

SYNOPSIS OF SIXTEENTH ACTUARIAL RESEARCH CONFERENCE*

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Professor Henk Boom is walking very tall these days. After a year of hard work, snafus in the postal services and air travel notwithstanding, he chaired one of the most successful Actuarial Research Conferences ever. The staff of CAAN proudly voted him as "actuarial educator of the year" for his achievement. Well done Henk and kudos to all who assisted you and, in particular, Elias Shiu.

Sixteenth Actuarial Research Conference

"Computers: The State of the Art and Its Implications
For The Actuarial Profession."

held at the University of Manitoba, August 27-29, 1981.

100 ⁺ 2 persons registered for and attended the Conference. The final registration list issued before the conference contained 97 names: 44 persons from the United States, representing 22 different states and the District of Columbia; 4 from Quebec; 25 from Ontario; 1 from British Columbia; and the remaining 23 from the host province of Manitoba. Alternatively, there were 24 academics; 50 from life insurance companies; 4 from other companies; 16 from consulting; 2 from government; and the new research director of the Society of Actuaries. Love those statistics! 22 papers were presented to the Conference from Thursday morning to Saturday noon. These papers will ultimately be published, but in the meantime, persons wanting copies should write to the authors. A brief commentary on the Conference follows.

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Conference co-ordinator, Henk J. Boom opened the Conference at 8:45 Thursday morning in the Senate Chambers of the University, where all meetings were held. Dr. Arnold Naimark, President of the University, welcomed the delegates and, for the benefit of visitors from the United States, he explained that Canada was a country designed to draw on the best aspects of British government, French culture, and American know-how; but somehow had reached a state which appeared to reflect French government, British know-how, and, alas, American culture. This was followed by Robin Leckie, President of The Society of Actuaries (and a former President of the Canadian Institute of Actuaries) bringing welcome from the Society. Robin acknowledged that a few years ago, the Society had been found seriously wanting in its encouragement of research. He expected this to change and pointed to the newly appointed, first Research Director of the Society, James L. Cowen, who was in the audience, as evidence of the new commitment of the Society.

Earl C. Joseph, Staff Futurist with Sperry Univac in St. Paul, Minnesota, gave the keynote address. He traced the various ages of the computer from the hardware age starting around 1950, through the data processing era, the information age, the current software age and, looming in the offing, the people amplification era, the expanding knowledge base and the expert systems era. We should expect a "smart actuary machine." With clinical finesse he laid bare the future. The new information age would find more than 70% of the employed collecting and disseminating information. By 1995 we should expect that in factories the robot population would exceed the human population. In the area of hardware the collection of smart machines would employ talking chips, listening chips, component computers, systems-on-a-wafer, and applications program chips. A typical conversation between a chef and his "smart chef machine" might go like this:

Chef : "Here is a roast."
Machine: "What kind?"
Chef : "Beef."
Machine: "What weight?"
Chef : "Ten pounds." (not metric?)
Machine: "How done?"
Chef : "Medium."
Machine: "What time?"
Chef : "5:30."
Machine: "O.K."
and another superb meal is in process.

Joseph went on to trace this through "smart management machines" and into an ethnotronic (from ethnic and electronic) world. He traced the hardware from chip now, through wafer next, and then to bio-technology, with the latter expanding

capacity by about (1000)³. Everything in Joseph's tone and prediction pointed to a brave new world.

Gordon B. Thompson, Communications Studies, Bell Northern Research, Ottawa followed Joseph. He spoke from the heart. His thesis was that "we take the new wine of this new technology and force it into old conceptual skins." He developed the concept of an "acoustic space" and outlined some of the problems experience with it. Instead of providing a shared space, telephone technology creates a discrete space and augments images of authority. Simply stated: In 100 years we have not yet learned how to use the Telephone properly. How will we fare with all the new technology being made available. He felt that evaluation of information is society's biggest challenge. We are hooked on tangible goods and have lost the concept of what progress is all about. We have the economics of abundance and; as such, the approach must be one of deciding what we want to reject or do not want, in an effort to isolate or get at those things we really want.

Hendrik J. Boom of Concordia University in Montreal presented a paper entitled "The Promise of the Very High Level Language." The thesis in this paper was that the problem was primarily a management problem. The traditional approach is one of a stepwise refinement (also called "divide and conquer"), where the large program, which cannot be adequately managed, is divided into its component parts, with each separate part assigned to a different programmer. The better solution is to write and test out small programs first. Then the approach of the high level language is to provide these general tools, so that the programmer does not write much overhead code to get the larger program running. Higher-level notation can make it easy to write some programs quickly, without specifying excessive detail.

That was Thursday morning. Thursday afternoon followed in due course. We were unable to attend this session so the commentary is taken from, the formal material presented.

Thomas N. E. Greville of the Mathematics Research Centre at the University of Wisconsin presented a paper entitled "A Fortran Program for Generalized Whittaker-Henderson Graduation." This paper presented a FORTRAN program for graduating equally spaced data by a generalization of the Whittaker-Henderson method. The vector v of graduated values is determined so as to minimize a quadratic form $Q = F + S$, where F is an index of fit and S is an index of smoothness. The approach might be used where quantities being graduated are mortality rates by age and the values for an infant ages or extreme old ages (or both) are obtained by a different procedure.

Murray Silver of Temple University in Philadelphia presented a paper entitled "Determining the Interest Rate of an Annuity-Certain." The paper employs closed-form formulas to determine the unknown rate of interest i , given n for an n -year annuity certain. Coefficients of the formulas are determined by computer search, minimizing the error function.

Robert E. Williams of the Mutual Life Insurance Company of Canada in Waterloo, presented a paper entitled "A Corporate Model in APL." The corporate model involves a design which emphasizes the strengths of APL (its ability to handle arrays and its computational techniques; and the ease with which systems may be assembled and programs debugged) and compensates for its shortcomings (documentation for input data and global variables may be inconvenient and/or difficult; and in minimizing nested loops one may wind up with more complex calculations) as a computer language for modelling.

Panel Discussion: Hendrik J. Boom (Concordia University), Albert K. Christians (Gibraltar Life) and Brian J. Fortier (Cologne Life Reinsurance) were the panelists leading the discussion on the topic "Recent Developments in Modern Computer Language."

Gottfried O. Berger of Cologne Life Reinsurance, Connecticut, presented a paper entitled "A Computer Algorithm for Multiple Claims Models." The paper concerned itself with applications of arrays using Laplace transforms, subject to the conditions that: the starting function has a power expansion with known coefficients; and there is no doubt about the convergence of the power expansions of the original function, its image, and all other functions which are created by convolution in the process. These requirements are generally met when dealing with models for rare claims events.

That concluded the Thursday afternoon session.

Edmund C. Berkeley of Berkeley Enterprises in Newtonville, Massachusetts, was our distinguished speaker after the evening banquet. Those of our actuarial readers who recall "The Actuary" of November, 1980, will know that in 1949 he made a dozen major predictions about our computer future and that, by 1979, eleven had been realized. He has written 14 books, of which "Giant Brains or Machines That Think", published by Wiley in 1949, is probably best known. He also publishes five periodicals, from "The Computer Directory . . .", in 1951, to "The Fork River Anthology: Poetry and Sense", which has just been started. For the evening he spoke on the topic "Society, Computers, Thinking and Actuaries" and developed his topic by presenting the following ten propositions and elaborating on them:

- (1) "More than 50 percent of programming by human beings will vanish as computers take over programming."
"Anything that a human mind can think, a computer mind can think also."

- (2) "Every defined intellectual operation will be performed by computer faster, better and more reliably than by a human being." He provided a dozen important features in which the human brain and the computer brain are very much alike, and the last of these was "Both are programmed by a culture."
- (3) "All the language of thought will become calculable like mathematics." Among other comments, he quoted Charles Babbage: "Now in 1981 it is clear that every branch of knowledge from Anatomy to Zoology is organized in the same simple way: a mathematical system."
- (4) "Computers will be able to compute judgement." "Judgement means a decision that one course of action is preferred to another." He referred particularly to the work of Dr. Hans J. Berliner and his program for playing backgammon, coded BKG 9.8, which recently became world champion.
- (5) "Computers will be able to understand any natural language used by human beings beginning with English." Here he cited the work of the World Translation Co., of Ottawa, Canada.
- (6) "Actuaries and not "computer professionals" will become the main guides for society in the wise use of mathematics, probability, and computers for the benefit of man, provided they widen their horizons and choose to do so."
- (7) "The pursuit of truth, common sense, wisdom, and humanity is an appropriate additional mission for the next 100 years of the actuarial profession."
- (8) "Possible implementations of this mission need to be a subject for actuarial study and discussion." "Actuaries do have social responsibilities."
- (9) "The most virulent problem of society currently is control over nuclear weapons and the elimination of nuclear fission energy." Actuaries easily grasp the full truth of the statement: "If my chance of surviving each year of my life is anything less than 1, eventually I will die."
- (10) "It is not right for actuaries and managers in insurance companies to exclude the risks of nuclear weapons, nuclear fission energy, war, and genocide, in (a) policy contracts, (b) thinking and discussion, and (c) political and professional action.
"Let us bestir ourselves and deserve our good fortune to live on this magnificent life - supporting planet."

To the uninformed we proudly say that Edmund C. Berkeley, F.S.A., is an actuary in good standing, among many other noble things.

Friday morning started off with a clatter of words, a flashing of lights and a hi ho! Dinney away.

George R. Dinney of the Great-West Life in Winnipeg is an eloquent speaker and writer, a good showman and, above all else, a person who cannot and should not be ignored. This morning his event was entitled "Life Insurance as a Game." Programmed to the

Apple computer it was a first run of an approach to the "Universal Life" insurance plan approach. He proudly lays claim to parentage over "Universal Life", which he developed between 1962-1965. He acknowledged that there were other sires trying to wrest his baby from him. He took some comfort from Oscar Levant's comment that "Imitation is the sincerest form of plagiarism." His presentation, an amalgam of screened slides, colorful commentary and data presented on five television monitors dispersed around the meeting room, involved a person communicating with the computer to build up, question and answer by question and answer, an individually tailored program of insurance protection and savings. Even in these infant stages, it provided a persuasive and potent approach.

After coffee had had its calming effect we went on with the program.

Kenneth E. Iverson, of I. P. Sharp Associates in Toronto presented a paper (co-authored by Jerry H. Cudeck and James K. Spurgeon of the same firm) entitled "The Contingent Benefits of APL." Iverson is known to most (I will never forget his name, except that a quirk in my mental random access unit made me do this at two critical times in as many days) as the father of APL ("A Programming Language" published by Wiley, 1962) and continues to promote his illustrious child, like a doting parent and with a missionary zeal. Two prime fruits of this Conference were that Iverson also gave a major address to staff and students of the University on Thursday afternoon and his associate, Jerry Cudeck, gave a valuable two-day seminar on Monday and Tuesday following, under the sponsorship of the University and the Actuaries' Club of Winnipeg. Both of these side-shows were very well attended and received. Back to the Conference paper. The paper involved an effort to get the many actuarial users to extend their knowledge of APL and, in particular, to explore its analytical powers in the treatment of actuarial problems. One of the valuable features is its readability. Actuaries often encounter problems with programs written by others. In APL, because of its analytical properties, it is much easier to maintain and extend programs. The authors go on to illustrate this quality of readability.

Aaron Tenenbein, of New York University, New York, presented a paper entitled "Statistical Theory of a Simulation Scheme For Determining the Surplus Needs of a Life Insurance Company." The paper concerned itself with a method for bivariate distributions where complete information is not available. He also distributed copies of two papers: "Simulation of Bivariate Distributions With Given Marginal Distribution Functions" (Tenenbein and Gargano); and "A Bivariate Distribution Family With Specified Marginals." (Johnson and Tenenbein).

C. Glover Anderson of the Manitoba Telephone System in Winnipeg gave a presentation entitled "The Electronic Highway in Manitoba: the Changing Face of Telecommunications." The paper outlined what MTS, a provincial government crown corporation, was currently doing and how it was preparing to meet the challenges of the new technology. A big problem for MTS was the many new companies entering the field and challenging the government monopoly, particularly, since MTS was a closely regulated firm with a system of financing where some lines, e.g. long-distance and colour phones, were subsidizing other lines of business. Understandably, the thrust of competitors was into the more profitable lines. The MTS monopoly was under serious challenge and this made planning difficult.

That concluded Friday morning. Friday afternoon witnessed the introduction of new technology to maintain the order in the Conference. Until now, speakers had been given a five-minute time warning by flashing a cardboard sign from somewhere in the first row of seats. Now a "five-minute" beep-beep and a "time-up" beep-beep was sounded by the chairman's wristwatch. Speakers took this in good humor and in good stride.

Brian J. Fortier of Cologne Life Reinsurance, Connecticut, delivered a paper entitled "Algorithms and Appropriate Technology." He recalled the classic definition of an algorithm as being, roughly stated, a definite procedure, for a definite problem, which terminates in a definite answer or terminates by saying there is no answer. This definition did not satisfy "the travelling salesman problem", which is defined in an algorithm but does not terminate. He suggested that the real algorithm programming language is APL, which is everything that ALGOL should have been.

Albert K. Christians of Gibraltar Life in Dallas presented a paper entitled "Engineering Actuarial Software: A Survey With Examples Based on SOFASIM." The paper surveys developments which have promoted higher software quality and notes the serious consequences which may result from low quality software. He presented four rules of programming: (1) remember that it must serve the human reader, not the computer; (2) match the program to the problem, to promote maintenance and understanding; (3) use structured programming, so that the logic is easily recognized and understood and it conclusively produces satisfying results; and (4) use data hiding, so that each module in the system has access only to that data which it must have to perform its function.

Elmore Jenkins of Valuations, Inc. Illinois, delivered a paper entitled "Program Testing: The Substitution of Demonstrations For Impressions." The paper was concerned with the elimination of errors and distinguished clearly between a process of testing functions and the testing of a system.

Kathryn A. Plante, of the Confederation Life in Toronto presented a paper entitled "A Pade Approximant To The Risk Theoretic Cumulative Distribution Function." The approximation of an unknown cumulative distribution function is identified as the central problem in risk theory. The process outlined produces a numerical method which is very suitable for calculation purposes.

Friday ended with a fine reception, supported by local insurance firms and consultants, and a three-hour filming of a trio of documents relating to "The Silicon Factor."

Saturday morning, the final session, produced a full program and a good attendance.

Thomas N. Herzog of the United States Department of Housing and Urban Development, D. C., presented a paper entitled "Generating Pseudo-Random Numbers in APL." His opening gambit was the comment that "random numbers are too important to be left to chance." (That reminded me that good actuaries and statisticians go to great pains to obtain "a carefully selected random sample.") The paper suggests that APL is a powerful tool for solving actuarial problems. It goes on to suggest improvements in generating pseudorandom numbers for Mone Carlo type problems and an "optimum" procedure for generating pseudorandom normal deviates in APL.

David W. Erbach of the Great-West Life in Winnipeg delivered a paper, co-authored by Rama R. Kocherlakota, entitled "Equilibrium Conditions of Universal Life Insurance Under Existing Economic Circumstances." The paper developed from the observation: "The life span of a company which does not keep up with the times is a good deal less than the lifespan of many of their policyholders."

S. Amir Bukhari of the University of Manitoba in Winnipeg presented a paper entitled "Micro-Processor Data Network Environment." The paper examined the design and protocol issues in implementing data bases on microprocessors in office environments. First, the three data models - relational, hierarchical and network - were reviewed and compared with each other. The capabilities of microprocessors were examined and a data model was suggested for implementation. Current developments in data networks were examined and questions of protocol and network technologies were considered. Design methods suitable for implementing such systems were presented. The use of formal methods of system description and design were highlighted and illustrated by examples.

Frank G. Reynolds of Waterloo University in Ontario delivered two papers. The first was entitled "Reform of Actuarial Notation". The paper traces development and change over the years. It concludes that in the past 15 years "the simplicity, elegance and clarity" of our existing system have been displayed to the best advantage, but, unfortunately, changes are in the offing: possible,

but unlikely, is that technological advances will serve to enshrine the present system; a computer compatible language could be developed over the next 5 to 10 years; or, and unlikely, in the near future, a linear machine-compatible universal notation will be developed. His second paper was entitled "Control of Line Transactions." This paper concerns itself with the problems of minimizing human errors when companies convert to on-line transactions processing. It traces various transactions and concludes that comparison of the movement of the reserves and the accounts provides a good, basic check for completeness and for the accuracy of manual processing.

Witold Kinsner of the University of Manitoba, Winnipeg, presented the final address of the Conference, entitled "Magnetic Bubble Memories and Their Application." (From the description of the technology and, doubtless, a Freudian response, I was sorely tempted to substitute "Mammaries" for "memories" in the title. Decorum and decency prevailed.) The presentation traced the development from 1961, in Holland, through 1967-1973 at the Bell Labs, and through to today. The technology is currently expanding explosively and some established companies are leaving the field whipped like whimpering puppies, with other rushing in to fill the void or take the lead. Magnetic bubbles are non-volatile, which means the data is not lost when the power is cut off. It is now possible, for the first time, to build a storage unit with greater capacity and smaller volume than the human brain (capacity estimated at 100 European billion bytes). Functions related to bubble technology are: generators; propagators; detectors; annihilators (bubble eaters that "bite at the bubbles"); transferors; and implications. The University of Manitoba is directing research into the first three functions. He concluded with a comment that might have served as the Conference theme: "Whatever can be done by machines should be done by machines, as a matter of reliability, productivity and cost."

Arnold Shapiro, the Actuarial Research Conference Chairman, from Pennsylvania State University, closed the Conference with a vote of thanks to Conference co-ordinator and host, "Henk" Boom, and the comment that this was the best conference he had attended. He also announced that the theme of the 1982 Conference was likely to be "Estimation of Mortality and Other Decrement Rates" and would be hosted by either Waterloo University or the University of Wisconsin, around the same time in August, next year.

All in all, a jolly good show.