



DARYL JOHN DALEY, 4 APRIL 1939 – 16 APRIL 2023
AN INTERNATIONALLY ACCLAIMED RESEARCHER IN APPLIED
PROBABILITY AND A GENTLEMAN OF GREAT KINDNESS

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Daryl Daley was born in Melbourne in 1939, the son of John and Thirza Daley. John was an accountant and company administrator who became the manager of the Hotel Australia and a Melbourne City Councillor. Thirza was a talented pianist and piano teacher. Daryl had an older sister, Glyn, who was born in 1936. The siblings called each other Zip and Nip and were always friends.

When Daryl was nine, the family moved from the suburb of Coburg to Mount Ida Avenue in East Hawthorn and started to attend St John's Camberwell Anglican Church. This ended up being something of a constant in his life: he was a parishioner at St John's when he died. It was also at St John's that Daryl learned to play the pipe organ, and began another of his passions, choral singing. Like his father, Daryl went to Trinity Grammar School where, remarkably, he was dux in both 1955 and 1956.

After completing his school education Daryl enrolled in a Bachelor of Science at the University of Melbourne. Daryl's first degree was a BSc majoring in chemistry, which he completed in 1961. The following year, he completed a BA with Honours, majoring in mathematics. His Honours thesis was entitled 'Customer impatience in single server queueing systems'.

Daryl went on to extend his Honours work in an MA under the supervision of Peter Finch. He credited Peter, then in the University of Melbourne Department of Statistics, for introducing him to a life of research. Peter gave Daryl a few of his recent publications to read, and Daryl responded by thinking about possible generalisations and extensions. Independently, Daryl found a relevant paper by the Russian author I. N. Kovalenko, which he was asked to read as part of a Science Russian subject. Putting these ingredients together led Daryl to the original ideas that he wrote up in his thesis.

In September 1962, Peter left the University of Melbourne for the Australian National University (ANU) in Canberra, and most of the subsequent contact between Daryl and Peter was by mail which, of course, in those days meant snail mail. In January 1963, the correspondence included the draft of Daryl's MA thesis, which was submitted the following May. The thesis was examined by the famous British mathematician John Kingman who was a younger colleague of the leading British probabilist of the time, David Kendall. Kingman had visited Australia in 1963.

Early in his undergraduate years at the University of Melbourne, Daryl met Nola Hamilton who had recently moved to Melbourne from New Zealand with her family. Nola was training as a primary school teacher. They married six years later, after Daryl had finished his

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undergraduate degrees and won a scholarship to Cambridge. Very soon after getting married, they were on a ship to England. Their first child, John, was born in 1967, followed by their other two sons, Geoff in 1972 and Alan, in 1975.

Daryl's MA work formed the basis of a paper, 'General customer impatience in the queue GI/G/1', which appeared in the second volume of *The Journal of Applied Probability* in 1965. It is noteworthy that this wasn't even his first paper. In 1964, he had published a paper on single-server queues in *The Journal of the Australian Mathematical Society* and, with David Kendall, a paper 'Epidemics and rumours' in *Nature*. Publications in *Nature* were, and still are, valued as an indicator of scientific achievement at the highest level. For Daryl to have co-authored such a paper so early in his career was a considerable feather in his cap.

Daryl started a PhD at Pembroke College, Cambridge with John Kingman as his advisor, but ended up being supervised by David Kendall. He received his PhD in 1967 with a thesis entitled 'Some aspects of Markov chains in queueing theory and epidemiology', combining the two application areas that had motivated his research work up to that stage. The breakthrough that led to his thesis occurred in 1965 with an idea that he had after reading a paper by the University of Melbourne academic Bruce Craven in the *Journal of the Australian Mathematical Society*.

Further input came from a discussion with the visiting Australian Pat Moran, who was Professor of Statistics at ANU, the centre of applied probability research in Australia at the time. Daryl ended up applying his ideas to mathematical models of queues, genetic processes, and epidemics. A result of the work was the term *stochastic monotonicity*, which is still studied today. Very much later I can remember reading about stochastic monotonicity, but I didn't at the time realise that the concept dated back to Daryl's thesis.

After completing his thesis, Daryl had the opportunity to make extended academic visits to a variety of places, including Washington and Baltimore, before returning to Cambridge where he had a research fellowship at Selwyn College. Even as a young researcher, he became very much part of the applied probability community in the UK, regularly working with some well-known people.

In 1970, Daryl applied for and was offered positions in each of ANU, Monash University, and the University of Melbourne. He accepted the job at ANU because it gave him more freedom to carry out his research.

During the 1970s and '80s, Daryl managed to find reasons to visit such destinations as Laramie (Wyoming), Bloomington (Indiana), Kalamazoo (Michigan), Chapel Hill (North Carolina), MIT Lincoln Labs (Lexington, Massachusetts), Bell Labs (New Jersey), and GTE Labs (Waltham, Massachusetts) in pursuit of his academic goals. He also extended his collaborations to Europe and Asia, with visits to Aarhus (Denmark), Stockholm (Sweden), Wroclaw (Poland), Vilnius (Lithuania), Freiburg (Germany), and Singapore. It is significant that, unlike most western academics, he spent significant time collaborating with eastern European colleagues.

In 1983, Daryl translated *Comparison Methods for Queues and Other Stochastic Models*, by Dietrich Stoyan, into English. In completing the translation, I believe that he made some methodological contributions. Daryl is also well known as an author of two influential books: *An Introduction to the Theory of Point Processes*, written with David Vere-Jones, and *Epidemic Modelling: An Introduction*, written with Joe Gani.

Daryl's interest in point processes had started during his PhD studies when John Kingman pointed him to numerous references to David Vere-Jones' work on the rate of convergence of Markov chain probabilities. This was how Daryl first heard about David Vere-Jones, with

their first face-to-face meeting occurring at a meeting of the Royal Statistical Society in 1966. When Daryl returned to Cambridge in September 1968, David Kendall drew his attention to further work on point processes by Maurice Bartlett. Daryl ended up submitting a paper that extended this work. David Vere-Jones identified himself as referee of this paper and drew Daryl's attention to his own related work.

Subsequently, David Cox asked Daryl whether he would be willing to write a survey paper on point processes as preparation for a Berkeley symposium on the subject. Daryl agreed, but suggested that David Vere-Jones should be asked to be part of the project. On the way back from Berkeley, Daryl and Nola stopped in Wellington to visit David and his wife Mary. Daryl and David ended up writing the survey paper together, by correspondence between Canberra and Wellington.

Daryl and David's interest in point processes developed over subsequent years, culminating in the writing and publication of the first edition of *An Introduction to the Theory of Point Processes* in 1988. Writing the book involved many flights across the Tasman. In 2000, the publisher Springer told Daryl and David that the first edition was out of print and asked them whether they wanted to write a second edition. Initially, Daryl and David were reluctant, but Springer persisted and eventually they agreed to prepare a second edition, conditional on it being a two-volume work. This was because there was a large amount of new material that they wanted to include, and they didn't want to delete any material from the first edition.

The preparation of Volume 1, *Elementary Theory and Methods*, was spread over 2000 to 2003, while Volume 2, *General Theory and Structure*, took longer, between 2003 and 2008. The book in both of its editions has become one of the standard references on point processes, used by researchers all over the world.

As previously noted, Daryl had been interested in modelling epidemics since his second publication with David Kendall. In 2001, Joe Gani was invited to an epidemic modelling conference at the Institute of Mathematics and Statistics in Singapore. He declined the invitation but suggested that Daryl might go in his place. At the conference, the head of the biological section of the Singapore Statistics Office¹ gave a talk on epidemic records.

Daryl found the data on dengue fever very interesting. This prompted him to maintain contact with the Singaporean speaker, making stopovers in Singapore on the way to three or more visits to the UK. He also chased down data on the incidence of dengue fever in Australia. In 2009, Daryl and Joe's book *Epidemic Modelling: An Introduction* was published. Like *An Introduction to the Theory of Point Processes*, it rapidly became a standard reference in the area, introducing many researchers in public health to a stochastic approach.

It is not so well known that Daryl gave decades of behind-the-scenes service to the Statistical Society of Australia Inc (SSAI) through his contributions² to the *Australian Journal of Statistics/Australian and New Zealand Journal of Statistics*. He was Secretary-Treasurer of the journal's publishing company for 10 years, and then contributed as Technical Editor for 12 years. His service was recognised with his election to Honorary Life Membership of the SSAI in 1989.

In 2004, I was fortunate enough to be asked to co-edit, with Philip Pollett, a Festschrift for Daryl in the *Australian and New Zealand Journal of Statistics* to celebrate Daryl's 65th

¹Unfortunately, I can't find a record of who this person was. Judging from citations in Daryl's papers, my guess is that it might have been K.-T. Goh of the Quarantine and Epidemiology Department, Ministry of the Environment, Singapore.

²This is described in Simon Sheather's 1999 article 'Retirement of Daryl Daley as Technical Editor', *Austral. N. Z. J. Statist.* **41**, 1–2.

birthday. I'm a little biased, but I think that the list of authors for that issue is the best that the journal has ever had, testament to the respect that these authors had for Daryl. Joe Gani's Preface, on pages 5–11, gives an excellent account of Daryl's life and work to 2004, with emphasis on his devoted service to the SSAI, and lists his publications to that time.

It was 1983 when Daryl first became interested in assessment of high-school students. This interest was started by a query about girls' schools' rankings, when the proportion of girls' school students successfully applying to university fell from 50% to 40% as the Australian Capital Territory (ACT) Government changed from the ranking system used in NSW to a 'new' ACT system. Daryl organised a talk on the topic at the ACT Branch of SSAI.

With possible naivety with respect to the political debate, he offered SSAI (mostly his) help that ended up concluding that modes of assessment—multiple-choice methodology vs student-generated written responses—were the cause of bias. Daryl wrote a joint paper on the scaling of high-school marks with Eugene Seneta, which appeared in *The Australian Journal of Statistics* in 1985, and a number of technical reports. His conclusions were eventually written up in a report to the ACT Board of Senior Secondary Studies (BSSS) with recommendations that, in 1990, were largely adopted as standard for scaling of ACT school-based assessments. In 1995, Daryl's report was also used by Tim Brown in advising on the scaling of 'new' Victorian Certificate of Education (VCE) assessments. With Bob Edwards, Daryl continued to provide advice to the BSSS and develop the system, at various times on contract or on an honorary basis. As recently as 2018, he and Bob wrote a new review that expanded on their previous work.

Possibly because he was not exposed to undergraduate students as a teaching and research academic, Daryl ended up supervising comparatively few PhD students. He was the principal supervisor for Geoff Laslett, who wrote his thesis in 1975, and Kristine Carpio, who wrote her thesis in 2006. I believe that he also helped Mark Westcott and Robin Milne substantially when they were PhD students, although he was not an official supervisor.

The Applied Probability Trust (APT) was started in 1964 by Joe Gani, just before he moved to The University of Sheffield to take up his appointment as the holder of the newly created Chair of Probability and Statistics. The APT has published *The Journal of Applied Probability* since 1964 and *Advances in Applied Probability* since 1969. These journals have grown to be amongst the most respected applied probability journals in the world. Even though the office has remained in Sheffield, Joe Gani's eventual return to Australia has meant that there has always been significant Australian involvement in the Trust.

Joe invited Daryl to join the Trust in 1994 when a previous trustee, Ted Hannan, died. Daryl visited Sheffield every year to meet with the Executive Editor of the Trust until his health made intercontinental travel difficult in 2018. He was the Trustee who monitored the details of the operation, particularly its financial management, and made sure that nothing was missed. Daryl was also very much involved in the production of Special Issues of the APT journals, especially the Festschrifts for David Vere-Jones in 2001, Chris Heyde in 2004, and Peter Jagers in 2018. The fact that the Trust is flourishing today is due in no small measure to Daryl's efforts.

Finally, I want to mention Daryl's role in the Applied Probability Group at the University of Melbourne (UoM). He became an active member of this group with an honorary professorship at UoM when he and Nola moved back to Melbourne from Canberra in 2005. Three or four generations of students benefited enormously from talking with Daryl on a regular basis. Just by taking part in conversations, he exemplified the type of thinking that is characteristic of

a world-class researcher. Not only did he give general advice, but he also helped in concrete ways such as by proofreading theses.

In addition to his mathematical career, Daryl was a gifted musician. He was a regular church organist at St John's Camberwell in Melbourne, St John's Reid in Canberra, and then again at St John's Camberwell when he returned to live in Melbourne. He was an ever-willing accompanist, keen to contribute to musical evenings at mathematical conferences around the world. He sang with distinguished choirs while studying at Cambridge, and continued to sing all through his life with the Canberra Chorale, the Winter Singers, Oriana, the cathedral choir at St Paul's in Melbourne, and the Melbourne Bach Choir. He was also a dextrous recorder player.

Daryl's other great love was hiking. He was a fervent believer in the value of the after-lunch walk, and sometimes claimed that more problems were solved on walks than in seminar rooms. Wherever he travelled for mathematics, he often took the opportunity to attend local concerts and hike the local hills.

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DARYL JOHN DALEY PUBLICATIONS

(a) Books and Monographs

- A (edited with revisions). D. Stoyan, *Comparison Methods for Queues and Other Stochastic Models*. Wiley, Chichester, (1983) xiii + 217pp.
- B (with D. Vere-Jones). *An Introduction to the Theory of Point Processes*. Springer-Verlag, New York, (1988) xxii + 702pp. [Out of print 1998.]
- C. *Determining Relative Academic Achievement for Fair Admission to Higher Education*. Report to Australian National University, Canberra College of Advanced Education, and ACT Schools Authority. (1989) 149pp.
- D (with J. M. Gani). *Epidemic Modelling: An Introduction*. Cambridge University Press, Cambridge, (1999) xii + 213pp.
- E (editor). *Probability, Statistics and Seismology: A Festschrift for David Vere-Jones* (Journal of Applied Probability **38A**), (2001) xvii + 292pp.
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- G. Re-typeset T_EX version (with minor editing) of Bochner, S. and Chadracharan, K. (1949), *Fourier Transforms*, Princeton University Press, iv + 128pp (typewritten original vi + 222pp).
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(b) Articles in Journals &c.

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