

The Contributions of Herbert Robbins to Mathematical Statistics

Tze Leung Lai and David Siegmund

Herbert Robbins was born on January 12, 1915, in New Castle, Pennsylvania. In 1931 he entered Harvard College at the age of 16. Although his interests until then had been predominantly literary, he found himself increasingly attracted to mathematics under the influence of Marston Morse, who during many long conversations conveyed a vivid sense of the intellectual challenge of creative work in that field (cf. Page, 1984, p. 7). He received the A.B. summa cum laude in 1935, and the Ph.D. in 1938, also from Harvard. His thesis, in the field of combinatorial topology and written under the supervision of Hassler Whitney, was published in 1941 [3]. (Numbers in brackets refer to Robbins' bibliography at the end of this article.)

After graduation, Robbins worked for a year at the Institute for Advanced Study at Princeton as Marston Morse's assistant. He then spent the next three years at New York University as instructor in mathematics. He became nationally known in 1941 as the coauthor, with Richard Courant, of the classic *What Is Mathematics?* [4]. This important book has influenced generations of mathematics students here and abroad in many editions and translations. To date more than 100,000 copies have been sold.

In 1941 Robbins enlisted in the Navy. He was demobilized four years later as a lieutenant commander. His interest in probability theory and mathematical statistics began during the war and was itself something of a chance phenomenon, which arose from overhearing a conversation between two senior naval officers concerning the effect of random scatter on bomb impacts (cf. Page, 1984, pp. 8-10). Because of his lack of appropriate security clearance, he was prevented from pursuing this problem during the war. Nevertheless, his work on the naval officers' problem led to the fundamental papers [7] and [10] in the field of geometric probability.

In 1946 Harold Hotelling was setting up a department of mathematical statistics at the University of

North Carolina at Chapel Hill. Having read [7] and [10], and greatly impressed by Robbins' mathematical skills, Hotelling offered him the position of associate professor to teach measure theory and probability to the graduate students in the new department. Robbins accepted the position and spent the next six years at Chapel Hill. During this relatively short period Robbins not only studied and developed an increasingly deep interest in statistics, but he also made a number of profound contributions to his new field: complete convergence [12], compound decision theory [25], stochastic approximation [26], and the sequential design of experiments [28], to name a few.

After a Guggenheim Fellowship at the Institute for Advanced Study during 1952-1953, Robbins moved from Chapel Hill to Columbia University as professor and chairman of the Department of Mathematical Statistics. Since 1953, with the exception of the three years 1965-1968 spent at Minnesota, Purdue, Berkeley, and Michigan, he has been at Columbia, where he is Higgins Professor Emeritus of Mathematical Statistics. During this period he has published over 100 papers on a variety of topics in probability and statistics. His most notable contributions include the creation of the empirical Bayes methodology, the theory of power-one tests, and the development of sequential methods for estimation, hypothesis testing, and comparative clinical trials.

Robbins was President of the Institute of Mathematical Statistics in 1965-1966, Rietz Lecturer in 1963, Wald Lecturer in 1969, and Neyman Lecturer in 1982. He is a member of the National Academy of Sciences and the American Academy of Arts and Sciences. He is widely regarded as one of the world's leading and most imaginative mathematical statisticians.

Robbins has five children and two grandchildren. Children by his first marriage to Mary Dimock are Susannah and Marcia. Children by the second marriage to Carol Hallett are Mark, David, and Emily. At the age of 71 Robbins is still young in spirit, and is as remarkably original and energetic as in the past. He continues to be a prolific contributor to the statistical literature, and much of his work continues to have a profound impact in statistics and related fields. Some of his most important contributions to mathematical statistics are discussed below.

Tze Leung Lai is Professor of Mathematical Statistics, Department of Statistics, Columbia University, New York, New York 10027. David Siegmund is Professor of Statistics, Department of Statistics, Stanford University, Stanford, California 94305.