THE GREATNESS OF GEORGE BOOLE

By
William Reville, University College, Cork.

George Boole (the Father of Symbolic Logic) was probably the most illustrious academic who ever worked at University College, Cork (then Queen's College, Cork). He was not only a mathematical genius but also a fine humanitarian. A strong minded individual, he was prepared to engage in protracted and bitter arguments with academic colleagues. His revolutionary advances in mathematics are today fundamental aspects of computer science and electronics and his Boolean Algebra is used to design and operate computers and other electronic devices. The definitive biography of Boole is 'George Boole: His Life and Work', by Desmond MacHale, (Boole Press, 1985).

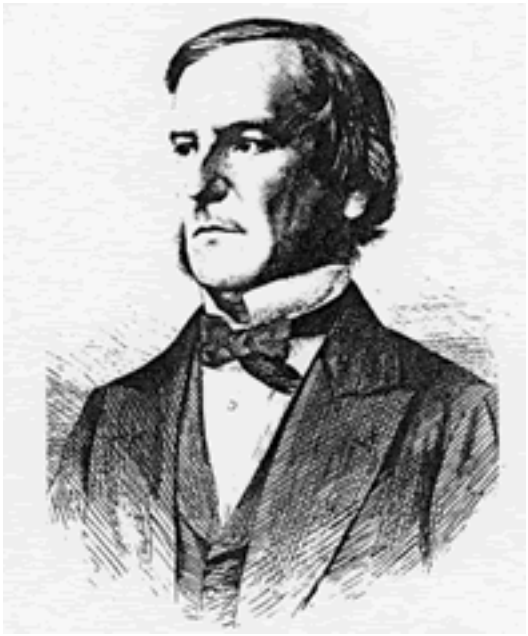
George Boole was born in Lincoln, England in 1815. The family economic circumstances were very modest - his father was a struggling shoemaker and his mother a lady's maid. His father was also an amateur scientist and instrument maker, and together with his son made many fine scientific instruments.

Intellectually, George was a child prodigy. He started school at the age of 1½. There is a lovely story of how he went missing one day at the age of 2½. After much searching he was found in downtown Lincoln in the middle of an excited crowd. Individuals in the crowd were shouting out difficult words to the child as a spelling test. George was fluently and correctly spelling the words and being showered with coins in reward.

George was a voracious reader. He had mastered Euclid by age 11, and he taught himself Greek and Latin, and later French, German and Italian. At the age of 13 he began a couple of years of secondary education at a small commercial school.

When George was 16 his father went bankrupt, forcing the boy to withdraw from formal education in order to work to support the family. All of his further education was self-taught. He worked as an assistant in several teaching positions and eventually opened his own school in 1834.

During his teaching career in Lincoln, Boole became deeply involved in social causes and adult education. He was a founder of The Female Penitents Home whose function was the rehabilitation of prostitutes. He was also deeply involved in The Mechanics Institute, whose function was to facilitate poor people to educate themselves. Public Lectures were given in the Institute, many by Boole himself. (We therefore felt it appropriate to call our 1995 UCC Public Lecture Series, to commemorate UCC 150, The Boole Public Lecture Series).



George Boole

Boole first became interested in mathematics as a tool to solve mechanical problems in instrument making. His interest quickly blossomed and he began an elaborate project of self-education in this area. In 1838 he wrote his first mathematical paper. In 1841 he founded a new branch of mathematics called Invariant Theory, later to inspire Einstein. He was awarded the first Gold Medal of The Royal Society of London in 1844 for a paper on Differential Equations whose methods are still used today.

But the work that stamped Boole as a mathematical genius was his contribution to mathematical logic and probability. He may have been motivated here by his intense religious convictions. At the age of 17 he had a mystic experience in which he felt God called on him to explain how the mind processes

thought. He decided to do this in a mathematical form, for the Glory of God.

Boole proposed that logical propositions should be expressed as algebraic equations. The algebraic manipulation of the symbols in the equations provides a fail-safe method of logical deduction, i.e. logic is reduced to algebra. Boole replaced the operation of multiplication by the word 'and' and addition by the word 'or'. The symbols in the equations can stand for collections of objects (sets) or statements in logic. For example, if x is the set of all brown cows and y is the set of all fat cows, then x+y is the set of all cows that are brown or fat, and xy is the set of all cows that are brown and fat.

Let z = the set of all Irish cows. Then z(x+y) = zx+zy; in other words 'the set of Irish cows that are either brown or fat is the same as the collection of cows that are Irish and brown or Irish and fat'.

Boolean algebra provides the basis for analysing the validity of logical propositions because it captures the two-valued character (binary) of statements that may be either true or false. Boole had discovered a new kind of mathematics that would later turn out to be ideal for the manipulation of information within computers. Also, much of the 'new maths' studied today by schoolchildren stems from Boole's work.

In 1937, a number of workers noticed that Boole's two valued logic lent itself to a description of electrical switching circuits. They showed that the binary numbers (0 and 1), combined through Boolean algebra, could be used to analyse electrical switching circuits and thus used to design electronic computers. Today, digital computers and electronic circuits are designed to implement this binary arithmetic.

As Boole's reputation grew, he became confident enough to apply for university posts. When the Queen's Colleges were founded in Ireland in 1845 he applied for a Professorship and he was appointed to Queen's College, Cork (now UCC) in 1849 as Professor of Mathematics. Not bad for a man who had little or no formal secondary education and no degree.

In 1854 Boole married Mary Everest, niece of Sir George Everest, after whom the mountain is named. Boole's marriage was very happy and the couple produced 5 daughters. In addition to his university teaching and research, Boole was also active in Adult Education in Cork.

By the mid 1850s the fortunes of the university had declined. There was dissatisfaction amongst the staff with the policies of the College President, Sir Robert Kane. Boole opposed Kane. He wrote vitriolic letters to the newspapers complaining about Kane, and Kane replied. A Royal Commission was set up to investigate affairs. Kane was forced to change his ways, but Boole was admonished for washing dirty linen in public.

Let me digress briefly to say a word about rows in the academic world. There is a feeling abroad that such rows are more bitter than are rows in other professions. I suspect that there is some truth in this, but I have never worked outside the university, so I cannot be sure. There are several reasons why quarrels between academics might be particularly bitter. There is some wisdom in the oft-quoted sneer made by Henry Kissinger - 'University politics are vicious precisely because the stakes are so small'. Academics in general, in my experience, are too eager to quarrel amongst themselves and far too reluctant to stand up for the legitimate interests of the university when these are attacked by outside bodies. Let me therefore propose an alternative version of the Kissinger quote - 'Rows amongst academics are so vicious precisely because they are the only rows they allow themselves'.

Boole wrote his most famous work 'An Investigation of The Laws of Thought' in Cork. Apart from his famous work on mathematical logic and probability, he also made notable contribution to the development of calculus. He was awarded many honourary degrees and awards. In 1857 he was elected a fellow of the Royal Society of London.

Boole died prematurely in 1864 from pneumonia developed as a result of a wetting. He is buried in the churchyard of St. Michael's Church of Ireland, Blackrock, Cork.

A window, The Boole Window, was installed by public subscription in the Aula Maxima at UCC. Recently the new Boole Library and Boole Lecture Theatre complex at UCC were named in his honour. However, his most enduring legacy will be that whenever the subjects of Mathematics, Electronics, Logic, Information Theory, Cybernetics and Computer Science are taught, his name will be remembered for his beautiful, simple and universally useful theories.

(This article first appeared in The Irish Times, May 20, 1996.)