THANK YOU, DR. SHANNON

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Edmonton should have been ablaze with lights and, indeed, it was, as it always is. The reason for illumination nominally is for promoting law and order in the city and its suburbs, but it should have been a hero's welcome for Claude Shannon, who attended the Sixth World Computer-Chess Championship as a guest. And there he was with us attending almost every session, quietly, looking very much the ordinary citizen, invariably accompanied by his wife, not looking impregnable or idiosyncratic and seemingly much younger than his 75 years. You could touch him, in a manner of speaking, and indeed he spoke and addressed us all, tersely, sparringly and with much good sense.

Programming the unprogrammable

To your Editors, who may have the advantage of years over many of their readers, it was an experience almost as incredible as would have been meeting Newton or seeing Einstein resurrected. Looking back, the incredibility only increases with hindsight. We have worked it out: his fundamental contribution to chess programming was published in 1950. It was first presented as a speech he delivered at the National IRE Convention on March 9, 1949, New York, and therefore it was conceived in 1948 or even before. The article itself carries the date of October 8, 1948.

To our students, programming comes as a second nature. At worst they do it in FORTRAN, at best, they do it in what is termed a fourth-generation language. In effect, we teach them to program in terms of concepts and all the niggling details of how to extract information from a database, or how to take care of conversion between datatypes (if allowed at all) are taken care of by their kindly system. Rightly so, but we cannot refrain from adding that they are a molly-coddled lot. Speaking frankly, even with all these aids the concepts do not always come out very clearly. Now let us hark back to the late 1940s: a computer then was not programmable in any reasonable sense. Compilers were still a long way off and everything you wanted your operators to do had to be spelled out in fantastic detail, necessitating perhaps twenty words to perform a long division. Floating-point notation, the mainstay of so many present-day micros, was in its infancy and anybody venturing to use it was punished by being saddled with, at least, a few hundred words of additional programming gobbling up perhaps up to a quarter of available memory. In short, and to reiterate, in the late 1940s there were no decently programmable computers as our students would now consider them.

Yet in those days Shannon pondered computer-chess theory and considered a computer, in the abstract, as a programmable machine, capable of doing anything one could formulate. He then surprised our world by neatly formulizing three strategies, quoted as fundamental for the forty years to come. All serious workers still cite his 1950 article, with the minor change that the type-A and type-B strategies still bear their original names, whereas current usage has it that his 'Another type of Strategy' has meanwhile been termed a type-C strategy by universal consent.

All this and information theory to boot

Had this been all, he would have gone down in history as the grandfather, nay, the archetypal orginator of what you can buy in the shops as chess-playing automata.

Of course, as many of us know, this was *not* all. Claude Shannon's true fame, so they say, rests on information theory which he founded single-handedly. Mathematics, especially applied mathematics, as now embodied in commercially-available chips is indebted to Dr. Shannon. Commercially-available chips use cleverly and compressively his results; let it be sufficient to mention that one of his papers in the field has been suppressed for more than a decade by a national security agency, because it stated in a few well-chosen words, supplemented by a few easily-understandable formulae, the basics for constructing and decoding ciphers.

Here again his vision was breathtaking. The premier article published has spawned a rich progeny· large areas of statistics have been recast in terms of his information theory – to those in the know a brief mention of Doob's (1952) book is sufficient All measures of uncertainty were reduced to bits, conceptually sent over through noisy but domitable channels which Dr Shannon first envisaged.

Ciphering while juggling

The results were as profuse as they were unexpected. We now know that an English letter, some hundreds of which you have been consuming now, has an information content of about 1.3 bit at most, whereas present-day facilities still use eight-bit for the same purpose. This, in itself, is a rare achievement, but it falls far short of even touching upon Claude Shannon's versatility. He was the first to conceive of a mechanical mouse, threading its labyrinthine way through maze upon maze, punningly called it Theseus after the mythical Athenian hero who was guided through the pristine labyrinth by Ariadne, his paramour in prehistoric Greece.

To revert to chess, Dr. Shannon also conceived and implemtented an endgame automaton which is now admitted not to have been playing perfectly but at least well enough to confront IGM Edward Lasker with a few hard puzzles to solve.

In fact, AT&T Bell Laboratories looking back over 55 years of their Engineering and Science in the Bell System (1925-1980), went on record that Shannon's ideas were seminal to their chess-playing computer Belle which from 1980 onwards has won National Computer-Chess Championships and the World Championship (Millman, 1984).

Needless to say, many honours have been awarded to Dr. Shannon, they are literally too numerous to mention them all and the only thing one may regret is that there is no Nobel prize for, roughly speaking, the programming sciences. Otherwise we believe he would have been the first candidate, easily, and by far outpacing any conceivable competitor. Among the honours that have been received by Dr. Shannon are the Alfred Noble Prize of the American Institute of Electrical Engineers, the Morris Liebmann Award of the Institute of Radio Engineers, the Stuart Ballantine Medal of the Franklin Institute, the Research Corporation Award and the Science Trailblazer Award from the Detroit Science Center to mention a few ones.

Nor would it be correct to present the Shannon we had in Edmonton, Alberta, as a dry-as-dust theoretician, exulting in formulae such as

$$H = -\sum_{i=0}^{n-1} p_i \log_2 p_i .$$

Far from it. He took a personal delight in sleight-of-hand, notably in juggling, keeping *n* balls in the air at the same time as performed by a human being. In proof of which we can offer only a picture of his personal delight and a Ph D. thesis (Beek, 1989), in which his is quoted with due respect, but we believe, with some trepidation for his contribution to the mathematics of . juggling.

Edmonton's lights shone. To us, due to Dr. Shannon's presence at the Sixth World Computer-Chess Championship, it shone with an increased brilliance: sufficient reason for all close to the computer-chess community to believe that they shone the brighter.

Editor's Note

Had Dr Shannon's articles been as inaccessible as those of the one by Komissarchik and Futer (1974), we would have been proud to have been published at least his 1950 paper on Programming a Computer for Playing Chess. However, even to those deprived of a comprehensive library this paper is now easily within reach in the book by Levy (1989, pp. 2-13). Hence, we refrain.

References

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Photo by Jos Uiterwijk.

DR. SHANNON TESTING HIS COMMON EQUATION OF JUGGLING.
Being in the know that time is invariant under the transformation to be used.
(Edmonton, Alberta, 1989)