
SOCIETY OF ACTUARIES

Article from:

# The Actuary

November 1980 – Volume 14, No. 9

## Letters

(Continued from page 2)

the bond in which loan proceeds may have been invested, in these days of drastic interest rate fluctuations? (4) Then there's the broker's commission to buy a bond, and again to sell it. (5) If the policy has been assigned irrevocably to your spouse, beware of these transactions becoming intermingled with your funds, with unhappy consequences for you as executor. (6) Lastly, for trusts under the 1976 Estate Tax laws, the simpler your asset portfolio, the easier it is to make your plans and to have them carried out after your death.

*T. Arnol Crowther*

* * * *

### A — Minus

*Sir*:

In his column, "Mainly For Seniors," John T. Watts of the Copley News Service writes, "A major new acturial study does show surprising gains in life expectancy for men, as well as women." I'd like to think that misspelling was a typo, but fear the problem is one of identity.

*Robert R. Lynch*

* * * *

## A 1494 PROBABILITY PROBLEM

*Ed. Note: This is adapted from a few paragraphs in a paper by Prof. Hans Bühlmann, the leading Swiss actuary, that was presented at the* 1978 *Tel Aviv Insurance Seminar. The paper appears in the seminar booklet,* New Frontiers In Insurance, *Yehuda Kahane, Ph. D., Editor.*

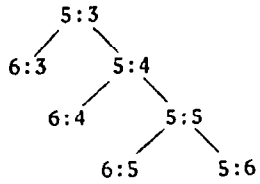
The scientific form of insurance was made possible by the emergence of probability in the 15th century. The first probability problem appeared in a book entitled *Summa de Arithmetica, Geometria, Proportioni et Probabilta* (1494), written by Fra Luca Paccioli, a Franciscan monk.

> Ques.: A and B play a fair game called "gioci de Balla." They agree to continue until one has won six rounds. But the game stops when A has won five and B three. How should the stakes be divided?

Fra Luca's answer, 5:3, is, of course, wrong, but interesting. He apparently argued by use of proportionality, without even recognizing the probabilistic character of the problem. But still, it is fair to say that probabilistic thinking began with this problem. Many learned men tried their luck with it and only missed by very little to break through to the correct basic thinking.

We now believe that two Frenchmen, Pierre de Fermat, lawyer and judge in Toulouse, and Blaise Pascal, physicist in Paris and later religious thinker in Port Royal, were the first to solve the problem—150 years later! The solution proposed by Fermat is based on the realiization that, in order to determine who gets the stakes, the maximum number of games which still need to be played is three. So simply by listing the eight possible outcomes of three games, Fermat arrived at the answer 7:1.

In his enthusiasm about his solution, Fermat wrote to Pascal. It is not clear whether Pascal believed Fermat's solution. In any case, he tried another approach, what would be called the tree method:




Now Pascal, too, was excited, and he wrote back to Fermat, "N'est-ce pas merveilleux que la verité à Paris est la même qu'à Toulouse?"

*E.J.M.*

### NOTICE TO OUR SUBSCRIBERS

If you send your 1981 renewal before December 31st in response to this notice, the cost to you will be the same as heretofore—$3.50 for students, $4.50 for others. If you wait to be billed, the amount will be a dollar higher.

Pay to the Society of Actuaries; mark your check "1981 Subscription to *The Actuary*"; mail it to the Society, 208 S. La Salle St., Chicago, IL 60604.

### Deaths

Eloise K. Goodrich, FSA 1926
Geoffrey F. N. Smith, FSA 1952
Charles A. Taylor, FSA 1928

## AHEAD OF HIS TIME

In January 1936, William Phillips, a London actuary, presented a paper to the Institute in which, after paying his respects to the Rhind papyrus of the second millenium B.C., he recommended that (a) life insurance companies proceed to convert all their internal figures for premiums, reserves and face amounts from the denary scale of notation (s.n.10) to s.n.8, (b) a simple machine be designed to convert those s.n.8 figures to the binary scale, s.n.2, (c) a light-ray machine, capable of using only the digits zero and one, do the arithmetic then customarily performed by desk calculators and Hollerith cards, and (d) clerks be taught to convert the results mentally from s.n.2 back to s.n.8. He had thus set himself two tasks, both formidable: first, to convey an understanding of why all this would be worthwhile; second, to arouse enthusiasm among those who grasped the idea.

To illustrate his step (c), Mr. Phillips had brought to the meeting the essential parts of a mechanism of his own invention which, although not a light-ray machine, served to demonstrate the process of using figures in binary form.

The actuaries present on that historic occasion were witnessing no less than the precursor of today's computer, whose prototype was then less than a decade away. Today, when actuaries can be classified into (i) a minority of us capable of getting maximum value from automation,* (ii) most of the rest of us, who have at least a working knowledge of computers, and (iii) dinosaurs, it's worth reflecting on the reception accorded in 1936 to Mr. Phillips' paper entitled Binary Calculation.

To begin with our own *Transactions*: that paper was routinely listed in *T.A.S.A. XXXVII*, but, subject to rebuttal from readers' recollections, it seems fair to assert that the paper created no stir on this side of the Atlantic.

In London, discussers of the paper gave some intriguing accounts of past and current aids to arithmetic, but, understandably, Mr. Phillips' proposal sparked more scoffing than support. One speaker (not an actuary) questioned whether a machine that could work so

*See L. J. Lohmann's letter, Masters or Dabblers, in our June 1980 issue.

(Continued on page 4)

## Ahead Of His Time

(*Continued from page 3*)

fast could be kept occupied! The then President, Mr. Coutts, felt it necessary to encourage the author to pursue his idea despite "any cold water thrown on it this evening."

Jumping forward a quarter-century—

(1) In January 1962, the Institute was told that the Phillips apparatus that had been on display that 1936 evening had come to occupy a place of honour in the South Kensington Science Museum, where it may be seen to this day.

(2) In November 1964, Mr. Phillips was awarded the Institute's Gold Medal for his life of accomplishments. That 1936 paper was described as his outstanding achievement, marking him "many years ahead of his time."

(3) In a letter published in the *Sunday Times*(London) in September 1965, William Phillips described the mental processes, extending through more than twenty years, that had brought him to the idea that he had unveiled that evening in 1936. Said he:

> "After completing actuarial examinations in 1913 I turned back to boyhood interest in (Charles) Babbage's 1834 dream of an Analytical Engine, a self-operating, self-recording calculating machine . . . and during the 1914-18 war I was still thinking (of this) in terms of gear wheels. Then began the chain that led to the idea of the binary electronic computer.
>
> "1919 to 1924: connected existing ideas with punched card accountancy —two rival systems then of 'reading' the holes, i.e., electric contacts or spring-loaded pins—but why not rays of light? . . .
>
> "Normal denary scale uses digits 9 down to 0, but binary arithmetic uses only digit 1 and 0 ('hole' or 'no hole'). Whole multiplication table consists only of $1 \times 1 = 1$.
>
> "Snag! Though multiplication simple, addition devilishly difficult. In binary scale $1 + 1 = 0$, and carry 1 (as in denary $9 + 1 = 0$, and carry 1). Death of grand idea?
>
> "Half asleep in deck chair on transatlantic liner, 1925, suddenly 'saw' a worked-out binary 'long multiplication' turn *of its own volition* anticlockwise through an angle of 45 degrees—a diamond-shaped area of assorted 1's and 0's. Solution of 'carry' problem: alternately add simultaneously on all even-numbered columns while 'carrying' to the odd-numbered columns.
>
> "How to add electric pulses? What is wanted is a flip-flop, something which shuttles form 'off' to 'on', and from 'on' to 'off', in the latter case simultaneouly sending a 'carry' pulse to next column. Still thinking in terms of mechanism until in 1928 or 1929 learned that in 1919 Eccles and Jordan had demonstrated that a thermionic valve could be in either of two stable states, and made to change with the speed of light.
>
> "1931: Wynn-Williams produced designs for electronic valves as counting units—all the binary electronic computer needed was a battery of such 'counters.'
>
> "1934: plan of electronic computer working in binary, but with octonary (digits 0 to 7) input and output completed to make the human operator's task easier. Babbage's 1834 sleeping beauty had awakened—after the proverbial hundred years."

(4) William Phillips died in March 1968 at age 75. His obituary in J.I.A., Vol. 94 spoke of his "creative faculty which flows from the ability to see the familiar from an unfamiliar angle." It mentioned also his characteristic directness of expression which "did not always commend him to his listeners."

This example was cited:

> "Who present (at a Staple Inn Hall discussion, not about the binary system, when Phillips had been an F.I.A. only eight years and wasn't yet thirty) can forget his rebuke to a very senior member who had displayed difficulty in accepting satistical evidence counter to all his experience. . . . The gasp at the actual words (of which no printed record remains) can be remembered, with relish, after nearly half a century."

This account of Phillips' tenacious pursuit of an idea may—indeed is intended to—encourage actuaries when they find that the way of the innovator seems, at the time, to be as hard as that of the reformer. And to warn the rest of us to be cautious about haste in dismissing, or deriding, an absurd idea.

(*Continued on page 8*)

## W. RULON WILLIAMSON

*An Appreciation by James E. Hoskins*

The recent death of Bill Williamson, shortly after his ninety-first birthday, impels me to offer comments about him of a more personal nature than the formal obituary that will appear in the *Transactions*.

When I entered temporary employment at The Travelers in the summer of 1914, Bill immediately took me under his wing, showed me the workings of company life, and introduced me to a small group who frequently lunched together. Bill had become a specialist in pensions and group insurance, but although my assignment was to individual life insurance I had the occasional opportunity to work under his direction.

Bill was fond of outdoor life, and I frequently joined him on hikes and an occasional canoe trip. After he moved to the Washington area, almost all my visits there resulted in a hike along the Potomac or to some historic site. On those occasions, and in my visits to his home after his marriage, I learned that he read widely, and often interjected an appropriate quotation into the conversation. And I remember that when I expressed curiosity about a detail of a painting on a Christmas stamp, Bill promptly sent me an account of the work and its artist.

His foremost avocation was mountaineering. He was an avid member of the Appalachian Mountain Club, and took part in establishing some national trails. I recall his telling of climbing some lesser known Alpine peaks which he regarded as more difficult than some that were more famous. When asked why he nevertheless climbed one of the popular mountains, he replied that it was easier to climb it than to explain why he hadn't done so.

When The Travelers was asked to recommend an actuary to help set up the fledging Social Security system, Bill's experience and temperament made him the logical nominee. Those who knew him only later, when his writings and public statements had a distinctly conservative tinge, may be surprised to learn that in those early days he was regarded as a liberal.

The last part of his career was devoted largely to urging changes in the Social Security system which he came to feel

(*Continued on page 5*)

## Ahead Of His Time

(Continued from page 4)

Our warmest thanks to Ronald S. Skerman, F.I.A. and Kenneth A. Usherwood, F.I.A., who furnished information and guidance for this article. Also to Alexander J. Gale, F.I.A., who supplied the following reminiscences on William Phillips' personality:

"My first contact with him was when he interviewed me at the start of my actuarial career in 1931. One remark I treasured throughout my working years—'Don't forget, we will take the best days of your life and the best hours of each day and if you are not enjoying it—go elsewhere.'

"An outstanding personality—a legal advocate when he wished (he became a qualified Barrister), in modern idiom a computer-memory-store of facts, extraordinary energy and stamina, and capable of continual original thought and new ideas, but I thought tiring of the follow-through stage and not a great arithmetician.

"He delivered two actuarial papers in the 1930's. The first which gave him his standing as a technical actuary was 'The Curve of Deaths' (J.I.A. Vol. 66). It put him right on the path to the inner Institute of Actuaries' recognition.

"Not long afterwards, rumour had it that he was doing another paper to the Institute—and the name Babbage became part of his conversation, usually coupled with references to binary notation. We also learned of a largish stringed machine in a primitive state. which blossomed into the 'Differential Analyser.' At the meeting in 1936 it was, I recollect, beyond most of us, hardly surprising really, particularly to those who, like me, as students, had been looking for clues to examination solutions in our meeting attendances.

"His machine returned to our office, took up a good deal of our modest basement space and evacuated itself eventually with the rest of us to Surrey where it remained until it surfaced as part of the new revolution.

"He was a serious photographer and painter; he was not a games player, but did not denigrate those who were; infuriating with minor mistakes, superb in major problems. He was not an acquisitive man, despite his early career as an Investment Actuary, but did talk seriously to me about inflation as early as the mid-1940's!"

*E.J.M.*

## Computers

(Continued from page 1)

At the end of that chapter appears this:

> We can even imagine what new machinery for handling information may someday become: a small pocket instrument that we carry around with us, talking to it whenever we need to, and either storing information in it or receiving information from it. Thus the brain with a motor will guide and advise the man just as the armor with a motor carries and protects him.

I did not foresee chips of silicon (or germanium) on which 64,000 computer circuits could be imprinted, nor very large-scale integrated circuits (VSLI). This is on the order of an entire computer in the space of a quarter of a postage stamp.

But a human brain with its biochemical construction is able to store probably close to 100 billion ($10^{11}$) bits of information. The silicon chip, or some other device, still has a long way to go, but I am sure it will go there—and beyond, up to the relativity limits.

### Those 1949 Predictions

Table 1 summarizes what has happende in the development of 12 predicted devices, and also translates my terminology of former days to the jargon of 1980.

Enormous numbers of applications of these electronic "brains" have been and will be made. A list we published in 1974 enumerated over 2,600 of these. In the future the number of applications of computers will be like the number of applications of books.

### Some 1980 Forecasts

Recently some of my associates and I have found new ways for automatic translation by computer with due regard for meaning. This system applies to automatic computer programming using natural language, automatic documentation of computer programs, automatic conversion of programs from one language to another, and automatic summarizing of texts.

This system, which we call DJINNI, applies in a limited context of about ten to a thousand words. For example, seven lines of English "instructions to a clerk" will change into 67 lines of COBOL program, right the first time. (See footnote—Ed.)

Many other workers in this field of "artificial intelligence" are producing interesting, remarkable and seminal results.

I close with three forecasts:

(1) More than 50 percent of human programming will vanish as computers take over.

(2) Every defined intellectual operation will be performed by computer, faster, better, and more reliably than by a human being.

(3) All the language of thought will become calculable like mathematics.

*Ed. Note: Mr. Berkeley offers a reprint of a report on* DJINNI *on request to his* Year Book *address. Possibly he might supply also a copy of his magazine, now called* Computers and People *which he has been producing ever since* 1951.

**Table 1. Predicted Devices and Their Present Status**

| *No.* | 1949 *Prediction* | 1980 *Status* | *Its Name Today* |
|---|---|---|---|
| 1. | Automatic Address Book | Done. | Automatized mailing lists. |
| 2. | Automatic Library | Done. | |
| 3. | Automatic Translator | Done. | World Translation Co. of Canada, e. g. |
| 4. | Automatic Typist | Largely done. | Word processor. |
| 5. | Automatic Stenographer | Beginning. | |
| 6. | Automatic Recognizer | Several elements done, but not most. | |
| 7. | Automatic Controls | Done. | |
| 8. | Weather Brain | Not yet done. | |
| 9. | Psychological Testing | Done. | Automatic diagnosis, drill, . . . |
| 10. | Psychological Trainer | Done. | Computer-assisted instruction |
| 11. | Automatic Production | Done. | |
| 12. | Automatic Modelling | Done. | Models of economies, societies, conflicts, etc. |

□