



SOCIETY OF ACTUARIES

Article from:

The Actuary

July/August 1989 – Volume 23, No. 7

Speakers examine actuarial foundations

Speakers Hans Buhlmann, Ernest J. Moorhead and James A. Tilley examined the foundation of ideas and concepts that make up actuarial science during the general session, "The Challenge from Within," moderated by James C. Hickman, at the Centennial Celebration June 12. Buhlmann is President of the Federal Institute of Technology in Zurich. He also is the Honorary President of the Swiss Association of Actuaries and editor of the ASTIN Bulletin. Moorhead, now retired, is a former President of the Society of Actuaries and the American Academy of Actuaries and author of the recently published book, *Our Yesterdays: The History of the Actuarial Profession in North America, 1809-1979*. Tilley is Managing Director of Morgan Stanley & Co.

The following are edited excerpts from each speaker's presentation:

Buhlmann on risk and uncertainty

"If you want to control risk, you have to do the underwriting properly. If you want to control, also, uncertainty, you have to come out with additional tools, and the tools they designed...are called experience rating and...credibility theory. And may I say it here, credibility theory is really the most prominent contribution American actuarial science has given to the whole world of actuarial science."



Hans Buhlmann

"The question must be asked, why such crude mechanisms for financial risk? The answer is, of course, here. First, the mathematical treatment is very difficult. Second, errors in the model are very costly because if your model is wrong here, you go completely wrong. There is no law of large numbers on the financial side."

"What I'm going to say now is probably the most important development of our profession that we should

recognize right now...In 1972, the famous Black Scholes formula was published. And, the basic idea inherent in that is so powerful that our profession must (a) learn it and (b) also associate its ideas into [our] tool kit."

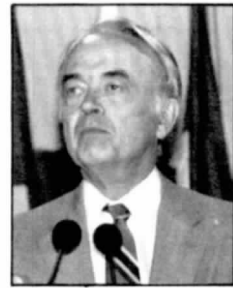
"Let me summarize how I see the development of our profession. In the 17th century the profession started on the model as developed by Halley by his table of mortality. The actuaries growing out of this, I would call the actuaries of the first kind, or the classical actuary. Sometime, in this century, the first miracle of the actuarial profession did happen when actuaries learned how to control uncertainty on the risk side. And from this, the actuaries of the second kind emerged.

"The second miracle is the one I just told you about, the development on the financial side, that provided completely new tools to be incorporated into our profession, and I think this will produce the actuary of the third kind."

Moorhead on history

"By way of contrasting the economic constancy of olden days with the dizzying times that actuaries now cope with, our founding fathers, in 1889, established annual dues of \$10 with zero meeting registration fees. Sixty years later, when the Actuarial Society's affairs were wound up, the annual dues were still \$10, and there was still no registration fee for meetings. One wonders, though, whether the interests of the profession might have been better served by a somewhat higher dues scale, particularly after the inflation of World War I. I certainly think that a student nowadays can see ways in which that money could have been wisely spent to the benefit of the profession of the day and of the future."

"As the 20th century dawned, thoughtful actuaries already knew that the extravagances and related misdeeds of, in particular, three leading New York life companies, would arouse public retribution. The Armstrong Investigation in 1905 gave the young Actuarial Society its first big opportunity to exert its influence outside the circle of its own members. They made excellent use of it. Twenty-



James C. Hickman

six members meeting unofficially — the Society had bound itself constitutionally to entertain no resolutions expressive of opinion — found themselves like-minded in their objections to several proposed legislative remedies and were successful in heading off all but one of these. They had, moreover, the great advantage that the Investigating Committee's consulting actuary, 43-year-old Miles Menander Dawson, who had qualified by examination as a Society Member only two years previously, was one of the wisest and most open-minded of that or any other generation of actuaries."

"Between 1909 and 1916, the operative word was 'proliferation.' The American Institute of Actuaries in Chicago, the Casualty Actuarial and Statistical Society in New York, and the Fraternal Actuarial Association in Cleveland destroyed the professional unity that we have since struggled vainly to retrieve. The leaders of the Actuarial Society were not entirely to blame for this — the American Institute was formed by actuaries of companies either quite recently organized or converted from the assessment to the level premium system, and laws in many states prevented life companies from writing casualty insurance. The actuaries of fraternal societies might have been brought under the umbrella of the American Institute but there is no record that this was considered by either of those parties."

"Then in 1914, the time when the need for actuaries was not obvious to the managements of casualty insurance companies, the daunting specter, social insurance, became reality in the form of mandatory workman's compensation insurance in several states and in Canada."

Tilley on actuarial models

"My paper is essentially an essay on mathematical ideas. It is among other

Foundations cont'd

things, however, an exhortation to actuaries, including all of you in the audience, to step away from your current problems and to bend your minds away from the traditional channels of actuarial thought...and to search for the common elements of actuarial models. The reason for searching for common elements is that if we are able to find them, then we can sensibly decide how our future may evolve. If we understand our current problems in a common enough framework, we may reasonably make extrapolations that can stand the test of time."

"...We may need to expand our models from their purely actuarial aspects and to include nonactuarial aspects. Indeed for many of the problems — the difficulties with our system of tort law, the providing of healthcare to people of all ages, inflation protection, retirement benefits and, particularly pressing right now, the problem of AIDS — ...the nonactuarial elements may, in fact, be the most pressing."

"...We ought to adopt a more systematic approach when we look at actuarial problems...The place to start is to realize that many, if not all, of our actuarial ideas really are expressions of the dynamics, the time evolution of systems, and are embodied in equations of motion, and emotion as well, I suppose."

"The formal mathematical study of equations of motion is known as systems dynamics. There is input to the system, the system itself is represented by some kind of process in a black box, equations of which really characterize the system, and out of the system emerges output."

"A slightly more complicated version of a system recognizes that one can impose some control over the input before we let the process have at it, and that, in turn, will modify the nature of the output."

"And all of this leads more generally to a very fundamental question... of stochastic versus deterministic behavior. The real importance in the study of chaos or...just nonlinear dynamics, is...whether the behavior you're looking at is governed by deterministic equations of motion or is actually fundamentally random, fundamentally unpredictable. And what's really interesting is that a lot of behaviors one sees in the world, although they have the appearance of randomness and of unpredictability,



James Tilley

when you look a little closer, you find a great deal of the purported unpredictability, or variation, is actually explainable by nonlinear phenomena, nonlinear deterministic phenomena."

"...Black Monday, in October 1987, for the global stock markets gave a real shot in the arm to chaos theorists. It's very difficult to believe how that kind of behavior could emerge from a true random walk or any of the other forms of purely stochastic models. But it's not the least bit difficult to see how that kind of behavior can emerge and, in fact, emerge a little more frequently than those of us would be comfortable with from a nonlinear dynamics model."

"...If artificial intelligence, particularly voice recognition and other aspects really develop...I can imagine myself, I don't know whether it's the

year 2025 or 2050 or a little later than that, but I can imagine myself sitting down with my computer. [I'd be] talking to it about the problems I want to work on in...very complicated systems with a lot of interrelated elements, actuarial and nonactuarial elements, and explaining what I thought about the interrelations and explaining what things that I felt really had to show up as output to be useful. And, I can then imagine the computer drawing on the results of other disciplines and having a dialogue with me and, together, getting to a point that makes a lot of sense. I expect that that won't come early, and it may not come in my lifetime."

"Nonlinear dynamics may challenge us to rethink the fundamental issue of stochastic versus deterministic models. But in any event, whether that happens or not, the importance of mathematics of financial economics will cause actuaries to become skilled in the theory of stochastic processes. Without significant advances in computers...particularly artificial intelligence and voice recognition, actuarial science probably will not evolve to its potential...I have no doubt that a successful future in actuarial science depends on borrowing concepts and mathematics from other disciplines."

More than 1,200 actuaries and 500 accompanying persons attended the Centennial.

