

Maxwell (Max) Herman Alexander Newman¹

Born February 7, 1897, Chelsea, England; died February 22, 1984; leader (?f the Enigma codebreakers at Bletchley Park during World War II, whose group developed the concept of Colossus; later worked on the Manchester Mark I computer.



1970.

Education: BA and MA, St. John's College, Cambridge, 1924.

Professional Experience: Cambridge University: fellow, St. John's College, 1923-1945, university lecturer in mathematics, 1927-1945, honorary fellow, St. John's College, 1973-1984; Manchester University: Fielden Professor of Mathematics, 1945-1964, professor emeritus, 1964-1984; visiting professor, Australian National University, 1964-1965 and 1967; visiting professor, University of Warwick, and Michigan State University, 1964-1969; visiting professor, University of Wisconsin, Madison, University of Utah, and Rice University, 1965-1966; George A. Miller Visiting Professor, University of Illinois, 1969-

Honors and Awards: fellow, Royal Society, 1939-1984; president, London Mathematical Society, 1950-1952; president, Mathematical Association, 1960; De Morgan Medal, London Mathematical Society, 1962; Sylvester Medal, Royal Society, 1968; DSc, University of Hull, 1968.

Maxwell Herman Alexander Newman, known to all his friends as “Max,” was born in Chelsea, London, on February 7, 1897, and died on February 22, 1984. His family name was originally Neumann, his father having come from Germany. Max changed his name by deed poll in 1916.

He went to school in Dulwich from 1904 to 1908 and from there to the City of London School. He went up to Cambridge in 1915, having won an entrance scholarship to St. John's College. He remained in residence till December 1916, and then spent the next three years in various forms of national service, including service in the British Army as a paymaster and a stint as a schoolmaster at a school in Epping Forest.

Newman returned to Cambridge in the autumn of 1919. In 1921 he was a wrangler in part II of the mathematical tripos, obtaining a distinction in what was then the equivalent of part III. He was elected a fellow of St. John's College in November 1923, and retained that position until 1945. He had spent the year 1922-1923 in Vienna, where he was strongly influenced by Reidemeister, among others. He was appointed university lecturer at Cambridge in 1927. He visited Princeton as a Rockefeller Research Fellow in 1928-1929 and returned, to the Institute for Advanced Study, in 1937-1938. The School of Mathematics was, at that time, still housed in Fine Hall, and it is interesting to remark that, on the list of permanent and visiting members of the institute, Max Newman's is the only name carrying the simple prefix “Mr.”

In September 1942, Newman joined the Government Code and Cipher School (GCCS) at Bletchley Park and remained there for the rest of the war. He was in charge of a section concerned with the machine decipherment

¹ Changed by deed poll in 1916 from Neumann.

of secret German signals. The machines in question (the Bombe and the Colossus) may not inaccurately be described as the forerunners of today's computers.

In September 1945 Newman, already released from his war service, resigned his Cambridge positions to take up his appointment, in succession to Mordell, as Fielden Professor of Mathematics in the University of Manchester, and remained there till his retirement in 1964. During that time he built up a very strong research department and also played a major part in ensuring the university's leading role in the design, development, and scientific utilization of the computer. Not least of his achievements in this direction was his appointment of Alan Turing as reader in mathematics in October 1948.

Newman was largely instrumental, with Hodge and Whitehead, in launching the British Mathematical Colloquium, an institution of vital significance to the mathematicians of the UK. The inaugural meeting of the colloquium was in Manchester in 1949, and Newman was able to call on the cooperation of the members of his department, especially Walter Ledermann, to ensure the success of the enterprise.

In 1962 Newman gave an invited address to the International Congress of Mathematicians, which met in Stockholm in that year. It should be emphasized that such invitations are made in recognition of current work, not past achievements, so that it was a rare event for such an invitation to be received by a person at the age of 65.

On retirement, Newman spent three years (1964-1967) as visiting professor; the first and third years he was at the Australian National University, at the invitation of his erstwhile Manchester colleague, Bernhard Neumann, while the year 1965-1966 was spent at Rice University in Houston, Texas. During this period he remained active in research.

Newman was elected a fellow of the Royal Society in 1939, and was awarded the Sylvester Medal in 1959. He was president of the London Mathematical Society for the years 1950-1951 and was awarded the De Morgan Medal in 1962. He was president of the Mathematical Association in 1959. In 1968 he was given the honorary degree of DSc by the University of Hull, and in 1973 he was elected to an honorary fellowship of his college, St. John's.

In 1934 Newman married Lyn Irvine; they had two sons, Edward and William. His wife was an author and continued to write under her maiden name. Her book *Field with Geese* was a delightful study of the social life of these fascinating birds, based on her experience with the geese living on the farm at Comberton, near Cambridge, which was their home. Lyn died in 1973 and, later that year, Newman married Margaret Penrose, the widow of Lionel Penrose, who survived him.

Max Newman was a man of deep culture and sensitivity. His knowledge ranged over a broad field and he showed a great love of the arts. He was a very accomplished musician and a fine pianist. Bernhard Neumann recalls that when Newman went to the Australian National University on his retirement from the chair at Manchester University, he was scheduled to play a Beethoven piano concerto with a local orchestra-but, unfortunately, the orchestra disbanded.

Newman's Mathematical Contributions

Max Newman's principal contribution to mathematics was in the field of combinatorial topology, where he did pioneering work. He was almost certainly inspired by a desire to prove the *Hauptvermutung*, and it is perhaps not too fanciful to assert that, had it been true, Newman would have proved it. He improved very significantly the notion of a combinatorial move, designed to generate an equivalence relation between combinatorial manifolds. (Incidentally, it is interesting that Newman spoke of the “combinatory method” and “combinatory topology” rather than use the word “combinatorial.” This insistence on etymological rectitude is also to be found in his habit of pronouncing the first syllable of “homotopy” with a long vowel, and in his rejection of the neologism “onto,” which, if he did encounter it, he humorously pronounced “on-toe.”)

Newman's ideas in combinatorial topology exercised a profound influence on Henry Whitehead, whose elementary moves were simply the adaptation of Newman's moves to the more general topological situation he was studying. Thus Whitehead's *simple homotopy theory* was a direct offshoot of Newman's pioneering work. Indeed, Newman's influence on Whitehead went even further, and Whitehead was often heard to testify of his great debt to Max Newman. These two giants of twentieth-century mathematics were the warmest of friends, and all who knew them both recall Newman's profound sadness at Henry's premature death in 1960.

Newman's interest in topology persisted throughout his mathematical career and was rejuvenated by the renaissance of combinatorial, or *geometric*, topology, which began in the 1950s. He gave an invited talk entitled “Geometric Topology” at the Stockholm Congress in 1962, and published an important paper on the engulfing theorem in the *Annals of Mathematics* in 1966. It is important to remark of this later work that Newman showed not only his own mathematical virtuosity unimpaired by age but also a very impressive and unusual mastery of highly sophisticated contemporary ideas.

Newman's original contributions were not confined to topology. He also contributed to mathematical logic, which we may see as the bridge between his early interests in topology and his later interest in computer science.

Newman wrote only one book, *Elements of the Topology of Plane Sets of Points*, which was first published (by the Cambridge University Press) in 1939. A second edition appeared in 1951, and was then reprinted, with fairly minor changes, in 1961. It is beautifully written in the limpid style one would expect of one who combined clarity of thought, breadth of view, depth of understanding, and mastery of language. Newman saw, and presented, general topology as part of the whole of mathematics, not as an isolated discipline, and many must wish he had written more.

Bletchley Park (BP), Government Code and Cypher School (GCCS), 1942-1945

Max Newman was approached in May 1942 to do secret work at Bletchley Park and started work there in September of that year. Turing had been recruited to BP much earlier and Newman fully appreciated the significance of Turing's ideas for the design of high-speed electronic machines for searching for wheel patterns and placings on the highest-grade German enciphering machines, and the result was the invention of the “Colossus” and its systematic exploitation for cryptanalytical purposes. On the other hand, it was not envisaged that the entire process of “setting” a message in the wheels of the encoding machines would, in practice, be mechanized (actually, this was done at the very end of the war, rather to establish an “existence proof for the method). So the total effort required the cooperation of those who exploited certain statistical biases in the

language with the aid of Colossus (that is, the Newmanry), and those who used hand methods to exploit German procedural weaknesses or, in other ways, to complete the task (that is, the Testery).

It does not seem possible to overestimate the importance of Newman's contribution, even though one does not associate the most conspicuous features of the success of the total effort with him in any direct or immediate way. To use an American term, Newman was the great “facilitator”; he ensured that those who worked in this section had the best possible conditions for success and the greatest possible freedom from interference. He was uncannily good at anticipating future needs, with respect to both equipment and personnel. Unobtrusively but with supreme effectiveness, he ensured that no effort of any member of his team was wasted. Anyone familiar with normal civil service procedures will appreciate how remarkable was his success-and therefore ours-and how unusual were the circumstances he created. None of us lacked his encouragement and he understood our needs and met them.¹

University of Manchester

When Newman assumed the Fielden chair at Manchester University in the autumn of 1945, he immediately set to work to create an outstanding mathematics department. He brought to bear two great gifts-on the one hand, his profound knowledge of and excellent taste in mathematics and, on the other hand, his extraordinary administrative flair, which had been in evidence, to such decisive effect, during his war service at Bletchley Park. He shared the responsibility for building up mathematical activity at Manchester University with Sydney Goldstein, the professor of applied mathematics, and they worked very harmoniously together. It should also be remarked that Newman carried with him to Manchester from BP a deep awareness of the potential importance of electronic computers; it was one of his finest achievements to ensure Manchester's leading role in this field. With Turing recruited in 1948 and F.C. Williams and T. Kilburn already on the faculty, Manchester indeed had a formidable team. Newman once again was the “facilitator,” the man with the broadest vision, and thus Ferranti was commissioned to build a pioneering machine. One recalls a typical example of Newman's good sense in orchestrating this endeavor-at a certain stage he said, “We are now ready to build Mark I. Any further bright ideas will go into Mark II.” For Newman recognized that it would be essential to have a working model in order to know what the operational snags, the “bugs,” might be.

Newman, as a fine research mathematician himself, naturally appreciated the role of research in a mathematics department. There was no doubt that research talent and potential constituted the primary criteria for appointment to his department. However, Newman fully recognized that there was a continuity in the spectrum of professional duties of a university mathematician that encompassed both teaching and research.

Newman made it perfectly clear that it was important to try to ensure good teaching. He paid a great deal of attention to course curricula, which were very explicit without, of course, being totally prescriptive; and he was very careful about assigning teaching duties. He introduced the system whereby the entire department scrutinized the proposed examination questions, which had to be accompanied by model answers. His control of

¹ Newman died several years after the much belated release of information about the work of the GCCS. Newman wrote the Royal Society biography for Alan M. Turing in 1953, several years prior to that release of information about the work at Bletchley Park. Of that period Newman was only able to write “. . . in 1939 war broke out. For the next six Years he (Turing) was fully occupied with his duties for the Foreign Office.

the operations of the department was, however, achieved by quiet diplomacy rather than by diktat; he was, in many respects, the model of how a head of department should function.¹

BIBLIOGRAPHY

Biographical

Adams, J.F., "Maxwell Herman Alexander Newman," *Biographies of 'Fellows of the Royal Society*, Vol. 31, 1985, pp. 437-452.

Hilton, Peter, "Obituary-M.H.A. Newman," *Bull. London Math. Soc.*, Vol. 18, 1986, pp. 67-72.

Hinsley, Sir Harry H., and Alan Stripp, *Code Breakers: The Inside Story of Bletchley Park*, Oxford Univ. Press, Oxford, UK, 1993.

Randell, Brian, "The Colossus," in Metropolis, N., J. Howlett, and Gian-Carlo Rota, *A History of Computing in the Twentieth Century*, Academic Press, New York, 1980, pp. 47-92.

Ritchie, David, *The Computer Pioneers*, Simon and Shuster, New York, 1986.

Significant Publications

Newman, M.H.A., *Elements of the Topology of Plane Sets of Points*, Cambridge Univ. Press, Cambridge, UK, 1939, 1951, 1961.

UPDATES

Portrait changed (MRW, 2013)

¹ Edited with permission from Hilton 1986.