OBITUARY

KURT AUGUST HIRSCH

Kurt August Hirsch, Emeritus Professor of Pure Mathematics in the University of London at Queen Mary College, died on 4 November 1986. He was a member of the London Mathematical Society from 1944 and served it well for many years: as a member of Council from 1952 to 1954, 1955 to 1959 and 1961 to 1966; as Honorary Secretary from 1955 to 1959, as Vice-President from 1963 to 1965; as joint editor of the Transactions of the Moscow Mathematical Society from 1963 to 1972 and as editor of the Russian Mathematical Surveys from 1962 to 1986.

Kurt Hirsch was born on 12 January 1906 in Berlin, the youngest of five children and only son of Dr Robert Hirsch (1855–1913) and Anna (née Lehmann; 1870–1936). Robert Hirsch was a chemical engineer and owner of a soap factory. His father, August Hirsch (1817–1894), a distinguished epidemiologist and historian of medicine, held a professorship of 'pathology and medical history and literature' at Berlin University from 1863 and was for a time Rector of the University. Since Jews were not allowed then to occupy University Chairs, he was baptised into the Christian faith, changing his name from Aron Simon to August. He brought up Robert as nominally Christian and Robert did likewise with his children.

In 1913, after the collapse of his business, Robert Hirsch committed suicide, leaving his family, which had hitherto enjoyed a comfortable bourgeois standard of living, quite poor. The emotional strain on the seven year old Kurt made him unmanageable and he was sent away to a boarding school, probably in Frankfurt-an-der-Oder. It was certainly there, at the humanistischen Staatlichen Friedrichs-Gymnasium, that he finished his school days in 1924. He wished to continue his studies but needed financial support. As a grandson of a former Rector, Kurt qualified for a grant from the University of Berlin and so was able, in the autumn of 1925, to enroll as a student there.

He divided his time between mathematics and philosophy. The professors of mathematics were L. Bieberbach, R. von Mises, E. Schmidt and I. Schur. Hirsch was captivated above all by Schur and his kind of mathematics, yet his doctoral dissertation concerned not algebra but the philosophy of mathematics. He passed the oral examination on 10 June 1930 in philosophy as main subject with mathematics and physics as subsidiary fields. According to regulations, the degree could not be conferred until the dissertation had been printed and deposited in university libraries. Since Hirsch, in 1930, was already married with one child, he could not then afford the cost of printing the dissertation and this was delayed until 1933.

The examiners as stated in the dissertation were Bieberbach and the philosopher Max Dessoir; but Schur and the psychologist Wolfgang Köhler may also have been present at the oral ⟨7⟩. The title of the dissertation is 'Intuition und logische Form zur gegenwärtigen Philosophie der Mathematik'. Wilfrid Hodges writes: 'Its subject is the dispute in the 1920s between David Hilbert and L. E. J. Brouwer on the foundations of mathematics. Hirsch sees this dispute as just one chapter in an old debate between two philosophical world-views. Brouwer's intuitionism is a modern

K. A. HIRSCH in 1969

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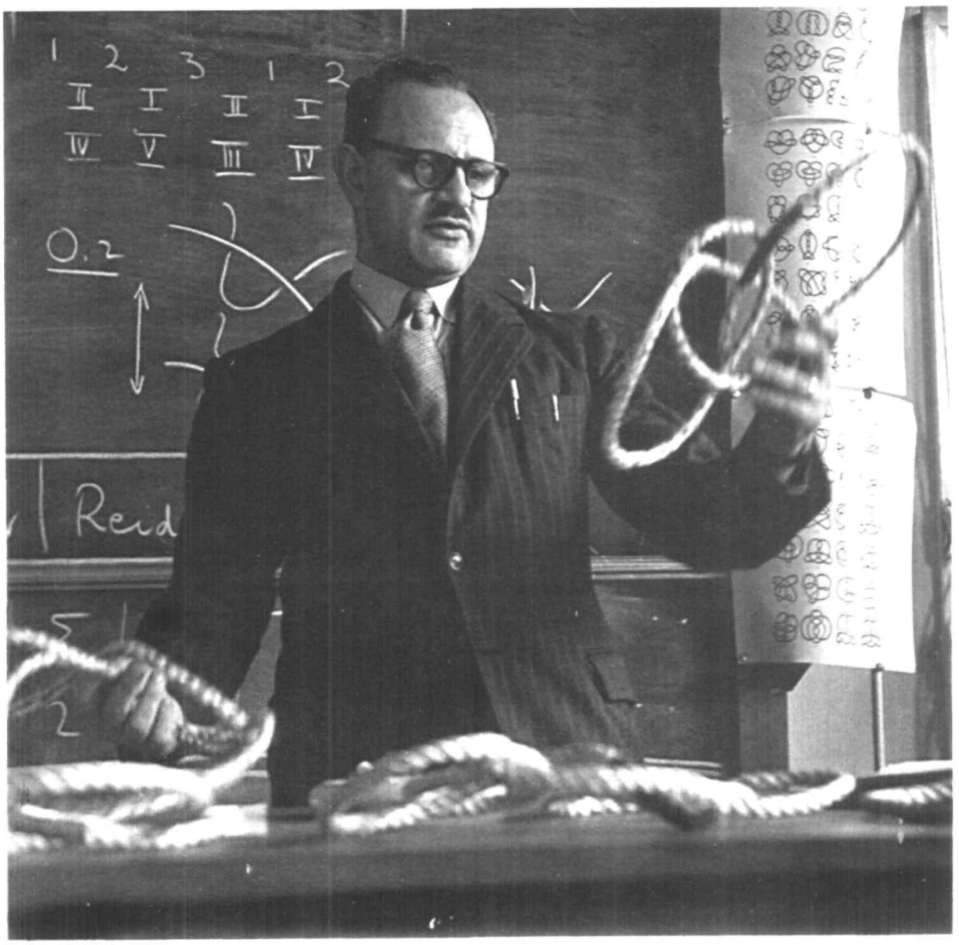

Kurt Hirsch lecturing at the British Association meeting in 1949.

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counterpart of Descartes' thesis 'What I perceive clearly and distinctly is true', while Hilbert's formalistic views line him up with Leibniz. Hirsch traces this debate back into medieval and classical discussions about the nature of universals: Brouwer belongs with the nominalists and Hilbert with the platonists. (In his discussion of the contrast between platonism and intuitionism, Hirsch anticipates the very influential lecture 'Sur le Platonisme dans les Mathématiques' which Paul Bernays gave in 1934 ⟨**2**⟩.) Hirsch's conclusion is that although mathematicians are under some pressure to find a compromise which patches up the mathematical differences between Hilbert and Brouwer, any genuine resolution of the philosophical dispute will need to go far beyond mathematics'.

The dissertation dealt with questions that were not of direct concern to Hirsch's teachers and since it was never published in a journal, its originality remained unrecognized. Hirsch himself may have undervalued its worth ⟨**7**⟩. There was no copy in his possession when he died.

In 1928 Kurt married Elsa Brühl, having adopted the Jewish faith for her sake. They had three children: Daniel (1929), Sabine (1932) and Anna (1939). With a family to support Hirsch needed to supplement his university grant and he found congenial employment from 1928 as a journalist reporting on scientific matters for the Vossische Zeitung. This was a highly respected, liberal daily newspaper, one of the oldest in Europe, with origins in the early seventeenth century. A fellow journalist on the staff was Arthur Koestler. Over the years Hirsch developed closer ties with the paper and from 1933 he had a weekly column that he was free to fill in any way he wished. He would commission articles from people like Heisenberg and Schrödinger or write pieces on mathematics and philosophy himself [**20**]. From the moment the Nazis seized power in 1933, the Vossische Zeitung, because of its political position, was doomed; for a whole year it struggled to keep going but on 31 March 1934 it was closed down. Hirsch promptly left Germany for England, where he had distant relatives on his mother's side.

During his time as a journalist from 1930 Hirsch never lost touch with serious mathematics. He ascribed this to taking part in a small, informal study group which, under the guidance of Robert Remak, worked through van der Waerden's two-volume *Moderne Algebra*. Here he came across Emmy Noether's maximal condition on ideals and, having read Schreier's 1929 paper on the Jordan–Hölder theorem, which contains the modern definition of soluble group, he formed the novel idea of studying soluble groups satisfying the maximal condition on subgroups [**20**].

In April 1934 Hirsch arrived in England and was met at Liverpool Street Station by two friends from Berlin—Bernhard Neumann and Hanna von Caemmerer (who later became Bernhard's wife). Bernhard, though a little younger than Kurt, had known him as a fellow student and had also been a member of Remak's study group; Hanna was visiting Bernhard, who had emigrated in August 1933 and was studying with Philip Hall in Cambridge.

Hirsch was unsure whether to continue with journalism or mathematics; after Hall encouraged him to pursue his ideas about soluble groups with the maximal condition, he finally decided on mathematics. He became a pupil of Hall and member of King's College, Cambridge, which supported him financially from 1935 to 1937.

When Elsa Hirsch and the two children arrived in September 1934, Kurt rented a house at the edge of Cambridge in a street where Bernhard Neumann had his lodgings. While they were together in Cambridge, Kurt and Bernhard saw much of

each other and of Hall; but there was little organized activity in algebra. Neumann recalls that an algebra seminar they started did not survive for long and that a course of lectures by Hall had an audience of only three. Although Hirsch and Neumann already had Berlin doctorates, they both decided to take a Cambridge PhD, partly because they felt this would help them in the search for jobs. Hirsch was awarded his degree in 1937 and Neumann his in 1935; both left Cambridge in 1937.

Hirsch's Cambridge thesis is entitled 'On a class of infinite soluble groups'. The groups in question, which Hirsch termed 'S-groups', are the soluble groups with the maximal condition on subgroups. Following P. Hall ⟨**6**⟩ these are now called polycyclic. Hirsch looked for Jordan–Hölder type theorems for these groups. A strong composition series of a polycyclic group G means a series whose factors are cyclic of prime or infinite order and the number of finite factors is as small as possible; a strong chief series of G is a series of normal subgroups where each finite factor is a chief factor, each infinite factor has no non-trivial G-invariant subgroup of infinite index (so it is free abelian) and again the number of finite factors is as small as possible. Hirsch proved that the infinite factors in a strong chief series are invariants of G and also that the number of infinite factors in a strong composition series is an invariant; this number is now called the *Hirsch number* of G.

When G is (polycyclic and) nilpotent, Hirsch showed that the elements of finite order form a characteristic subgroup and he deduced that any two strong composition (or chief) series have isomorphic factors. This was later generalized to supersoluble groups by Zappa ⟨**15**⟩. However, there is no Jordan–Hölder theorem for polycyclic groups in general, as J. F. Bowers, a research student of Hirsch, established in 1960 ⟨**3**⟩.

The thesis contains a proof that in any group the product of two nilpotent normal subgroups is nilpotent, a fact also discovered by Fitting ⟨**4**⟩. Hence every polycyclic group G has a unique largest nilpotent normal subgroup B and Hirsch proves that B contains its centralizer in G. Moreover, if G is not nilpotent, then G has a finite non-nilpotent homomorphic image. He characterizes the nilpotent ones among polycyclic groups as those with the normalizer condition and also, in answer to a question of Olga Taussky, as those in which every maximal subgroup is normal.

The fourth and last chapter of the thesis contains a discussion of 'skew-groups'—finitely generated, torsion-free nilpotent groups of class 2 with cyclic centre. The commutator operation is here an integer valued skew-symmetric bilinear map and the classification of such maps under congruence provides a complete classification of skew-groups. Hirsch published this in [**4**], and there may be a connexion here with his first mathematical paper [**1**] which is about rings: if K is a field of characteristic zero, $K\{x\}$ is the free K-algebra on $x_1, \ldots, x_n$ and W is the algebra obtained from $K\{x\}$ by imposing the relations $x_i x_j - x_j x_i = a_{ij} 1$, where $a_{ij} \in K$, then W is a simple algebra if, and only if, the skew-symmetric matrix (a_{ij}) has non-zero determinant.

The material in the first three chapters of the thesis appears in [**2**, **3**, **5**]. The final two papers of the series on polycyclic groups [**9**, **11**] contain respectively the result that a polycyclic group is residually finite and that the Frattini group of a polycyclic group is nilpotent (a fact also found by N. Ito ⟨**8**⟩).

Hirsch published nothing further on polycyclic groups but he frequently lectured on them and retained a lively interest in the constantly growing body of work

connected with them. An important reason for the continued widespread attention to polycyclic groups is that they form precisely the class of soluble matrix groups over $\mathbb{Z}$ ⟨**9**, **1**⟩. The link with linear groups is the basis of the excellent modern account of polycyclic groups in Segal's book ⟨**13**⟩ and is also the theme of his 1987 article ⟨**14**⟩, based on his lecture at Hirsch's 80th birthday celebration.

Hirsch was made temporary assistant lecturer at the University College of Leicester (now the University of Leicester) from 1 January 1938. The only other member of staff in mathematics was E. V. Whitfield. During his first term Hirsch had to commute because he was also teaching a course, in algebraic number theory, in Cambridge. At Easter the family moved to Leicester.

In the summer of 1940, almost all adult male refugees were interned as 'enemy aliens' and Hirsch was sent in June to a camp on the Isle of Man. (His own copy of his Cambridge dissertation is stamped on the inside cover 'Central Internment Camp 16 July 1940 Douglas, I.O.M.' and has the pencilled note in his writing 'House 7'.) He worked in the kitchens learning to cook for eighty people, and was also active in a 'free university' that immediately came into existence. His release was hastened by strong representations from the Principal of Leicester University College, F. L. Attenborough, enabling him to be back in Leicester for the beginning of the academic year in October.

University appointments were frozen during the war years and it was not until 1944 that his position was made permanent. Whitfield and Hirsch remained on their own until 1946 when R. Buckley was appointed. In 1947 E. J. F. Primrose joined the mathematics staff and was much helped by Hirsch. They kept in touch after Hirsch left Leicester and later had a long and warm association in their work for the *Russian Mathematical Surveys*. Also in 1947 Kurt and Elsa were naturalized as British citizens.

At the beginning of 1948 Hirsch was appointed to a Lectureship at King's College, Newcastle upon Tyne (then a part of the University of Durham but now the University of Newcastle) by the new Professor of Pure Mathematics, W. W. Rogosinski. A. W. Goldie and F. F. Bonsall arrived in the autumn of the same year. Rogosinski and Hirsch quickly created a lively mathematical climate. The syllabus in algebra and analysis was reformed; visitors were invited to a weekly colloquium and soirée at Rogosinksi's or Hirsch's house. Goldie writes 'It was a wonderful atmosphere, these [two] knew what a real university was about and set out to create a microcosm of it in pure mathematics. Bonsall and I shared a room next to K. but the rooms had a common phone reached through a hatch. He, of course, used it almost exclusively, having all sorts of business to transact. His personality made an impact rather stronger than that of Rogo, though one could see that K. regarded R. as more important than himself on the only ground that mattered to K. namely, mathematical standing. He had a calm judgement in such matters'.

During his Leicester and Newcastle period Hirsch indulged his passion for chess. He was Leicester County Champion in 1945–46 and won the individual county championship in Newcastle in 1950. He continued to play after his move to London but not as seriously.

At the end of the war the editors of *Mathematical Reviews* urgently needed reviewers for papers written in Russian. Hirsch revised the little Russian that he had learnt in school and offered his services. Thus began his long and important

association with the translation into English of Russian mathematics. He translated a number of standard texts, including *The theory of groups* by A. G. Kurosh (1955), *The theory of matrices* by F. R. Gantmacher (1959) and *Basic algebraic geometry* by I. R. Shafarevich (1974); he was a joint editor of the *Transactions of the Moscow Mathematical Society* (1963–1972) and from 1962 until a few weeks before his death he edited the *Russian Mathematical Surveys*.

The translation project closest to his heart was probably that of the second edition of Kurosh's book, which he provided with appendix notes and an updated bibliography. Hirsch began this work while still in Newcastle and finished it in London in 1954. Kurosh and his school were the first to attempt a systematic study of infinite soluble and nilpotent groups and the volumes translated by Hirsch were to prove extremely influential in the non-Russian world. Hirsch met Kurosh for the first and only time in 1958 at the International Congress in Edinburgh; he never visited the Soviet Union.

Hirsch's own work in polycyclic groups fitted naturally into the Kurosh framework and led him to further work on locally nilpotent groups. He proved **[8]** that in any group with maximal condition on subgroups the normalizer condition implies nilpotence, a result that also appears in ⟨**10**⟩ as a corollary of the more general theorem that the normalizer condition by itself implies local nilpotence. In **[12]** Hirsch proves Plotkin's theorem by using the following new results: in any group, the product of two locally nilpotent normal subgroups is locally nilpotent, whence there exists a unique largest locally nilpotent normal subgroup. These results (with different proofs) were also discovered at the same time by Plotkin ⟨**11**⟩. The existence in all groups of a unique maximal locally nilpotent normal subgroup has proved to be of fundamental importance for infinite group theory and this subgroup is now called the *Hirsch–Plotkin radical*.

In 1951 Hirsch was appointed to a newly established Readership in Pure Mathematics at Queen Mary College in the University of London, where he remained until his retirement twenty two years later. From October 1958 he was Professor of Pure Mathematics.

The department he joined consisted of ten people, including only three other pure mathematicians, one of whom was close to retirement. The Head of Department was an astronomer, Professor G. C. McVittie, who left at the end of Hirsch's first year to be replaced by V. C. A. Ferraro, an applied mathematician. There were no research students in pure mathematics and the undergraduate syllabus, which was common to all the London Colleges, contained almost no algebra and no modern algebra at all.

With great energy Hirsch set about modernizing and enlarging the London mathematical environment. His first aim was to establish at the College a group of algebraists able and willing to communicate with each other. He believed that a small department is only weakened by a divergence of research interests among its members, that even a handful of specialists in one area can create a strong research setting and that, as far as undergraduate teaching is concerned, any respectable mathematician, whatever his special interests, must be able to teach the entire pure mathematics undergraduate curriculum. This was an unusual policy in England at the time. Hirsch frequently sought the advice of Philip Hall on appointments and in the first ten years, as vacancies occurred or new positions were created, he brought to the College, in chronological order, K. W. Gruenberg, A. J. Weir, P. J. Higgins, A. Learner and P. M. Cohn (all pupils of Hall except Higgins).

For many younger pure mathematicians associated with Queen Mary College during the fifties and sixties it was Hirsch who seemed to represent the department. Yet the Head of Department throughout this period was Vincent Ferraro. Hirsch often felt frustrated at having no official direct access to the College Principal, but although stormy periods between him and Ferraro occurred, they were never long lasting, since Ferraro fully supported Hirsch's aims and methods. The two men had an essentially good working relationship based on mutual respect.

Through contacts with friends and colleagues at other universities Hirsch attracted research students from the time he arrived. He was much concerned to build up a sizeable postgraduate population in algebra. This was hard work especially for the first six or seven years when he supervised all PhD and MSc students himself. But he succeeded; numbers of postgraduates grew and by the mid sixties there were generally some twenty or more registered per year, all in algebra and most in group theory. Hirsch kept a fatherly eye on the progress of every student, insisting that they all speak at a weekly pro-seminar and attend the weekly algebra colloquium.

This colloquium was his special joy. It had been started in 1950 at King's College by Richard Rado (who had also been a member of Remak's study group in Berlin) as a 'seminar in algebra and topology'. From 1951 to 1954, when Rado left London, it was run jointly by Rado and Hirsch and after A. Fröhlich arrived at King's College as Rado's successor in 1955, it continued as a joint venture of the two Colleges. It soon began to serve as the weekly meeting place of everyone in the London area interested in algebra. A large proportion of the speakers came from outside London, including many visitors from overseas, some of whom spent extended periods at Queen Mary College.

Hirsch also devoted much effort to building up algebra as a subject in the London University undergraduate syllabus. Here he had the influential support of Harold Davenport, who was Head of Department at University College and had befriended Hirsch in the prewar years at Cambridge. Hirsch was Chairman of the Board of Examiners for the BA (Honours) and BSc (Special) Degrees 1958–60; Convenor of the Pure Mathematics Postgraduate Lectures Committee 1963–66 and Chairman of the Board of Studies in Mathematics 1964–66. At the College, he always took his undergraduate teaching very seriously; his lectures were carefully prepared and he was an excellent expositor.

Hirsch loved to travel and did so frequently, in Europe and North America and later the Far East and Australia; Elsa always accompanied him. They spent three complete academic years away from London during his career: at the University of Colorado, Boulder, in 1954–55, at Washington University, St. Louis, in 1960–61, and during 1968–69 mainly at the University of New South Wales, Sydney. On all his journeys Hirsch never missed an opportunity of making propaganda for his London College so as to attract to it visitors and research students. At home, in their Hendon house in north-west London, Kurt and Elsa were famous for warm and lavish hospitality and the invariably excellent food at their friendly parties, when Kurt often did much of the cooking.

At the beginning of 1960 Hirsch suffered his first serious heart attack. When he was still very ill and in intensive care I visited him and found him, to my surprise, propped up in bed reading a new article by Philip Hall. He made a good recovery and was able to go abroad in the summer as planned.

Hirsch's first two research students at Queen Mary College were S. Moran and

A. Wagner; in all he supervised about a dozen PhD students. The last was B. A. F. Wehrfritz, whom he prized highly and with whom he continued a warm friendship. At the 1965 group theory meeting in Canberra he lectured on Wehrfritz's PhD thesis [**15**].

J. Terry Hallett was his student in the late fifties and investigated which finite groups occur as the automorphism groups of torsion-free abelian groups. She obtained her doctorate in 1961 and her thesis forms the starting point of a series of joint papers with Hirsch ([**13**, **16**, **17**, **18**, **19**]) in which they study this question. Suppose the finite group A is the full automorphism group of the torsion-free group G. It is easy to see that G must then be abelian. In [**13**] they prove that A must be a subgroup of a direct product of a finite number of primordial groups (this term is due to A. L. S. Corner); these are groups of the following types: cyclic groups of order 2, 4 or 6; the quaternion group; the dicyclic group of order 12 and the binary tetrahedral group of order 24. Hirsch and Zassenhaus give an alternative proof in [**14**] by transforming the problem to the following question which they then answer: which simple $\mathbb{Q}$-algebras have an order that is generated as a $\mathbb{Z}$-ring by its finite group of units?

In [**16**] Hirsch and Hallett show that every primordial group does arise as a full automorphism group of a torsion-free group and begin the study of which subdirect products of primordial groups can arise. This is continued in the final three papers of the series, but Corner tells me that these contain errors. An account of the Hallett–Hirsch theory based on [**13**] and [**16**] appears in Chapter XVI of the book by Fuchs ⟨**5**⟩.

After his retirement in 1973 Hirsch continued to attend seminars and colloquia in London whenever possible and he spoke at the 500th meeting of the Algebra Colloquium on 27 April 1978.

Much of the time he travelled and often lectured in far away places. Even after Elsa died (on 1 January 1980) he went three times around the world. His last journey, in 1986, began in January, a week after a big celebration at Queen Mary College in his honour on the occasion of his 80th birthday. He stopped among other places in Singapore, Sydney and Canberra, Los Angeles and Berkeley and in Boulder, Colorado, where his daughter Sabine lives. The paper connected with his editing work followed him around the world. In the summer he taught a course on number theory at the University of British Columbia in Vancouver and here suffered two severe heart attacks.

Although serious, it seemed as though he would recover from the first. When my wife and I entertained him to lunch at the University Faculty Club not long after this, he seemed to be recovering and was full of plans for the future, hoping to attend the group theory conference in Singapore the following year. That same afternoon however he had his second attack. Sabine came to Vancouver and with her help he recuperated sufficiently to travel home to London in September, but further medical complications set in over the next few weeks and his strength faded rapidly. He understood there was no chance of regaining his former life style and was ready to die. His mind was clear and lucid and he summoned his family to him on Saturday 1 November; the following Tuesday morning he died peacefully at home.

Hirsch has left a firm mark on mathematics in London. His most impressive achievement was the way he transformed in a dozen years a tiny pure mathematics department, concerned exclusively with undergraduate teaching, into an active,

internationally respected centre for research in algebra, without being in overall charge of the department and without making enemies or arousing jealousies. The growth of algebra in London University is also largely due to him, while internationally, the mathematical community owes him a debt of gratitude for the immense amount of work he devoted to the translation of Russian mathematics. Queen Mary College gave recognition to his service by conferring on him a Fellowship of the College on 12 November 1980.

Hirsch was a shrewd judge of people and managed to create at Queen Mary College an unusually friendly environment for students as well as staff. Everyone felt encouraged to be cooperative. Younger members of staff found him easy to work with and knew they could count on his help and protection. He gave them generously of his time with sound advice on teaching, on examining and on supervising research students. His broadly based education was evident in all his dealings. During the sixties, at a time of increased student numbers and falling qualifications, he fought fiercely to maintain high and serious academic standards. Like all good teachers, he could communicate enthusiasm to big classes and individual students with equal success.

During the many years of my friendship with him I never heard him say anything malicious or wounding about anyone. He harboured no resentment of his internment in 1940 but on the contrary spoke of his experience with good humour; especially his initiation into the mysteries of cooking. He liked discussing recipes and showing off his many kitchen machines. He was a compulsive buyer of gadgets. The material comforts he and Elsa could at last afford in their later years delighted him. He loved driving expensive cars and used his car constantly, even in congested London. He was a man of restless energy. Both he and Elsa enjoyed people and they provided a focus for social life wherever they lived. They were warm and dependable friends.

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