



DAVID GEORGE KENDALL

PROBABLY TAKEN AROUND 1975 WHEN DGK WAS WORKING ON CONTIGUITY DATA FROM MANORIAL RECORDS OF WHIXLEY, YORKSHIRE.

DAVID GEORGE KENDALL
15 January 1918 — 23 October 2007

David Kendall was a leading figure in probability and statistics, and a pioneer in applied probability, stochastic analysis and geometry, and associated statistical analysis. Through his own research and that of his students in Oxford and Cambridge, he established modern probability theory in the United Kingdom. With his recent death, we have lost another of the great generation of statisticians that spanned the 20th century.

Kendall's skills and interests were broad. His intention as a mathematics student was to become an astronomer. The war intervened, and, following demobilization, he moved into the developing field of probabilistic modelling and analysis. Making use of exceptional mathematical skills, he identified and solved problems in many areas including population modelling, branching processes, queueing theory, Markov processes, stochastic analysis, as well as stochastic geometry and the statistical analysis of geometrical data.

He undertook significant positions of leadership within the statistics and mathematics community, including being the first Professor of Mathematical Statistics at Cambridge University from 1962–1985, and the President of the Bernoulli Society for Mathematical Statistics and Probability at its inauguration in 1975.

David Kendall was born in Ripon on 15 January 1918, the son of Fritz Ernest Kendall and Emmie Taylor. He remained faithful to his Yorkshire roots, spending frequent holidays there in later life. He was influenced as a teenager by George Viccars, the senior mathematics master at Ripon Grammar School. His interest in astronomy was sparked in the early 1930s by a series of radio talks by James Jeans. He realised that a strong mathematical background was essential to becoming a successful astronomer, and he applied to Oxford and Cambridge accordingly. Gonville and Caius College's offer of an Exhibition could not be accepted on financial grounds, and instead he accepted in 1936 a (closed) Hastings Scholarship at Queen's College, Oxford, where his tutor was U. S. Haslam-Jones. He formed ties to H. H. Plaskett and E. A. Milne, and, under their influence, he published his first research paper at the end of his second undergraduate year. It dealt with the computation of a certain integral, and it appeared in the *Zeitschrift für Astrophysik* (1938), volume 16.

On graduating in 1939 with a first class degree, Kendall was appointed to a Senior Studentship in Astronomy at Balliol College. The outbreak of war disturbed his plans, and he left his new post in 1940 for work on rocketry at the Projectile Development Establishment (PDE) in West Wales. When in due course Frank Anscombe and Maurice Bartlett moved away from PDE, Kendall's then boss Louis Rosenhead allowed him one week's leave to learn statistics. With the help of private tuition from Anscombe, a week proved sufficient for the matters at hand. Kendall has described (with Kenneth Post) his work on guidance systems for rockets in *Notes and Records of the Royal Society of London*, volumes 50 and 51. After the declaration of peace, he

travelled with T-force to talk to German scientists, thereby procuring in Göttingen a photograph of Gauss on his death bed.

Kendall returned to Oxford in 1946 as Tutorial Fellow of Magdalen College, a post he was to hold until his move to Cambridge in 1962. He was heavily influenced during this period by Maurice Bartlett. Amongst his early works of significance are two papers presented at discussion meetings of the RSS, dealing respectively with models for the growth of populations, and queues. He spoke with Moyal and Bartlett at the RSS Symposium on Stochastic Processes in 1949, and contributed a long and significant paper (with discussion) on stochastic models for population growth. This partly expository paper includes accounts of his own investigations, and it concerns one of his principal interests of the next decade, namely the theory of continuous-time Markov processes. His second paper summarises the state of queueing theory in 1951. Dennis Lindley's contribution to the discussion is especially interesting: firstly, he proposed the analysis of the waiting-times of successive customers in order to solve the general G/G/1 queue, but without explicit mention of the duality relation leading to the ladder-height representation; and secondly, he took up the notion of a 'regeneration point', to which Kendall and his collaborators were to return later.

One of David's useful contributions to queueing theory was the D/G/ k notation of his 1953 paper in the *Annals of Mathematical Statistics*, and he would jest about his Guy Medal in Silver, awarded in 1955, as "perhaps the only medal to be awarded for inventing a terminology and a notation". (He reminisced freely about his life in conversation with Nick Bingham, see *Statistical Science* (1996), volume 11). His major lasting contribution to queueing theory was probably the analysis via embedded Markov chains. It was around 1953 that David met Harry Reuter, thus initiating a happy collaboration into the foundational aspects of continuous-time Markov chains. Quite a few of David's interests from the 1950s are well represented in current undergraduate and Masters-level lecture courses around the world. Daryl Daley and David Vere-Jones have written about David's contributions to applied probability in the *Journal of Applied Probability* (2008), volume 45.

Kendall was elected in 1962 to the new Professorship of Mathematical Statistics at Cambridge, and to a Professorial Fellowship at Churchill College. There was evidently some disappointment in certain quarters that someone more obviously a statistician had not been found, but David's candidacy was overwhelmingly strong. He obliged by working on several problems involving analysis of data, while continuing his more theoretical work. His election to Cambridge permitted a regeneration of the Statistical Laboratory, and even led to a courtesy visit by Ronald Fisher to its then home in the basement of the Chemistry Building. He remained the *ex officio* Director of the Lab until the strings were loosened in 1973 and Peter Whittle took over leadership.

David's choice of problem area was characteristically individualistic, including inference problems of archaeology, such as grave sequencing and the reconstruction of local maps from contiguity data, and the distribution of standing stones and the statistics of ley lines. He continued working on models of applied probability inspired

by real-life problems. Two examples: a Brownian motion model to reconstruct the optic nerve connections following trauma; and modelling the flight of a bird equipped with “a clock, . . . a sextant, . . . and a copy of what used to be called the *Nautical Almanac*”. At the same time, he published several works of a more analytical nature: on ‘Delphic’ semigroups, and on regeneration and renewal.

In much of his work he was able to combine stochastic analysis and stochastic geometry, two strands that will forever be associated with his name through the two volumes in commemoration of Rollo Davidson, edited by DGK and E. F. Harding and published in 1973–1974. David was greatly saddened by the loss of Rollo in an Alpine climbing accident in 1970 and he was instrumental with colleagues in the establishment of the Rollo Davidson Trust at Churchill in 1975. From Rollo’s obituary in *Stochastic Analysis/Geometry*: “The hazards of [mountain adventure], never wholly to be avoided, are familiar to all, and to rail at its folly is to invite a reply which he himself [Rollo] might have made, . . . , ‘If you always look over your shoulder, how can you still remain a human being?’.”

In later years spanning his retirement in 1985, David worked on a theory of shape that extended his work on ley lines. This culminated in 1995 in the publication of the book *Shape and Shape Theory*, written by DGK, D. Barden, T. K. Carne, and H. Le, and described by a reviewer for *Mathematical Reviews* as “a mathematical jewel”.

David Kendall was much decorated, receiving amongst other awards the Guy Medal in Silver (1955) and in Gold (1981) of the Royal Statistical Society, the Sylvester Medal (1976) of the Royal Society, and both the Senior Whitehead Prize (1980) and the De Morgan Medal (1989) of the London Mathematical Society. He was elected to the Fellowship of the Royal Society (1964), to Membership of the Academia Europaea (1991), to Honorary Membership of the Romanian Academy (1992), and to the Fellowship of the Institute of Mathematical Statistics. He received honorary degrees from the Université René Descartes (1976), and the University of Bath (1986), and he took his Oxford DSc in 1977.

He was a mainstay of several learned societies, including service as the first President of the Bernoulli Society in 1975, and as President of the London Mathematical Society from 1972–1974. He was a Council member of the Royal Statistical Society from 1950–1952, and served as Vice-President from 1963–1964. When Joe Gani, Ted Hannan, and Norma McArthur were striving for support to set up what became the Applied Probability Trust in 1963, it was David who provided the key introduction to the LMS. He became the first Professorial Fellow elected by Churchill College, Cambridge, in 1962, and he remained a Fellow until his death. He was elected to an Honorary Fellowship of his old Oxford college, Queen’s, in 1985.

One might describe David as a gentleman of the old school. On occasion he could seem distant, but, on penetrating his slightly formal manners, one found a person brimming with knowledge and human values, and eager to help younger people with common interests. A devout Anglican throughout his life, David attended services at the Church of St Mary and St Michael in Trumpington. Through his students



THE EAST FACE OF TRYFAN, BY DGK IN WATERCOLOUR. ADAM AND EVE MAY BE DISTINGUISHED, AND ALSO THE HEATHER TERRACE. REPRODUCED BY KIND PERMISSION OF THE KENDALL FAMILY.

his scientific legacy, already substantial, has been multiplied manyfold. It may seem invidious to select a few from a list of the august, but, as an indication of the scientific breadth of his influence, we mention David Edwards, David Williams, Daryl Daley, David Vere-Jones, John Kingman, Rollo Davidson, Nick Bingham, Richard Tweedie, and Bernard Silverman.

David travelled widely, forming personal connections that were to be maintained. In later years he tended eastwards, making many trips to the countries of Eastern Europe and further afield. From his famous visit to China in 1983 with David Williams, he returned with a student, Huiling Le, now at Nottingham University. Many will recall his effective captaincy of the British team at that most extraordinary First World Congress of the Bernoulli Society held in Tashkent in 1986. He had a great love of the outdoors, and he took much pleasure from sharing climbing yarns and examining fossils, collected preferably from the cliffs at Whitby. One might easily believe that he accorded greater credit to the Reverend Henry William Watson for his founding membership of the Alpine Club than for his (incomplete) solution to the extinction problem for branching processes.

David did not permit retirement to intervene in his intellectual activities. He remained for many years a presence in the Stats Lab, until the distance to the new

site in Clarkson Road became a hindrance and he gave up cycling. Until shortly before his death he could be seen striding purposefully around Cambridge, and he frequently attended Lab parties and College lunches. It was with sadness that his colleagues and friends learned of his death on 23 October 2007, following a chronic illness through which he was nursed by his wife Diana. The University Church of Great Saint Mary's was comfortably filled by the celebrants at his Memorial Service, and the crowd convened to Churchill for tea and tributes.

David and Diana (née Diana Louise Fletcher) married in 1952. They have six children, Wilfrid, Bridget, Felicity, Judy, and twins George and Harriet, spanning just seven years in age difference, and eight grandchildren at the time of writing.

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