotoluene, a stable and very powerful explosive.

4. Thiry's assassination plot failed because:

- the site was a poor choice (a straight road that enabled the car to move too fast)
- the firing was badly synchronized, and failed to take account of the speed of the objective
- the signal used (a brandished newspaper) was ridiculous at nightfall
- no radical means of stopping the car (an explosion, a hearse, or some sort of obstacle) was planned
- the gunmen were placed along a line nearly perpendicular to the car, which reduced their angle of fire and increased the dispersion

5. We advise our readers who are especially interested in this subject to consult the two books written by David Wise and Thomas B. Ross, The Invisible Government and The Espionage Establishment.

6. Its predecessors were the Office of Coordinator of Information and the Office of Strategic Services (OSS), created on June 13, 1942 and directed by General Donovan, followed by the Central Intelligence Group, created on January 22, 1946 and directed at first by Rear Admiral Sidney W. Souers and then by Rear Admiral Roscoe H. Hillenkoeter who became the first Director of the CIA.

7. The Plans Division has sole control over secret operations of all kinds (Iran in 1953, Guatemala in 1954, the U2 flights, the Bay of Pigs, the Congo revolt in 1964, etc.)

8. Which in 1963 amounted to nearly \$2 billion. In 1967, total U.S. intelligence expenditures amounted to \$4 billion annually.

9. His brother, John Foster Dulles, was Secretary of State at the time and the most influential figure in the Eisenhower administration. The reign of the Dulles brothers lasted until the death of John Foster Dulles in 1959.

The Eisenhower Administration, it will be remembered, lasted from 1952 to 1960.

10. Theodore Roosevelt's grandson and a cousin of Franklin Delano Roosevelt.

11. The Soviets responded to the U2's by launching military observation satellites, which were used to photograph American strategic bases. Between October, 1957 and October, 1967, the Russians launched about 100 of these Cosmos "scientific" satellites from their bases at Tyuratam and Plesetsk. The satellites remained in orbit from 3 to 8 days before being brought back to earth.

During the same period, the United States launched about 200 secret military satellites. At the end of 1967, there were 254 American and 54 Russian satellites in orbit.

12. A subsidiary of United Fruit.

13. President Eisenhower described Guatemala that year as "a beautiful land of Central America whose mountains and moderate climate make it one of the garden spots of the hemisphere".

14. In these three countries, Kennedy's foreign policy was in direct opposition to that of the CIA, which was forced, officially at least, to fall into line. But the CIA continued to operate in the shadows, often against the instructions of the federal government.

15. The Bundesnachrichtendienst, better known as the Federal Intelligence Agency or FIA, is largely dependent on the CIA, which subsidizes and controls it. It is directed by Gerhard Wessel, a former lieutenant Colonel in the Wehrmacht. Wessel in 1967 replaced Reinhard Gehlen, a former ex-Nazi Colonel "recuperated" in August, 1945 by Allen Dulles, who at the time headed the OSS in Switzerland and was in charge of American intelligence activities in occupied Germany.

Gehlen, who had conceived the idea of the "Vlassov Army" (Russian anti-Communist troops) was given the responsibility for the underground that continued to operate behind Communist lines until 1950. In Poland, Gehlen's guerillas on March 28, 1947 murdered General Karol Swierczewski, Vice-Minister of Defense who, under the name of Walter, had commanded the 14th International Brigade in Spain, and who served as the model for one of the characters in Hemingway's For Whom the Bell Tolls.

Gehlen developed his network under the cover of a firm known as the "Economic Association for the Development of South Germany." He employed former members of the Gestapo such as Boemel-Burg, his intelligence chief in Berlin, and Franz Alfred Six, former SS General and one of Eichman's subordinates, who was put in charge of Gehlen's contacts in Western Europe.

With the aid of other highly-qualified specialists, Gehlen successfully infiltrated East Germany and the Eastern European states, uncovered Soviet intelligence rings, planted agents among groups of expatriate workers, and took charge of the refugee organizations.

But he also suffered failures. In 1954 Dr. Otto John, the head of a rival West Germany intelligence organization backed by the British, disappeared in Berlin and fled to the USSR. In 1961 the CIA learned that three of Gehlen's agents, Heinz Felfe, Hans Clemens, and Erwin Tiebel, had been passing information to the Russians since 1950. A short time before they were uncovered, the three double agents had been honored by their chiefs (Gehlen and Shelepin, chief of the KGB). As a result, the CIA grew wary of the West German intelligence and has since treated it with caution.

16. Under Eisenhower, financial agreements, particularly in the domain of oil, were under discussion between American firms and the Provisional Government of the Algerian Republic (GPRA). Contact had been made between representatives of Aramco (which was interested in the Sahara) and Ben Bella a short time before a plane carrying the Algerian nationalist leader from Morocco to Tunisia was intercepted on the orders of French Minister Robert Lacoste.

But at the same time the CIA was active in anti-Communist and anti-Gaullist movements, and it backed preparations for the 1961 French Generals' putsch, Richard M. Bissell, Director of the Plans Division of the CIA, met on December 7, 1960 with Jacques Soustelle, a French political figure who was planning a previous coup that failed.

17. The influence and activities of the CIA are beyond the scope of the imagination. It has been involved in nearly all the major international

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Encouragement for the Pursuit of Truth

1. From: Mrs. Ruth Shapin
5110 Elsinore Ave
Orange, Calif. 92669

My husband is an engineer and receives many technical journals in the mail. Since I am not a technical person I ignore most of them, but yours is one that my husband and I can share with great interest and enjoyment. I can only marvel at the breadth of your concerns and your deep social conscience, not to mention your courage in printing such items as the assassination articles and the recent very moving speech by William Kunstler. I am also greatly delighted by your Common Sense notebook. I particularly enjoyed "The Golden Trumpets of Yap Yap." These are the biting truths which genuine patriots must constantly teach their countrymen.

Thank you for your continual prodding of the engineering establishment such as in your inspiring Founders' Day speech. It is reassuring that a technical person can have a human heart. If more engineers had your spirit there is no way that a Honeywell could exist nor would our country be involved in the barbaric Vietnam war. We need many more men and women who are willing to serve as the conscience of technology. With regard to women, I would like to see your magazine devote some space and effort to the upgrading of women engineers. How about some articles by and about women engineers?

Finally, I would like to join your Society for the Prevention of Doomsday. Please send me more information about it.

2. From: Mrs. Lucy Bell
31 Reynolds Place
Newark, N.J. 07106

I am the wife of one of your subscribers and I want you to know that I value your magazine highly.

I particularly refer to your recent articles regarding the assassinations of John F. Kennedy, Mr. Wallace, and a previous one regarding the death of Walter Reuther.

I have just finished reading your September 1972 issue with your excellent features regarding the assassination of Robert F. Kennedy, William M. Kunstler's address at Tufts University, the report on North Vietnam and American Bombing, and your own "Horizons and Rebellion".

I wish to commend you and thank you for your courage and wisdom in incorporating these disturbing, though invaluable, writings in your magazine. I will continue to look forward to your subsequent issues and will pass them on to my friends who do not have a subscription to "Computers and Automation".

3. From: William H. Wynne
132 Gahan Dr. Rt. 4
Gulfport, Miss. 39501

As I was sitting here reading your magazine, I thought it would be nice if I typed a short line to let you know how much I enjoy the magazine. I believe the reason I prefer your magazine to other related magazines, is due to the amount of meaningful information you publish, and not to the amount of advertisement others seem to rely upon. Thank you.

4. From: Rainer M. Goes
1128 Portsmouth Ave.
Westchester, Ill. 60153

Please enroll me among your subscribers to "Computers and Automation". I admire your presentation of facts concerning important issues. This must be encouraged, even when one does not always reach the same conclusions from the same facts. To me the CIA cases show that underlings here as elsewhere want to get brownie points and take matters beyond original intent.

5. From: Thomas D. Bryant
Box 421
Ridgway, Ill. 62979

Since you are apparently interested in why people subscribe and renew, or don't renew, to CEA, I will add my 2¢ worth.

I subscribe to CEA because of the political articles (I don't know a computer from a gum-ball machine.) I dropped my sub to Ramparts so I could take on CEA. I consider Vincent Salandria's "The Assassination of President John F. Kennedy: A Model for Explanation" as possibly the most significant journal article I have ever read. Of course I plan to renew when my year is up.

Doomsday — Class A Hazards

From: Edmund C. Berkeley, Acting Secretary
Association for the Prevention of Doomsday
815 Washington St.
Newtonville, Mass. 02160

As reported in the October issue (p. 36), the Steering Committee divided the great hazards which face mankind into Class A, those that might lead to more than 1% of the human race dying in a year, and Class B, those which probably would not.

Here is a preliminary list of Class A Hazards:

- I. MANMADE — FROM CONFLICT:
 1. Nuclear war — widespread.
 2. Nonnuclear war — widespread: including nerve gases, biological warfare, fire storms such as gutted Hamburg and Dresden, etc.
 3. Genocide — pervasive mindsets which dehumanize an "enemy", leading to pogroms, gas chambers, massacres, saturation bombing, etc.
- II. MANMADE — NOT FROM CONFLICT:
 1. Economic growth indefinitely.
 2. Population expansion indefinitely.
 3. Worldwide starvation from new great pests on crops.
 4. Something unforeseen made or done which produces a poison for men like DDT for birds (example: producing softened egg shells for eagles and ospreys); pollution indefinitely.
 5. Failure of vested interests to respond adequately to unfavorable changes of the Earth environment (the Louis XIV syndrome: "Après moi, le déluge").
- III. NATURAL:
 1. Return of continental ice sheets in North America, Europe, and Asia.
 2. Increase of the average temperature of the earth so that the Antarctic ice sheet melts, raising world-wide sea level by 150 feet.

Subscription Errors: C&A Will Correct

*1. From: Jim Johnson
3976 Inglewood Blvd., Apt. 7
Los Angeles, Calif. 90066*

After reading in the July issue your correspondence with John Kaler, I decided I might be able to get my problem attended to by you, not having received satisfaction from your staff.

On March 7 of this year I sent "Computers and Automation" a check (#514) for \$18.50 to renew my subscription including the Computer Directory & Buyers' Guide. A few weeks ago I received a letter offering the Buyers' Guide for \$9.00 since I was not scheduled to receive it. I promptly sent a letter explaining that I had paid for it. I have received no further word from your staff and my latest issue of Computers & Automation arrived with *N on the address label as before.

The address label includes the following:

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3976 Inglewood Blvd.
Los Angeles, CA 90066

2. From the Editor:

Thank you for your letter concerning your subscription to "Computers and Automation" and the Directory and Buyers' Guide. Your label indicates that you have paid \$18.50 and that the *N is in error.

I shall make sure that you get the Directory, and I shall make sure that your label is corrected. We have recently had trouble with our subscription fulfillment processes, and have now changed to the third fulfillment service in the course of 12 months. Thank you for telling me.

If anything goes wrong again, please write me again, putting "Personal" on the envelope.

Lessons Learned from Recent Floods of Computer Rooms

*Computer-Link Corp.
14 Cambridge St.
Burlington, Mass. 01803*

During the past two months Computer-Link has been actively assisting a number of flooded computer users recover their data from their waterlogged tapes. Two important facts have come out of this work which are of great importance to every computer user.

First of all, patience is the key factor in recovering data from waterlogged tapes. Water damage has proven to be less damaging than some of the techniques employed to remove the water. If the tape is not overstressed or overheated, the water will evaporate and any mud or other dirt can be easily removed. The reels should be placed in a low-humidity area with air flow to assist evaporation. Reel sides that are touching the tape pack should be spread apart with the rubber gromets sup-

plied by tape vendors to allow air flow through the tape pack. When no surface moisture is visible, tapes may be easily cleaned and returned to active use.

If this process is rushed, tape damage has occurred because of overheating the oxide and because of excess tension, caused by wet tapes sticking to itself and the drives. A full report on these techniques is available from us.

The second fact to emerge from this work was the very low efficiency of older tape cleaners in use at customer data centers. In one case, a cleaning with a 4 year old machine was only 20% effective contrasted with better than 80% with a new tape cleaner. Similar results have also been seen in several other data centers. Since over 75% of the total cost of operating a regular tape cleaning program is spent on the labor of operating the machine and handling the tapes, it is very important to be certain that a tape cleaner is producing proper results and not just going through the motions of cleaning the tapes with little improvement of error counts.

A complete report detailing the other factors of tape age, application and performance at 1600 bpi has been prepared by and is available from us.

Sixth Annual Computer Services Industry Study Shows Profit for 1971

*Association of Data Processing Service Organizations, Inc.
551 Fifth Avenue
New York, N.Y. 10017*

"Computer services industry revenue for 1971 was nearly 2.4 billion dollars, up 24% over 1970, and showed 5.6% pre-tax profit, which significantly reversed the minus 8.3 pre-tax figure for 1970," J. L. Dreyer, ADAPSO's Executive Vice President revealed today in releasing the Association's Sixth Annual Industry Study. Nearly fifteen hundred firms were engaged in the computer services industry (principally data centers, timesharing firms and software houses) in 1971.

"One of the most significant factors of this major turn around in the industry," said ADAPSO's President, Bernard Goldstein, also president of United Data Centers, Inc., Greenwich, Conn., "that while 74% of all the firms reported increased expenditures, through expanding markets and improved management techniques, 76% of all firms reported an improvement in profitability." The ADAPSO study projected that 1972 figures would exceed 2.7 billion dollars and that by 1975 the industry should exceed 4.6 billion dollars.

More than 250 companies participated in the in depth study of the expenditures (personnel equipment, etc.) and revenues of organizations comprising the computer services industry. The survey material was coordinated by ADAPSO's Committee on Research and Statistics, chaired by C. Bard Hills, president of Wingate Computer Center, Providence, Rhode Island and analyzed by International Data Corporation's research team headed by Fred Anderson.

The study may be obtained through ADAPSO, or International Data Corp., 60 Austin St., Newtonville, Mass. 02160 at \$95.00 per copy.

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by
Edmund C. Berkeley

1. "Giant Brains or Machines that Think", John Wiley and Sons, New York, 1949, 277 pp; sale, over 25,000 copies (translated into French); second edition, 1961, softbound, \$3.00
2. "Computers — Their Operation and Applications", Reinhold Publishing Co., New York, 1956, 366 pp; sale, over 10,000 copies, hardbound, \$6.50
3. "Symbolic Logic and Intelligent Machines", Reinhold Publ. Corp., New York, April 1959, 203 pp; (translated into Russian); softbound, \$3.95
4. "Brainiacs — 201 Small Electric Brain Machines and How to Make Them", October 1959, 256 pp; softbound, \$4.95
5. "Glossary of Terms in Computers and Data Processing", June 1960, 96 pp; softbound, \$3.95
6. "Probability and Statistics — An Introduction Through Experiments", July 1961, 140 pp; sale, over 15,000 copies; (translated into French); softbound, \$3.75
7. "The Computer Revolution", Doubleday & Co., New York, N.Y., August 1962, 249 pp; (translated into Japanese and Polish); hardbound, \$4.95
8. "Teaching Machines, Programmed Learning, and Automatic Teaching Computers", Berkeley Enterprises, Inc., Newtonville, Mass. 02160, December 1963, 204 pp; softbound, \$3.95
9. "The Programming Language LISP: Its Operations and Applications", March 1964, 392 pp; softbound, \$4.95
10. "A Guide to Mathematics for the Intelligent Non-Mathematician", Simon and Schuster, New York, N.Y.; April 1967, 352 pp; (translated into Japanese and Swedish); softbound, \$2.45
11. "Computer-Assisted Explanation", May 1967, 280 pp; softbound, \$3.00
12. "Computer-Assisted Documentation of Computer Programs", Volume 1, April 1969, 120 pp; softbound, \$3.00
13. "Computer-Assisted Documentation of Computer Programs", Volume 2, April 1971, 104 pp; softbound, \$3.00

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ACROSS THE EDITOR'S DESK

Computing and Data Processing Newsletter

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APPLICATIONS

TEXTBOOK CONTROL SYSTEM SAVES DOLLARS FOR ST. LOUIS TAXPAYERS

*St. Louis Board of Education
Community Relations Division
911 Locust Street
St. Louis, Mo. 63101*

A computerized textbook control system is saving St. Louis taxpayers money while insuring that students will have the right book at the right time.

A pioneering textbook inventory control program links the Board of Education warehouse and the data processing division into a single system. The program is possible through the use of a new IBM System/370, the first to be installed in a public school system.

Mr. Ernest Jones, Acting Superintendent, described the system as a time-, money- and labor-saving means of insuring optimum utilization of the \$4.5 million worth of books the school system owns. With books located in 160 schools city-wide and with an annual \$800,000 expenditure for new and replacement books, the Board of Education runs a large scale program with one potential area of weakness.

"If one principal saves one or two copies of a given textbook as a hedge against damage or the unannounced arrival of new students," Dr. Sam Lawson, Board Treasurer, said, "that's good management. But if all principals do that with all books, that's mismanagement."

"We have therefore designed a system to serve the principal first, by making available to him whatever numbers of books he needs as fast as possible." The computer has been given a complete, verified inventory of all 1,900 different books currently in use in the school system.

When a principal sees a book shortage occurring or about to occur, he contacts the purchasing division. A clerk types in the catalog number of the book, and the district number from which the request came. The computer then searches its files and compares, school by school, room enrollment against number of books issued. This is listed for the clerk who makes the transfer decision, entering the decisions into the computer.

In addition to handling requests from principals, the computer notifies purchasing officers of warehouse shortages that are about to occur, thus giving

them time to obtain spare copies from other principals or replenish stocks from publishers.

BATON ROUGE MONITORS SEWERS WITH NEW COMPUTER SYSTEM

*Ray W. Burgess
Public Works Director
City of Baton Rouge
P.O. Box 1471
Baton Rouge, La. 70821*

Every 30 seconds a computer in Baton Rouge places a telephone call to part of the city's sewer system. If it likes what it hears, it hangs up and makes another call. If not, it informs a human operator that something is wrong and where to go to fix it. This unusual "conversation" is part of a new computer system that is helping the city monitor the condition of its sewer system on a 24-hour basis and cut its maintenance costs by more than \$20,000 a year.

Using an automatic telephone dialing unit, an IBM System/7 computer places calls to telephone units which relay tone patterns generated by sensors attached to 120 unmanned sewerage pumping stations throughout the city. If the tone pattern indicates that a malfunction has occurred, the computer identifies the irregular response and the type of malfunction and prints a message to an operator telling him precisely what is wrong at which station. A service crew is immediately dispatched to the trouble spot.

Previously, a dozen men went around in trucks checking these stations for malfunctions. At nights and on weekends, we were not aware of a problem until it got so bad that a resident called in. The new system has not only freed these men for more productive work, it does a far more efficient job — on a seven day, 24-hour basis, and at a cost savings of over \$1,700 per month.

SWEDISH STEEL PRODUCER LINKED TO G.E. COMPUTER IN CLEVELAND

*The Bugli Company, Inc.
60 E. 42 Street
New York, N.Y. 10017*

The quality of specialty steel produced at a mill in Söderfors, Sweden is being controlled by a satellite-linked General Electric computer in Cleveland, Ohio. Stora Kopparberg, one of the world's leading producers of high speed tool steel, recently announced that it now is relying on the

American computer for the delicate calculations made earlier by skilled foremen during the production of quality alloys. The new approach is said to be the most advanced in the Swedish steel industry.

In manufacturing alloy steels, the first step is to determine basic parameters for the content of various alloys. After the metals have been heated in an oven for a certain period, a preliminary analysis of the melt is made. Calculations are then made to determine how much alloy material should be added to achieve desired results. Even a small human error in these calculations can mean scrapping the entire melt.

Stora Kopparberg says significantly better results are obtained through use of the computer which is fed such data as the number, desired quality and quantity of the melt, along with measurements from the preliminary test. The computer printout, displayed at a terminal in the Söderfors plant, shows changes to be made in the mix to achieve steel of the quality desired.

All data is transmitted via public telephone lines between Söderfors and London and via satellite between London and the U.S.

EDUCATION NEWS

UNIVERSITY COMPUTER HELPS DOCTORS WITH "BEDSIDE TEACHING"

*Dr. Jim Griesen, Director
Administration Center Building
College of Medicine
Ohio State University
Columbus, Ohio 43210*

A computer at the Ohio State University College of Medicine is starting to assist doctors with their "bedside teaching." Under the program, patients seat themselves at typewriter-like computer terminals in hospitals, and communicate with a computer to receive instruction that might otherwise be provided by physicians, nurses, or allied health professionals.

The system, for example, might be used by the patient to learn about postoperative activities and restrictions, what to expect after surgery, or — in the case of diabetics — the recommended diet and practical day-to-day information that will be useful to the patient and his family. This type of instruction is a very necessary part of the total medical program, since certain procedures must be followed by the patient to avoid future complications.

Since the patient is actively involved in each learning exercise, the information provided via the computer terminal can be individualized — taking into account, for example, the patient's particular medical problem, sex, family status, and type of employment. Furthermore, the computer can provide opportunities for drill and practice for such things as menu planning and exercises for a diabetic mother with a family of six. The typewriter-like terminal produces a printed copy of the learning exercise which the patient can take with him.

The computer-supported program is a facet of OSU's computer-assisted medical instruction network established in 1968 under a Regional Medical Program grant. The RMP network was created as a learning and

instructional aid to keep health professionals abreast of new developments in medicine. Originally operational in four central and southern Ohio hospitals, the system now has been expanded to embrace services to 10 hospitals throughout the state of Ohio.

The program has been expanded as a result of professional medicine's growing reliance on computers as a health tool. For example, the number of self-instruction and refresher courses available has been expanded from four in 1968 to more than fifty.

The system is supported by an IBM System/360 Model 40 in use at the College of Medicine. This same IBM system also directs computer-assisted instruction in the College of Medicine, permitting students to take a variety of courses at their own pace.

ENGLISH COLLEGE'S TIMESHARING SYSTEM HAS 3000 USERS

*Ralph Campbell
Digital Equipment Corp.
Maynard, Mass. 01754*

A \$900,000 timesharing computer center has been opened at Hatfield Polytechnic in Hertfordshire, England. The center, based on a Digital Equipment Corporation DECsystem-1050, serves not only the Hatfield staff and students but also serves eight schools and eleven colleges throughout Hertfordshire. Over 3,000 people use the center with an average of fifty terminals actively on-line at any time. More than 14 languages including Basic, Fortran, Cobol, and Algol may be used simultaneously.

Within Hatfield Polytechnic, the system has 38 on-line terminals and a video display unit. Available for general student use are 27 terminals of which 20 are installed in individual work booths in a specially-designed classroom. The other terminals are available in laboratories where they are used for processing of experimental results. Throughout Hertfordshire, nineteen additional locations have computer terminals linked to the DECsystem-1050 by British Post Office Datel 200 service. Additionally, Watford College of Technology has a Digital DC-71 remote batch system linked via a Datel 2400 line which allows Watford to access Hatfield's DECsystem 1050 for batch processing in addition to interactive timesharing.

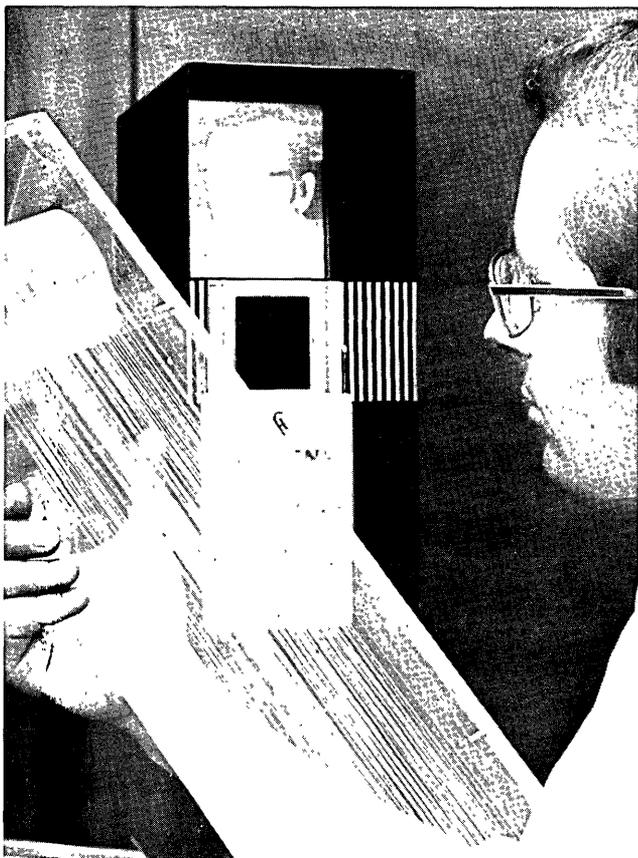
MISCELLANEOUS

VIDEOTELEPHONY VIA GLASS FIBER

*Siemens Aktiengesellschaft
D-8520 Erlangen 2, Postfach 325
Federal Republic of Germany*

In the quest for new possibilities of transmitting communications, scientists are also taking light waves into consideration. Besides communication transmission with light waves through the free atmosphere, sheathed glass-fiber conductors are being investigated. In the Siemens research laboratory in Munich, Germany, two experimental routes have been built with transmission channels made of glass fiber for videotelephone and speech signals. For the light source a laser diode is used which — like a directional radio transmitter — radiates modulated waves into a glass fiber. After passing

through the fiber, these light signals are converted back to electrical signals by means of a photodiode.



Contrary to transmission through the atmosphere, a closed transmission medium such as the glass fiber achieves the normal degree of reliability for transmission systems. However, the high absorption of the light rays in the glass poses problems. Even the best fibers available today have such losses that after a line length of 1 km, only 1% of the original radiation energy is available. It will therefore be necessary to amplify after every few kilometers, but this can be realized with tiny laser diodes and photodiodes. In addition to the German group of companies, other large research laboratories in the world are also working on this project.

The glass fiber used in the experimental setup at Siemens has a diameter of 100 μm . The core of the fiber which conducts the light displays a somewhat higher index of refraction than the sheath. On the boundary surface between core and sheath, total reflection occurs along the fiber, so that even when there are bends the light-ray is always reflected back to the core. With the glass fiber used today it is theoretically possible to transmit more than 50 megabits/s; this corresponds approximately to a TV picture channel. A multiple of this will be possible in the future.

The video and sound signals to be transmitted are converted to amplitude-modulated pulses with a repetition frequency of 2 MHz. A gallium-arsenide (GaAs) laser diode generates light pulses of a corresponding intensity from these pulses. They enter into the end of a glass fiber which is brought close up to the laser diode. At the other end of the transmission section, a photodiode converts the light pulses back to current pulses. The original communication signals are recovered by amplification and demodulation.

The great advantage of the thin glass fibers is that they can probably transmit communications far more economically than the copper wires of a telephone subscriber line, which are a hundred times heavier. A possible application is therefore to be found in a domestic "information socket", which in the future could offer an abundance of new communication possibilities via glass fibers. In addition to numerous television transmissions, canned programs for further education could also be brought into the home; the products on sale at the supermarket could be examined on the screen and newspaper pages could be transmitted. Connection to data banks will be just as much a part of the service as the access to diverse information systems.

WINNER OF U.S. CHESS CHAMPIONSHIP

*National Data Industries
59 Union Square
Somerville, Mass. 02143*

Phillip K. Ciolfi, on the right in the picture, president of National Data Industries, is shown congratulating Larry Atkin, programmer of the Control Data CDC 6400 computer which won the Third Annual U.S. Computer Chess Championship.

Atkin, and his partners Donald Slate and Keith Gonlen, were the favorites to repeat their 1970 and 1971 championships. The Tournament, a major attraction of the Association for Computing Machinery's 1972 Conference, pitted eight computers scattered across the country against each other. Communications between the computers and playing room were via telephone lines, with National Data Industries supplying terminals and interface equipment.



Also shown in the picture are, left to right, James Gillogly, whose PDP-10 computer lost in the final round; Tournament Referee, David Levy, London, England, International Chess Master and leading computer chess authority; and Dr. Monty Newborn, Columbia University, Director of the Chess Tournament.

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Litton Industries Beverly Hills, Calif.	U.S. Navy	Production delivery of seven Carrier Aircraft Inertial Navigation Systems (CAINS) monthly; approximately 150 CAINS systems are contracted to date at a total of \$25 million	\$12.1 million
Univac Division of Sperry Rand Corp., Blue Bell, Pa.	Warner Robins Air Material Area, Robins AFB, Georgia	Fiscal Year '73 maintenance of 153 1050-II computer systems in Air Force Standard Base Supply System located at 133 bases	\$8.3 million
Seal and Co., Inc., Wash- ington, D.C.	Washington Metropolitan Area Transit Authority, Washing- ton, D.C.	Extensive communications system for Metro Rapid Transit System (under construction); Computer Sciences will perform systems engineering, Seal & Co. will do installation	\$5.5 million
Computer Sciences Corp., Los Angeles, Calif.	RCA	An addition on contract to develop major computer program elements for U.S. Navy's AEGIS defensive missile system; raises value of CS 5-year subcontract to \$14.2 million	\$3.2 million
Computer Sciences Corp., Los Angeles, Calif.	New York City Off-Track Betting Corp. (OTB), New York, N. Y.	Use of computer system software and sale of related betting terminals for CSC's automated wagering system	\$2.7 million
Digital Equipment Corp., Maynard, Mass.	On-Line Systems, Inc., Pittsburgh, Pa.	Three additional DECsystem-10 computer systems which have twice the data processing speed of On-Line's present computers	\$2.5 million (approximate)
Trans-A-File Systems Co., Sunnyvale, Calif.	County of Riverside, Riverside, Calif.	An all-digital automated document filing and retrieval system for county law enforcement and criminal justice agencies	\$899,000
General Automation, Inc., Anaheim, Calif.	U.S. Navy	Installing 7 System 18/30's at Naval Air Rework Facilities around country for preparing N/C tapes for control of machine tools	\$850,000
SYSTEMS Engineering Labora- tories, Inc., Ft. Lauderdale, Fla.	General Electric Co., Apollo and Ground Systems, Daytona Beach, Fla.	Dual SYSTEMS 86 computer systems for use as part of a major simulation program for U.S. Air Force to control and generate visual information for pilot trainees	\$560,000 (approximate)
Honeywell, Inc., Systems and Research Center, Minneapolis, Minn.	Donovan Construction Co., St. Paul, Minn.	Systems integration of all equipment for planned I-35W/I-94 freeway traffic-control system of Minnesota Highway Dept.	\$435,489
Delta Data Systems Corp., Cornwells Heights, Pa.	PYE-TMC, London, England	DELTA 5200 Visual Display Terminals adapted for British Post Office needs; will form part of \$9 million, electronic-telegram retransmission center for British Overseas Telegram services	\$300,000 (approximate)
TRW, Inc., Redondo Beach, Calif.	County Board of Supervisors, Los Angeles, Calif.	Development of "Automated Index" system that will ultimately consolidate most relevant data on cases and individuals processing through the justice system	\$260,000
Raytheon Co., Autometric Operation, Wayland, Mass.	U.S. Department of the In- terior, Washington, D.C.	Development of Natural Resource Information System (NRIS) for use in management of natural resources	\$200,000
SofTech, Inc., Waltham, Mass.	NASA	AED (Automated Engineering Design) computer programming system for use in development of a telemetry language processor used for automatic checkout of space vehicle systems and other on-line systems software developments	\$102,102
Computer Products, Inc., Ft. Lauderdale, Fla.	Datacraft Corp.	Real Time Peripheral (RTP) line of com- puter interface equipment	\$100,00
Institute of Library Research, University of California at Berkeley, Berkeley, Calif.	Office of Education, Depart- ment of Health, Education and Welfare, Washington, D.C.	18 month nationwide study of library and information problems of prison populations; data will provide basis for improving library services toward achieving full potential in rehabilitational process	\$77,000
Systems Control, Inc., Palo Alto, Calif.	U. S. Environmental Protection Protection Agency	Adapting mathematical computer models to Spokane River in western Idaho and Washing- ton; study will provide tool for prediction of water quality in future treatment and control facilities of region	\$67,000
Howard University, Wash- ington, D.C.	Honeywell Information Systems, Inc., Wellesley Hills, Mass.	A 2-year grant for an undergraduate curriculum in computer science; courses previously offered on graduate level only	\$40,000
American Management Systems, Inc. (AMS), Arlington, Va.	Burlington Northern Inc.	Study of current financial and accounting systems (computer and manual), design and development of new disbursements system	\$39,000
Sycor, Inc., Ann Arbor, Mich.	Business Communication Sci- ences, Inc., Birmingham, Ala.	500 units of a specially-enhanced version of Sycor's Model 340 Intelligent Terminal	—
National Cash Register Co., Dayton, Ohio	Seaboard Allied Milling Corp., Kansas City, Mo.	NCR Century 300 and 7 NCR 399 terminal com- puters for completely computerized data processing system to monitor all phases of firm's operations	—
Digital Equipment Corp., Maynard, Mass.	Singer Co., Simulation Prod- ucts Div., Silver Spring, Md.	Up to 119 computer systems which includes all computer products and related peri- pheral equipment offered by DEC	—
Litton Industries, Mellonics Div., Beverly Hills, Calif.	Ventura County Community Col- lege District, Calif.	Total computer services under a one-year pilot contract	—

NEW INSTALLATIONS

<u>OF</u>	<u>AT</u>	<u>FOR</u>
Burroughs B 6700 system	Isuzu Motors, Kawasaki, Japan	Order processing, inventory, sales, service, supply, claim, purchasing and engineering applications; is 4th Burroughs computer installed by Isuzu (system valued at more than \$2 million)
Computer Automation ALPHA 16 system	British Leyland Motors Corp., Cowley, Oxford, England	Key role in experimental safety vehicle (ESV) program (part of U.S., British and NATO effort); ALPHA 16 is central controlling unit for special data acquisition system used in crash-testing projects; is 1,000th machine built and delivered by CA
Control Data CDC 3100 system	Ramkhamhaeng University, Bangkok, Thailand	Research, administration and student training
Control Data CDC 7600 system	Combustion Engineering, Inc., Windsor, Conn.	Scientific analysis (primarily nuclear code analysis) and data center services
Control Data CYBER 70 Model 72 system	Chung Shan Institute of Science and Technology, Taiwan	Scientific research applications (system valued at \$1.2 million)
	Companie General Geophysique (CGG) Paris, France	Seismic data processing applications in Canada for Canadian oil companies (system valued at \$1.5 million)
Control Data CYBER 70 Model 73 system	Southern Methodist University, Dallas, Texas	Academic and research data processing applications (system valued at \$1.3 million)
	Battelle Memorial Institute, Columbus, Ohio	Time-sharing applications for internal users, colleges and high schools; is coupled with previously installed CDC 6400
Honeywell Model 6040 system	Tietolaari OY, Helsinki, Finland	Processing 1.2 million invoices/year; inventory control of 600+ products (12.2 million transactions); maintaining 5000 customer accounts and 9 million transactions with its 15,000 milk producers; member dairies also use system for similar applications (system valued at over \$1.5 million)
Honeywell Model 6060 system	Norwegian State Computer Center (Statens Driftssentral for Administrativ Databehandling)Oslo, Norway	Coordinating data processing in governmental, regional and local administrations (system valued at more than \$3 million)
IBM System/7	Central Telephone and Utilities, Lincoln, Nebraska (3 systems)	Monitoring all telephone equipment and service throughout operations in ten states
	City of Seattle, Seattle, Wash. (2 systems)	Speeding up refuse disposal operations at city's two solid waste transfer stations
	City of Sioux Falls, South Dakota	Controlling city's shallow-well water supply; monitors well pump bearings to determine over-heat conditions, pumping pressure to give positive indication of on/off status, and well water level conditions
	Continental Telephone Electronics Co., Euless, Texas	Speeding circuit board production and testing the reliability of its electronic components used in telephone systems throughout the country
IBM System/370 Model 135	Brenco Automation Center, Inc., Des Moines, Iowa	Expanding data processing services it offers for the 17 Brenton Banks
NCR 315 systems	Thrift Data, Inc., Rosendale, N.Y. (2 systems)	New on-line data processing consortium comprised of 12 savings banks and savings and loan associations
SYSTEMS 86 system	General Electric Co., Re-entry & Environmental Systems Div., Philadelphia, Pa.	Acquiring, processing and displaying static and dynamic test data in real-time for aerospace hardware development programs; are linked with 12 Environmental Test Chambers (system valued at approximately \$640,000)
UNIVAC 1106 system	Fafnir Bearing Division of Textron, Inc., New Britain, Conn.	Fulfilling its manufacturing requirements in precision-made ball bearings (system valued at over \$1 million)
	Institute for Economic Research (IER), and Institute for Advanced Studies (IAS), Vienna, Austria	Macroeconomic conjuncture models, by IER, of Austrian economy; IAS use includes development of theoretical and empiric-statistical models (system valued at approximately \$1.3 million)
UNIVAC 1108 system	Instituto Nacional de Prevision (I.N.P.), Madrid, Spain	Real-time processing of social security records; includes entire Spanish labor force (system valued at \$4.6 million)
UNIVAC 9211 system	Stainless Metal Products, Inc., Chattanooga, Tenn.	Inventory control, shop loading, general accounting, payroll processing and implementing a cost retrieval system
UNIVAC 9211 B system	Anvil Products, Inc., Allison Park, Pa.	Invoicing, general accounting and payroll processing
UNIVAC 9300 system	Glenshaw Glass Co., Pittsburgh, Pa.	Coordinating operations at plants (Glenshaw, Pa. and Orangeburg, N.Y.), to develop an integrated information system and perform record-keeping operations
	Tube Investments' Domestic Appliance Div., Birmingham, Ala.	Production and inventory control, cost analysis, general accounting and payroll
UNIVAC 9300-II system	Albert F. Goetze Meat Packing Co., Baltimore, Md.	Sales analysis, linear programming, billing, payroll, and general accounting functions
UNIVAC Series 70/2 system	City of Tampa, Tampa, Fla.	Use in on-line police system
UNIVAC Series 70/6 system	First Church of Christ Scientist, Boston, Mass.	Replacing less powerful Series 70 equipment

CALENDAR OF COMING EVENTS

- Nov. 15-17, 1972: DATA CENTRE '72**, Sheraton-Copenhagen Hotel, Copenhagen, Denmark / contact: Data Centre '72, Danish IAG, DIAG, 58 Bredgade, DK 1260, Copenhagen K, Denmark
- Nov. 20-21, 1972: 8th Data Processing Conference in Israel**, Tel Aviv Hilton, Tel Aviv, Israel / contact: Information Processing Assoc. of Israel, Programme Committee, The 8th Data Processing Conference, P.O.B. 16271, c/o "Kenes", Ltd., Tel Aviv
- Dec. 5-6, 1972: TDCC 1972 Transportation Data Systems Forum**, Presidential Ballroom, Statler Hilton Hotel, Washington, D.C. / contact: Edward A. Guilbert, President, Transportation Data Coordinating Committee, 1101 17th St., N.W., Washington, DC 20036
- Dec. 5-7, 1972: Fall Joint Computer Conference**, Anaheim Convention Center, Anaheim, Calif. / contact: AFIPS Hdqs., 210 Summit Ave., Montvale, NJ 07645
- Jan. 17-19, 1973: 1973 Winter Simulation Conference**, San Francisco, Calif. / contact: Robert D. Dickey, Bank of California, 400 California St., San Francisco, CA 94120
- Jan. 31-Feb. 1, 1973: San Diego Biomedical Symposium**, Sheraton-Harbor Island Hotel, San Diego, Calif. / contact: Dr. Robert H. Riffenburgh, Program Chmn., San Diego Biomedical Symposium P.O. Box 965, San Diego, CA 92112
- Feb. 20-22, 1973: Computer Science Conference**, Neil House, Columbus, Ohio / contact: Dr. Marshall Yovits, 101 Caldwell Lab., 2024 Neil Ave., Ohio State Univ., Columbus, OH 43210
- Mar. 4-9, 1973: SHARE Meeting**, Denver, Colo. / contact: D.M. Smith, SHARE, Inc., Suite 750, 25 Broadway, New York, NY 10004
- Mar. 26-29, 1973: IEEE International Convention (INTERCON)**, Coliseum & New York Hilton Hotel, New York, N.Y. / contact: J. H. Schumacher, IEEE, 345 E. 47th St., New York, NY 10017
- Mar. 29-31, 1973: 10th Symposium on Biomathematics and Computer Science in the Life Sciences**, Houston, Texas / contact: Office of the Dean, The University of Texas Graduate School of Biomedical Sciences at Houston, Division of Continuing Education, P.O. Box 20367, Houston, TX 77025
- April 2-5, 1973: SOFTWARE ENGINEERING FOR TELECOMMUNICATION SWITCHING SYSTEMS**, University of Essex, Essex, England / contact: Mrs. Penelope Paterson, Institution of Electrical Engineers Press Office, Savoy Place, London WC2R 0BL, England
- April 10-12, 1973: Datafair 73**, Nottingham University, Nottingham, England / contact: John Fowler & Partners Ltd., 6-8 Emeral St., London, WC1N3QA, England
- April 10-13, 1973: PROLAMAT '73, Second International Conference on Programming Languages for Numerically Controlled Machine Tools**, Budapest, Hungary / contact: IFIP Prolamat, '73, Budapest 112, P.O. Box 63, Hungary
- April 24-26, 1973: I.S.A. Joint Spring Conference**, Stouffer's Riverfront Inn, St. Louis, Mo. / contact: William P. Lynes, c/o Durkin Equipment, 2384 Centerline Ind. Dr., St. Louis, MO 63122
- April 30-May 2, 1973: 1st Symposium on Computer Software Reliability**, Americana Hotel, New York, N.Y. / contact: David Goldman, IEEE Hdqs., 345 E. 47th St., New York, NY 10017
- May 14-17, 1973: Spring Joint Computer Conference**, Convention Hall, Atlantic City, N.J. / contact: AFIPS Hdqs., 210 Summit Ave., Montvale, NJ 07645
- June 4-6, 1973: 1973 8th PICA Conference**, Radisson Hotel, Minneapolis, Minn. / contact: IEEE Hdqs., Tech. Svcs., 345 E. 47th St., New York, NY 10017
- June 4-8, 1973: National Computer Conference and Exposition**, Coliseum, New York, N.Y. / contact: AFIPS Hdqs., 210 Summit Ave., Montvale, NJ 07645
- June 22-23, 1973: 11th Annual Computer Personnel Conference**, Univ. of Maryland Conference Center, College Park, Md. / contact: Prof. A. W. Stalnaker, College of Industrial Management, Georgia Institute of Technology, Atlanta, GA 30332
- June 26-28, 1973: Workshop on Computer Architecture**, Universite de Grenoble, Grenoble, France / contact: Grenoble Accueil, 9, Boulevard Jean-Pain, 38000, Grenoble, France
- July 20-22, 1973: 1973 International Conference on Computers in the Humanities**, University of Minnesota, Minneapolis, Minn. / contact: Prof. Jay Leavitt, 114 Main Engineering Bldg., University of Minnesota, Minneapolis, MN 55455
- July 23-27, 1973: 3rd Annual International Computer Exposition for Latin America**, Maria Isabel-Sheraton Hotel, Mexico City, Mexico / contact: Seymour A. Robbins and Associates, 273 Merrison St., Box 566, Teaneck, NJ 07666
- Aug. 13-17, 1973: SHARE Meeting**, Miami Beach, Fla. / contact: D. M. Smith, SHARE, Inc., Suite 750, 25 Broadway, New York, NY 10004
- Aug. 27-29, 1973: ACM '73**, Atlanta, Ga. / contact: Dr. Irwin E. Perlin, Georgia Institute of Technology, 225 North Ave., N.W., Atlanta, GA 30332
- Oct. 2-4, 1973: 2nd International Computer-Aided Design and Computer-Aided Manufacturing Conf.**, Detroit Hilton Hotel, Detroit, Mich. / contact: Public Relations Dept., Society of Manufacturing Engineers, 20501 Ford Rd., Dearborn, MI 48128
- Oct. 8-12, 1973: BUSINESS EQUIPMENT SHOW**, Coliseum, New York, N.Y. / contact: Rudy Lang, Prestige Expositions, Inc., 60 East 42 St., New York, NY 10017

ADVERTISING INDEX

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

- BERKELEY ENTERPRISES, INC., 815 Washington St., Newtonville, Mass. 02160 / Pages 40, 52
- THE C&A NOTEBOOK OF COMMON SENSE, ELEMENTARY AND ADVANCED, published by *Computers and Automation*, 815 Washington St., Newtonville, Mass. 02160 / Page 2
- COMPUTERS AND AUTOMATION, 815 Washington St., Newtonville, Mass. 02160 / Pages 3, 40, 51
- MOTIVATIONAL COMMUNICATIONS CORP., LTD., 2425 Confederation Pkwy., Mississauga, Ontario, Canada / Page 50
- WHO'S WHO IN COMPUTERS AND DATA PROCESSING, jointly published by Quadrangle Books (a New York Times Company) and Berkeley Enterprises, Inc., 815 Washington St., Newtonville, Mass. 02160 / Page 37

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 OCTOBER 15, 1972

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL \$ (000)	NUMBER OF INSTALLATIONS			NUMBER OF UNFILED ORDERS
				In U.S.A.	Outside U.S.A.	In World	
Part I. United States Manufacturers							
Adage, Inc.	AGT 10 Series	4/68	X	32	3	35	X
Brighton, Mass. (A) (10/72)	AGT 100 Series	1/72	100-300	(S) 8	3	11	3
Autonetics	RECOMP II	11/58	X	30	0	30	X
Anaheim, Calif. (R) (1/69)	RECOMP III	6/61	X	6	0	6	X
Bailey Meter Co. Wickliffe, Ohio (A) (6/72)	Metrotype	10/57	40-200	(S) 8	0	8	0
	Bailey 750	6/60	40-250	(S) 37	15	52	0
	Bailey 755	11/61	200-600	(S) 7	0	7	0
	Bailey 756	2/65	60-400	(S) 15	12	27	2
	Bailey 855/15	12/72	50-400	(S) 0	0	0	2
	Bailey 855/25	4/68	100-1000	(S) 16	0	16	0
	Bailey 855/50	3/72	100-1000	(S) 0	0	0	12
Bunker-Ramo Corp. Westlake Village, Calif. (A) (10/72)	BR-130	10/61	X	160	-	-	X
	BR-133	5/64	X	79	-	-	X
	BR-230	8/63	X	15	-	-	X
	BR-300	3/59	X	18	-	-	X
	BR-330	12/60	X	19	-	-	X
	BR-340	12/63	X	19	-	-	X
	BR-1018	6/71	23.0	(S) -	-	-	-
Burroughs	205	1/54	X	25-38	2	27-40	X
Detroit, Mich. (N) (1/69-5/69)	220	10/58	X	28-31	2	30-33	X
	B100/B500	7/65	2.8-9.0	-	-	-	-
	B2500	2/67	4.0	52-57	12	64-49	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	-	4	60
	B7500	4/69	44.0	-	-	-	13
	B8500	8/67	200.0	1	-	1	5
Computer Automation, Inc. Newport, Calif. (A) (4/71)	108/208/808	6/68	5.0	(S) 165	10	175	110
	116/216/816	3/69	8.0	(S) 215	20	235	225
Consultronics, Inc. Garland, Texas (A) (10/72)	4700	4/69	1.8	9	0	9	-
	DCT-132	5/69	0.9	35	85	120	-
Control Data Corp. Minneapolis, Minn. (R) (7/71)	G15	7/55	X	-	-	295	X
	G20	4/61	X	-	-	20	X
	LGP-21	12/62	X	-	-	165	X
	LGP-30	9/56	X	-	-	322	X
	RPC4000	1/61	X	-	-	75	X
	636/136/046 Series	-	-	-	-	29	-
	160/8090 Series	5/60	X	-	-	610	X
	921/924-A	8/61	X	-	-	29	X
	1604/A/B	1/60	X	-	-	59	X
	1700/SC	5/66	3.8	-	-	425-475	0
	3100/3150	5/64	10-16	-	-	83-110	C
	3200	5/64	13.0	-	-	55-60	C
	3300	9/65	20-38	-	-	205	C
	3400	11/64	18.0	-	-	15	C
	3500	8/68	25.0	-	-	15	C
	3600	6/63	52.0	-	-	40	C
	3800	2/66	53.0	-	-	20	C
	6200/6400/6500	8/64	58.0	-	-	108	C
	6600	8/64	115.0	-	-	85	C
	6700	6/67	130.9	-	-	5	C
	7600	12/68	235.0	-	-	8	C
							Total: 160 E
Data General Corp. Southboro, Mass. (A) (8/72)	Nova	2/69	9.2	(S) -	-	920	-
	Supernova	5/70	9.6	(S) -	-	195	-
	Nova 1200	12/71	5.4	(S) -	-	1740	-
	Nova 800	3/71	6.9	(S) -	-	240	-
	Nova 1210/1220/820	2/72	4.2;5.2	(S) -	-	130	-

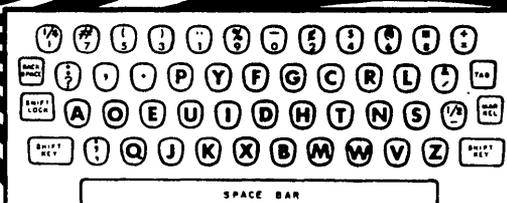
NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL \$ (000)	NUMBER OF INSTALLATIONS			NUMBER OF UNFILLED ORDERS
				In U.S.A.	Outside U.S.A.	In World	
Honeywell (cont'd)	H-1800	1/64	50.0	15	5	20	X
	H-2200	1/66	18.0	125	60	185	-
	H-3200	2/70	24.0	20	2	22	-
	H-4200	8/68	32.5	18	2	20	-
	H-8200	12/68	50.0	10	3	13	-
	DDP-24	5/63	2.65	-	-	90	X
	DDP-116	4/65	X	-	-	250	X
	DDP-124	3/66	X	-	-	250	X
	DDP-224	3/65	X	-	-	60	X
	DDP-316	6/69	0.6	-	-	450	-
	DDP-416	-	X	-	-	350	X
	DDP-516	9/66	1.2	-	-	900	-
	H112	10/69	-	-	-	75	-
	H632	12/68	3.2	-	-	12	-
	H1602	-	-	-	-	-	-
	H1642	-	-	-	-	-	-
	H1644	-	-	-	-	-	-
	H1646	-	-	-	-	-	-
	H1648	11/68	12.0	-	-	20	-
	H1648A	-	-	-	-	-	-
IBM White Plains, N.Y. (N) (D) (8/72)	305	12/57	3.6	40	15	55	-
	650	10/67	4.8	50	18	68	-
	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 I, II	9/60	4.1	285	186	471	-
	1800	1/66	5.1	415	148	563	-
	7010	10/63	26.0	67	17	84	-
	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	-
	7020, 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-I	9/62	75.0	10	4	14	-
	7094-II	4/64	83.0	6	4	10	-
	System/3 Model 6	3/71	1.0	-	-	-	-
	System/3 Model 10	1/70	1.1	-	-	-	-
	System/7	11/71	0.35 and up	-	-	-	-
	360/20	12/65	2.7	7161	6075	13236	1780
	360/25	1/68	5.1	1112	759	1871	1287
	360/30	5/65	10.3	5487	2535	8022	-
	360/40	4/65	19.3	2453	1524	3977	1363
	360/44	7/66	11.8	109	57	166	39
	360/50	8/65	29.1	1135	445	1580	662
	360/65	11/65	57.2	601	144	745	562
	360/67	10/65	133.8	57	6	63	99
	360/75	2/66	66.9	50	17	67	12
360/85	12/69	150.3	11	1	12	55	
360/90	11/67	-	5	-	5	-	
360/190	-	-	13	2	15	-	
360/195	4/71	232.0	-	-	9	48	
370/135	5/72	14.4	-	-	-	-	
370/145	9/71	23.3	-	-	-	-	
370/155	2/71	48.0	-	-	-	-	
370/158	-/73	49.5-85.0	-	-	-	-	
370/165	5/71	98.7	-	-	-	-	
370/168	-/73	93.0-170.0	-	-	-	-	
370/195	6/73	190.0-270.0	-	-	-	-	
Interdata Oceanport, N.J. (A) (9/72)	Model 1	12/70	3.7	205	75	280	85
	Model 3	5/67	-	-	-	200	X
	Model 4	8/68	8.5	270	115	385	40
	Model 5	11/70	X	70	20	90	X
	Model 15	1/69	20.0	40	24	64	X
	Model 16	5/71	X	1	5	6	X
	Model 18	6/71	X	2	6	8	X
	Model 50	5/72	6.8	4	2	6	17
	Model 70	10/71	6.8	165	40	205	135
Microdata Corp. Santa Ana, Calif. (A) (10/72)	Micro 400	12/70	0.1-0.5	160	0	125	-
	Micro 800	12/68	0.2-3.0	1700	650	2350	-
	Micro 1600	12/71	0.2-3.0	290	20	185	-
NCR Dayton, Ohio (A) (2/72)	304	1/60	X	5	2	7	X
	310	5/61	X	8	0	8	X
	315	5/62	7.0	425	300	725	-
	315 RMC	9/65	9.0	125	50	175	-
	390	5/61	0.7	250	375	625	-
	500	10/65	1.0	1000	1700	2700	-
	Century 50	2/71	1.6	200	0	200	-
	Century 100	9/68	2.6	1500	525	2025	-
	Century 200	6/69	7.0	460	215	675	-
	Century 300	2/72	21.0	0	0	0	-
Philco Willow Grove, Pa. (N) (1/69)	1000	6/63	X	16	-	-	X
	200-210, 211	10/58	X	16	-	-	X
	2000-212	1/63	X	12	-	-	X
Raytheon Data Systems Co. Norwood, Mass. (A) (7/72)	250	12/60	X	115	20	135	X
	440	3/64	X	20	-	-	X
	520	10/65	X	26	1	27	X
	703	10/67	12.5	(s) 175	31	206	2

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL \$(000)	NUMBER OF INSTALLATIONS			NUMBER OF UNFILLED ORDERS	
				In U.S.A.	Outside U.S.A.	In World		
Raytheon (cont'd)	704	3/70	8.0	(S) 240	60	300	20	
	706	5/69	19.0	(S) 75	14	89	2	
Standard Computer Corp. Los Angeles, Calif. (A) (6/72)	IC 4000	12/68	9.0	9	0	9	2	
	IC 6000-6000/E	5/67	16.0	3	0	3	-	
	IC 7000	8/70	17.0	4	0	4	1	
	IC-9000	5/71	400.0	(S) 1	0	1	-	
Systems Engineering Laboratories Ft. Lauderdale, Fla. (A) (10/72)	SYSTEMS 810B	9/68	2.6	168	10	178	-	
	SYSTEMS 71	8/72	0.9	-	-	-	-	
	SYSTEMS 72	9/71	1.0	13	3	16	-	
	SYSTEMS 85	7/72	6.0	2	1	3	-	
	SYSTEMS 86	6/70	10.0	26	1	27	-	
UNIVAC Div. of Sperry Rand New York, N.Y. (A) (4/72)	I & II	3/51 & 11/57	X	23	-	-	X	
	III	8/62	X	25	6	31	X	
	File Computers	8/56	X	13	-	-	X	
	Solid-State 80 I,II,90, I, II, & Step	8/58	X	210	-	-	X	
	418	6/63	11.0	80	39	119	23 E	
	490 Series	12/61	30.0	76	14	90	15	
	1004	2/63	1.9	1522	610	2132	-	
	1005	4/66	2.4	617	248	865	72	
	1050	9/63	8.5	136	59	195	-	
	1100 Series (except 1107, 1108)	12/50	X	9	0	9	X	
	1107	10/62	X	8	3	11	X	
	1108	9/65	68.0	103	129	232	58 E	
	9200	6/67	1.5	1106	835	1941	725	
	9300	9/67	3.4	412	62	474	510 E	
	9400	5/69	7.0	82	41	123	83 E	
	LARC	5/60	135.0	2	0	2	-	
	301	2/61	7.0	156	-	-	-	
	501	6/59	14.0-18.0	14	-	-	-	
	601	11/62	14.0-35.0	0	-	-	-	
	3301	7/64	17.0-35.0	76	-	-	-	
UNIVAC - Series 70 Blue Bell, Pa. (A) (9/72)	Spectra 70/15, 25	9/65	4.3	18	-	-	-	
	Spectra 70/35	1/67	9.2	103	-	-	-	
	Spectra 70/45	11/65	22.5	310	-	-	-	
	Spectra 70/46	-	33.5	33	-	-	-	
	Spectra 70/55	11/66	34.0	13	-	-	-	
	Spectra 70/60	11/70	32.0	13	-	-	-	
	Spectra 70/61	4/70	42.0	8	-	-	-	
	70/2	5/71	16.0	60	-	-	-	
	70/3	9/71	25.0	6	-	-	-	
	70/6	9/71	25.0	18	-	-	-	
	70/7	12/71	35.0	5	-	-	-	
	Varian Data Machines Newport Beach, Calif. (A) (8/72)	620	11/65	X	-	-	75	X
		620i	6/67	X	-	-	1300	X
		R-620i	4/69	-	-	-	80	-
520/DC, 520i		12/69;10/68	-	-	-	350	-	
620/f		11/70	-	-	-	201	3	
620/L		4/71	-	-	-	474	114	
620/f-100		6/72	-	-	-	13	16	
620/L-100		5/72	-	-	-	21	19	
Xerox Data Systems El Segundo, Calif. (N) (2/72)	Varian 73	-	-	-	-	-	12	
	XDS-92	4/65	1.5	43	4	47	-	
	XDS-910	8/62	2.0	170	7-10	177-180	-	
	XDS-920	9/62	2.9	120	5-12	125-132	-	
	XDS-925	12/64	3.0	10-20	1	10-21	-	
	XDS-930	6/64	3.4	159	14	173	-	
	XDS-940	4/66	14.0	28-38	3	28-41	-	
	XDS-9300	11/64	8.5	25-30	4	25-34	-	
	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 6	6/70	12.0	-	-	-	-	
	Sigma 7	12/66	12.0	24-35	5-9	29-44	-	
Sigma 9	-	35.0	-	-	-	-		

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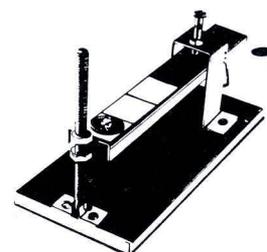
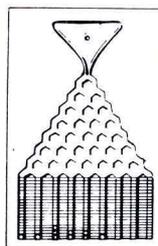
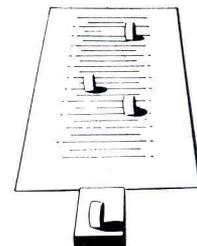
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