

The George Boole Foundation

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George Boole

George Boole 1815-1864

George Boole was born in Lincoln, England in 1815 and he died in Cork, Ireland in 1864.

In a book he wrote entitled, "The Laws of Thought", published in 1854, he described how humans deduce and make decisions. He also set this out as a practical mathematics of logic and probabilities. This work provided the rationale and methodology for reducing complex logical relationships to simpler sets of relationships which can reproduce all of the possible relationships from which the set was derived. This process is known as Boolean reduction. Boolean reduction is used to reduce the size and complexity of complex digital logic designs to produce workable logic designs for circuits for digital devices. The success of modern digital circuitry manufacturing, including micro-devices and the computer industry based upon these, rests directly upon the practical utility of the mathematics developed by George Boole.

George Boole's objective in developing this approach to logic was to explain how individuals use information and knowledge to deduce and take decisions. He succeeded in establishing, some 150 years ago, a practical basis for designing expert and knowledge based systems.

Boolean Logic and Human Intelligence - How we deduce things...

Artificial intelligence and knowledge engineering are considered by some to be recent concepts. However, George Boole's contribution to this sphere of endeavour is indisputable. Indeed his stated objective in developing his logical methods was to demonstrate that it was possible to formalise how humans deduce; how we think. This amazing quest and its completely successful conclusion is set out in his book, "The Laws of Thought on which are founded The Mathematic Theories of Logic and Probabilities" published in 1854.

In his own words, Boole wrote,

"The design of the following treatise is to investigate the fundamental laws of those operations of the mind by which reasoning is performed; to give expression to them in the symbolical language of a Calculus, and upon this foundation to establish the science of Logic and construct its method; to make that method itself the basis of a general method for the application of the mathematical doctrine of Probabilities; and finally, to collect from the various elements of truth brought to view in the course of these inquiries some probable intimations concerning the nature and constitution of

the human mind."

George Boole could not have been aware of the digital revolution to come but he did, with intent, address the fundamental issue of how to codify how humans think. This also created the method to identify precisely fundamental messages, common to a very large range of events. This Boolean Logic "reduction" was what Claude Shannon recognised to provide the very method for building better digital devices which in themselves could simulate human intelligence.

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Boolean Logic in the Digital World - The essential contribution of Claude Shannon



Claude Elwood Shannon
1916-2001

There is no doubt that the person who was instrumental in pointing out the importance of Boole's mathematical logic to digital systems, was Claude Shannon. Claude Shannon was born in Petoskey, Michigan, USA in 1916. He graduated from the University of Michigan in 1936 in mathematics and electrical engineering. In 1940 he gained a masters in electrical engineering and a Ph.D. in mathematics at MIT. Claude Shannon died in 2001

Although broadly appreciated for its brilliance, Boole's work had found limited practical application. However, in 1938 Claude Shannon published a paper, based on his 1937 thesis, entitled, "A Symbolic Analysis of Relay and Switching Circuits" where he explained how Boolean Logic could contribute to a more efficient circuit design. This seminal work launched Boolean logic into the digital world.

It is intriguing how the personal abilities of Shannon were such that, with the combined expertise of electrical engineering and mathematics and having studied Boolean Logic as an undergraduate, he was able to correctly identify the contextual significance of Boolean Logic. In doing so he made a vital contribution to the efficiency of circuit design based on Boolean logic and accelerated the world's entry into the digital era as we know it today.

An interesting paper entitled "1+1=1 a tale of genius" was written by Ian Petticrew who was the editor of the INTOSAI Magazine which is hosted on the web site of the National Audit Office (INTOSAI - International Organization of Supreme Audit Institutions) and describes in more detail the linkage between George Boole's and Claude Shannon's work.

This paper, from Issue 18, August 2003 of the INTOSAI IT Journal, is available in pdf format and can be accessed on this link: http://www.intosaiitaudit.org/intoit_articles/18p54top59.pdf

25th February, 2010