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Violet Rosina Cane, 1916-2008

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Violet Rosina Cane, MA (Cantab), 31.1.1916-27.6.2008, was a Cambridge-educated statistician whose research and consulting centered on the applications of classical statistical theory, as well as contemporary theory of stochastic processes, including that being developed by some of her colleagues and former teachers at Cambridge. These applications spanned many fields, such as, human psychology and physiology, animal behaviour, and the theory of epidemics. Cane's professional career started at Cambridgewith her appointment in 1948 as Statistician to the MRC Applied Psychology Unit, and continued with her election in 1957 as a Fellow of Newnham College, and her appointment in 1960 as University Lecturer in the Statistical Laboratory. She was an elected fellow of the Royal Statistical Society (1947), a fellow of the International Statistical Institute, and a founder member of the Experimental Psychology Society (1959).After a decade of research, teaching and administrative leadership at the Laboratory, Cane moved in 1971 to the University of Manchester, where she was the first woman appointed as Professor of Mathematical Statistics, and the first woman ever to be appointed as a professor in the Faculty of Science. She retired from Manchester in 1981 and returned to her home in Little St. Mary's Lane, Cambridge, from whereshe would issue to visit Newnham College and the Laboratory occasionally, and to proffer cogent commentary on local politics as a second-term Labour Member of the Cambridge City Council.

As Lecturer in the Statistical Laboratory, Cane directed much of her energy to its flagship programme, the Diploma in Mathematical Statistics. It was a felicitous match, inasmuch as Cane's multidisciplinary interests and the Laboratory's mission statement were in perfect alignment. According to a "History of the Statistical Laboratory" (2002, https://www.statslab.cam.ac.uk/history-statistical-laboratory), the staff of the Laboratory "were heavily engaged in consultation for other University departments, [and this was] regarded as one of the prime functions of the Lab." In turn, these consultations yielded opportunities for practical experience for Diploma students, whose "theoretical grounding should be accompanied by close acquaintance with an applied field and a testing investigation of data from that field." For example, Richard Startup reports taking criminology as his applied field in 1963-64, and this proved to be an excellent entrée to an academic career in social statistics and sociology. Because of this match, the aggregate scholarly profile of the Diploma students whom Cane tutored mirrored her own intellectual formation.

Cane was born in Camberwell, London, to Tubal George Cane and Anne Louisa Cane (Lansdell). She moved with her family to Cambridge at an early age, and in 1938 she graduated from the University's Newnham College with a BA (Class II) in Mathematics. In 1939-40,Cane took Maurice Bartlett's course in Mathematical Statistics, a course she remembered as "difficult", but generative of "a beautiful set of notes." After a short stint at the Board of Trade, Cane was awarded a Robbie scholarship in mathematics by the University of Aberdeen in 1941. She then joined the Foreign Office (1942-45), working at Bletchley Parkduring that period. As is now well-known, this period saw the recruitment into the war effort of many other mathematicians and scientists, including current and future Cambridge notables, such as, Frank Anscombe, Maurice Bartlett, David Kendall and John Wishart. Cane returned to Cambridge as a member of the first class taking the Diploma in Mathematical Statistics, which she was awarded in 1948.

Of her time as a postgraduate student and staff member at Cambridge, Cane remembered "the particular vividness and exhilaration of the immediate post-war years, as people streamed back from war-work to resume their studies." For example, at the MRC unit, Cane had a fruitful collaboration with Richard Gregory, a cognitive psychologist who took his undergraduate degree in Philosophy and Psychology at Downing College, Cambridge (1947-50), after serving in the RAF Signals branch during WWII. In 1952, Cane and Gregory even sought out Alan Turing, then at the Computing Machine Laboratory at the University of Manchester, to discuss their "interest in the possibility of constructing, at least theoretically, a machine whose operation resembles that of a human brain" (excerpt from a letter in the Turing Digital Archives,http://www.turingarchive.org/browse.php/D/16).Cane's letter of introduction to Turing goes on to describe his would-be visitors thus: "Mr. Gregory is a psychologist with a confused background of philosophy and electronics, and I am a statistician with some knowledge of mathematics." (Gregory's tutors at Downing had included Bertrand Russell and Fred Bartlett, so we presume that the "confusion" must have stemmed from his RAF service!)

The interaction between Cane and Gregory led to a series of single-authored and co-authored papers on the measurement of sensory thresholds; the effects of ageing on perception; and the process by which human beings infer the current state of an external stimulus, given probabilistic information of the different possible states of the stimulus. Cane's paper on thresholds and learning was well-received by the Research Section of the Royal Statistical Society in 1956, and was hailed by Peter Armitage, in his vote of thanks, as "provid[ing] the Society with its first official introduction to experimental psychology" (*JRSS-B*, 1956, 195-201). Their co-authored paper the following year in *Nature*(1957, 1404-1405) on visual thresholds proposed a statistical model for estimating two kinds of "noise" in the nervous system, that due to random fluctuations in the retina ("retinal noise"), and that due to "neural noise" occurring after visual encoding. After fitting their model to experimental data on adults ranging from 20 to 80 years-old, they concluded that, for vision, neural noise, but not retinal noise, increases with age. This result led them to "consider functional losses associated with ageing [e.g., losses in memory or motor control] as due in part to increase in neural noise."

More broadly, Cane used her position in the MRC Unit to pioneer the application of newly-minted stochastic models in areas, such as, choice, learning and contagion, to data currently being collected by psychologists and animal behaviourists. One such example is her application (*JRSS-B*, 1959, 36-58) of semi-Markov models, introduced by Paul Lévy and Walter Smith, to summarisein theoretically interesting ways: parental behaviour in male sticklebacks (reported by van Iersel), nest-building by canaries (reported by Hinde), and courtship behaviour of male fruit flies (reported by Bastock& Manning). Cane's professional interactions with Smith (Statistical Laboratory), Robert Hinde (Department of Zoology), and Margaret Vince (Psychological Laboratory) undoubtedly facilitated this rapid application of theory to data. John Kingman, who was at the Statistical Laboratory during 1962-65 and was a good friend of Cane, recalls that she "had a close collaboration with Margaret Vince, who was studying the way that quail chicks communicated from inside their shells so that they hatched at the same time." Cane modelled this situation by regarding an egg as a neuron and a clutch of eggs in contact as a neural network, and included this model in her comprehensive and insightful review of "Mathematical models for neural networks" at the *5th Berkeley Symposium on Mathematical Statistics* (1967, 21-36).

Cane was a supportive and generous mentor, who granted her students full access to her vast knowledge of mathematical techniques and behavioural research, as well as to her expansive academic network. Richard Startup, who was tutored by her for the Diploma, remembers her as "a conscientious and highly effective teacher." Rob Gandy, who took the MSc in Statistics under Cane's supervision at Manchester in 1972-73, remembers her as "kind, compassionate, and ready to go to great lengths to accommodate the academic and emotional needs of her students." He added that, in her role as Professor, Cane would "have all the new students and staff round to her flat near Platt Lane for drinks and food so that everyone could get to know everyone." In these and other ways, she inculcated a warm and supportive departmental culture at Manchester. Ewart Thomas, who did his PhD under Cane's supervision in 1963-67, recalls her activating her network to arrange for him to visit Richard Dawkins at the University of Oxford so that they could discuss their mutual interest in choice behaviour. Dawkins' theoretical and experimental research examined *transitivity* and response *rates* in the colour preferences of chicks, and was the basis of his 1966 D.Phil. thesis at Oxford. The happy result of this visit was that Dawkins allowed Thomas to use his research which, in turn, became the basis for a modelling exercise in Chapter VI of Thomas' own thesis at Cambridge!

As important as Cane's formal instruction was to her colleagues and students, her most enduring legacy probably has been her informal modelling of the advantages of certain habits of thought, and her obvious delight at conducting interdisciplinary research. Kingman recalls that, "Violet believed that common sense was as important as mathematical theory in statistical practice, and she loved to solve statistical problems by back-of-envelope calculations wherever possible. She was suspicious of the increasing reliance on computers, which she felt often replaced careful thought." Three of the four authors of this memorial personally experienced this informal transmission of taste and attitudes, and we are grateful for it.

Outside of the precincts of the "gown", Cane left her mark on the "town" as a conversationalist who could establish rapport with students of all ages, and as a politician who was concerned with both fairness and efficiency. Kingman's son, also John, "remembers Violet well, particularly her very fine collection of detective stories and going occasionally with her as a child to walk her cat (on a lead) in the gardens of Peterhouse." In the public sphere, Cane served two terms, 1965-71 and 1982-90, as a member of the Cambridge City Council, to which she was recruited by Ruth Cohen the Principal of Newnham College. Kingman recalls that "she was particularly critical of the management of traffic in central Cambridge, and did much to develop a more evidence-based approach." Then, while Cane was at Manchester, she served on the British Government's University Grants Committee (1974-79), and was credited with using her statistical common sense to improve the functioning of the Committee.

On the vexing issue of gender inequality in higher education and employment, Cane commented in *The Guardian* around the time of her appointment to the chair at Manchester: "Manchester University does seem to be rather behind the times. More women are taking maths now because it has become easier to do other things with a maths training instead of being tied to physics and chemistry." Gandy recalls that "the 'word on the street' amongst the staff and students at Manchester was that if she had been a man she would have been awarded a professorship at least 10 years earlier." This sentiment doubtless drew on the fact that previously three Cambridge men were appointed in sequence to senior positions in the Statistics programme at Manchester: Maurice Bartlett in 1947 becoming the first Professor of

Mathematical Statistics at Manchester, Peter Whittle replacing him in 1961, and Morris Walker accepting a Readership when Whittle returned to Cambridge in 1967. As already noted, Violet Cane added a new element to the sequence, leaving Cambridge for a professorship at Manchester in 1971. The website of the ManchesterDepartment of Mathematics currently states: "As a department, we are strongly committed to equality and diversity, and the success of our female mathematicians, be they staff or students." We believe that this bold statement is a fitting tribute to Cane's contributions to Manchester and to applied statistics.

As an unmarried Fellow of Newnham, Cane could have lived in college, but Kingman recalls that "she preferred her medieval house (actually two cottages) in Little St Mary's Lane, and commuted (by car, with cat loose on the back seat) between it and a pleasant flat in Manchester." She is fondly remembered in motion, cycling through the streets of Cambridge, and in reposeat her home, "a cup of tea at her elbow, a cigarette in her hand, and her cat on her lap." As would be expected, her visits to Newnham and the Laboratory decreased over time, but the many students and colleagues who were fortunate enough to have been touched by Cane's brilliance and generosity are especially indebted to her.

Photo of the Statistical Laboratory in Cambridge in 1964.
Sitting in the front row, Violet R. Cane is fourth from left,
between John F.C. Kingman (left) and David G.Kendall (right).
Her students, Richard Startup and Ewart A.C. Thomas,
are standing in the back row, third and fourth from left.
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