MAX NEWMAN 1897–1984

OBITUARY

M. H. A. NEWMAN

1. *Biographical details*

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 3 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 1922–23 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 1928–29 and returned, to the Institute for Advanced Study, in 1937–38. 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 at Bletchley Park and remained there for the rest of the war. He was in charge of a section concerned with the machine decipherment 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. (The present writer likes to recall that this was also the date of *his* appointment as Assistant Lecturer in the Department of Mathematics.)

Newman was largely instrumental, with Hodge and Whitehead, in launching the British Mathematical Colloquium, an institution of vital significance to the mathematicians of the United Kingdom. The inaugural meeting of the Colloquium was in Manchester in 1949, and Newman was able to call on the cooperation of the members

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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 is a rare event for such an invitation to be received by a person at the age of 65.

On retirement, Newman spent 3 years (1964–67) 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 1965–66 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 1950–51 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 D.Sc. 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 and they had two sons, Edward and William. His wife was an author and continued to write under he 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, the widow of Lionel Penrose, who survives 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!

2. *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; his key contribution is to be found in [7]. (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'.)

The fundamental property which Newman sought, and found, for his 'combinatory moves' was a sort of generalized *diamond* property; if M_1, M_2 can both be obtained from the manifold M by such moves, then it should be possible, by applying a sequence of moves to M_1 and a sequence of moves to M_2, to bring them back into coincidence. Newman fully realized that such a property was of very broad significance in combinatorics and in 1942 he published a very important paper [33] on abstract combinatorial theories which is today a cornerstone of theoretical computer science, in particular in the theory of reduction systems, and of local confluence in such systems.

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 the present writer often heard Whitehead testify to his great debt to Max Newman. These two giants of 20th century mathematics were the warmest of friends, and all who knew them both will recall Newman's profound sadness at Henry's premature death in 1960.

Newman had a sustained interest in Hilbert's Fifth Problem and made an important contribution to its ultimate solution by Gleason and Montgomery–Zippin. In his papers [17, 19] he solved a very special case of the problem; and [17] contains his proof of the absence of small periodic transformations of a connected locally Euclidean space. Precisely, if U is a domain in M^n and p is a positive integer, $p > 1$, then there exists $d > 0$ such that no uniformly continuous transformation of M^n of period p moves every point of U less than d. This result was later generalized by P. A. Smith; it is not only an essential ingredient of the solution of Hilbert's Fifth Problem, but it also appears in contemporary research in the concept of 'spaces having the Newman property'. In 1968 Dress gave a much shorter proof of Newman's theorem.

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 [53] entitled 'Geometric Topology' at the Stockholm Congress in 1962, and published an important paper [55] 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.

As we have already said, 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 [30, 43], *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. In the present writer's judgment this is the only text in general topology which can be wholeheartedly recommended without qualification. 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.

3. *Bletchley Park*, 1942–45

Max Newman was approached in May, 1942, to do secret work at Bletchley Park and started work there in September of that year. (The present writer (PH) was 'approached' in October, 1941, and commenced work in January, 1942. From approximately October of that year he worked on the 'Fish' ciphers in a section very closely associated with that headed by Newman. This section was headed by Major Ralph Tester, and the two sections were always known as the Testery and the Newmanry. PH acted as a principal means of liaison between the two sections.) 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 on 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 that 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. Any one 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.

4. *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 were commissioned to build a pioneering machine. One recalls a typical example of Newman's good sense in orchestrating this endeavour – 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 which encompassed both teaching and research. The present writer was fortunate enough to be appointed to Newman's department in the autumn of 1948, remained there till 1952 and then returned there at the beginning of 1956 after a spell at Cambridge; he owes to Max Newman his awareness of the guiding principle that, while there can be no certainties, the best way to ensure a good teaching department is to appoint people vitally interested in their subject.

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 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.

All of us who knew Max remain always in his debt and miss him very much.

5. *Acknowledgements*

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