Professor W. T. Tutte
Mathematician and Bletchley code-breaker
09 May 2002

William Thomas Tutte, mathematician and cryptographer: born Newmarket, Suffolk 14 May 1917; Fellow, Trinity College, Cambridge 1942-49; Lecturer, then Associate Professor, University of Toronto 1948-62; FRSC 1958; Professor of Mathematics, University of Waterloo, Ontario 1962-85 (Emeritus); FRS 1987; OC 2001; married 1949 Dorothea Mitchell (died 1994); died Waterloo, Ontario 2 May 2002.

W. T. Tutte will take his place in history for two reasons. First, as part of the now-famous code-breaking team at Bletchley Park, he made a significant individual contribution to the outcome of the Second World War. Secondly, he formulated and proved many of the theorems that form the foundation of the mathematical study of networks which we now call graph theory.

In both cases his achievements resulted from very deep insights into matters that, at first sight, might be thought simple. Paul Erdös, one of the 20th century's greatest thinkers, admitted that in the 1930s he had failed in his attempts to solve two of the major problems later settled by Tutte.

William Thomas Tutte was born in Newmarket, Suffolk, in 1917. In the library of his secondary school, the Cambridge and County High School, he discovered W.W. Rouse Ball's book Mathematical Recreations and Essays, in which he read about two results (the Five-Colour Theorem and Petersen's Theorem), both of which were to figure largely in his life's work. Although he went up to Trinity College, Cambridge, to read Natural Sciences, specialising in Chemistry, he also joined the Trinity Mathematical Society, where he met R.L. Brooks, C.A.B. Smith and A.H. Stone. The story of their work on the problem of "squaring the square" - the division of a square into unequal smaller squares - has been told many times: a problem in recreational mathematics led to connections with electrical networks, and thence to mathematical results that have wide-ranging applications.

The paper on squaring the square was published in 1940 in the Duke Mathematical Journal. By that time Tutte had completed his degree and been called up for national service. After initial training he arrived at Bletchley Park in Buckinghamshire in May 1941. He was one of many who regarded signing the Official Secrets Act as a lifelong obligation, and when stories of the great deeds done at Bletchley began to leak out, he did not immediately leap on the bandwagon. It was probably a relief to him when, in the 1990s, it became clear that at least some of the secrets were no longer official.

At his 80th birthday celebrations in 1997 he felt able to tell me some of the details, and in 1998 he gave a talk entitled "Fish and I" (now available on the internet). He tells how, others having failed, he was asked to work on the cipher system, known in Britain as "Tunny", used by the German Army High Command. He had an idea and, although not optimistic, he "thought it best to seem busy". So he copied out the ciphertext onto

squared paper, using chunks of various lengths, noticed certain patterns, and was able to infer the structure of the system.

The success of Bletchley as an institution was partly due to the fact that the powers-that-be were not stupid, and soon many people were helping to work out the implications of Tutte's discovery. This continued throughout 1942 and 1943, with regular upgrading of the techniques to deal with improvements in the system. Eventually it became necessary to use a form of number-crunching statistical analysis, and Tutte saw how this could be done. He reported his ideas and, in his own words, "there were rapid developments". The outcome was that the famous Colossus computer was deployed on these problems.

At the end of the war, Trinity College elected Tutte to a Research Fellowship in Mathematics. Exactly how this came about is unclear. C.A.B. Smith recalled being stopped in the street by a Fellow of Trinity, who said "We've just elected Tutte to a Fellowship but we don't know what he has done or where he lives." The period at Trinity was a highly productive one. Tutte's PhD thesis contained many seminal ideas, and these were published in papers that quickly established graph theory as a significant area of mathematics, with Tutte as its master builder.

Later, in his book Graph Theory as I Have Known It (1998), he gave a fascinating account of how he arrived at many of these fundamental results. Perhaps not surprisingly, it was often by a process that offered an intellectual challenge rather than a guarantee of success.

In 1948 Bill Tutte took up a post at the University of Toronto. Here he continued to produce a stream of new ideas and, rather unexpectedly, for he was a very shy man, he got married. His wife Dorothy would bemoan the fact that weekends had to be spent on research, because Bill feared that mathematical inspiration would dry up before he was 40 (at least, that's what he told her).

In 1962 Tutte was persuaded to move to the new University of Waterloo in Ontario. By this time his eminence was being recognised internationally. The university created around him a world-famous Department of Combinatorics and Optimisation, and was instrumental in the foundation of the Journal of Combinatorial Theory. Tutte himself was not an administrator, but he supported and encouraged those whose talents lay in that direction, and his placid temperament helped to calm the troubled waters that sometimes threatened his department.

By the 1970s the growth of air travel meant that Bill and Dorothy Tutte were able to travel extensively, and they returned to England on several occasions. In 1971 he was the principal guest at a small conference held in Royal Holloway College, London, and the success of that meeting led to the establishment of the continuing series of British Combinatorial Conferences.

He retired formally in 1984, but continued to be active in mathematics. In his quiet way he enjoyed the recognition that accompanied the growth in popularity and status of graph

theory, the subject he had built. Outstanding mathematicians were attracted to work in this field, many of them inspired by Tutte's earlier results. It was proper that his 80th birthday should be marked by a celebration in Waterloo, where he was able to talk about his work to an audience that fully appreciated what he had achieved.

Norman Biggs

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