

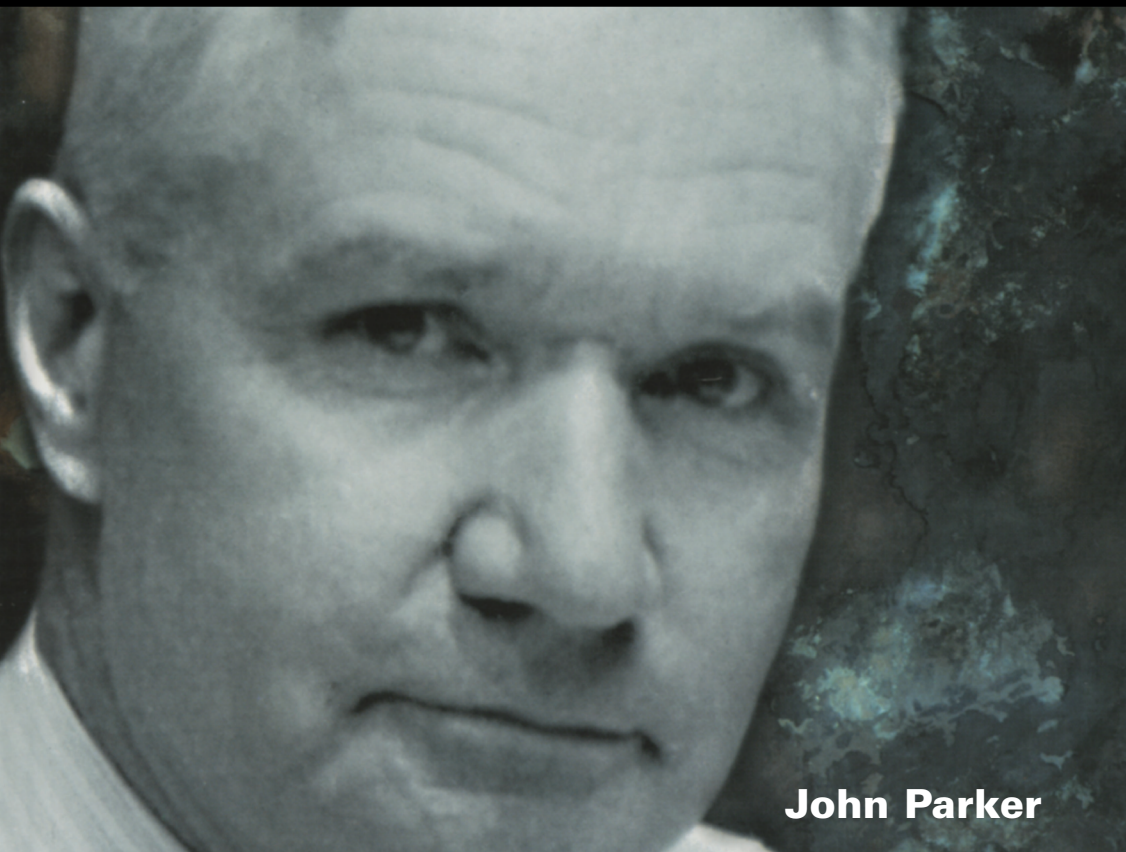
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R.L. MOORE

Mathematician & Teacher



John Parker



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Mathematician and Teacher

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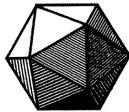
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Preface

Robert Lee Moore (1882–1974) was a towering figure in twentieth century mathematics, internationally recognized as founder of his own school of topology, which produced some of the most significant mathematicians in that field. The 50 students he guided to their PhDs can today claim 1,678 doctoral descendants. Many of them are still teaching courses in the style of their mentor, known universally as the Moore Method, which he devised. Its principal edicts virtually prohibit students from using textbooks during the learning process, call for only the briefest of lectures in class and demand no collaboration or conferring between classmates.¹ It is in essence a Socratic method that encourages students to solve problems using their own skills of critical analysis and creativity. Moore summed it up in just eleven words: ‘That student is taught the best who is told the least.’² A controversial figure, both for his style of teaching and his strong views, Moore was once described as a ‘Mr. Chips with Attitude’³. The attitude was an integral part of the method of his tuition to generations of students, and it also applied to the unique manner in which he discovered and developed mathematical talent among the young men and women he encountered during his 60-year teaching career. Moore was a born iconoclast, much given to challenging the status quo of academia and the conventional modes of scholarship of his time. With his snowy white hair immaculately combed, his piercing blue eyes always seeking exciting new proofs to complex problems, and

¹ Exceptions were Moore’s calculus and analytic geometry courses in which textbooks were used for setting problems. His doctoral students were allowed to refer to textbooks mainly to ensure their theses were original.

² From *Challenge in the Classroom*, a documentary film on the life and work of R.L. Moore, produced for the Mathematical Association of American in 1966 (now re-issued as *The Moore Method: A Documentary on R.L. Moore*, in the MAA’s publications division).

³ A former Moore student, in conversation with the author.

his well-muscled boxer's physique clad in dark three-piece suits and old-fashioned, hand-made, laced-up black boots, he was a commanding presence on the campus of The University of Texas for 49 years, encouraging and cajoling students in his deeply resonant voice into surpassing their own wildest dreams of mathematical attainment.

Therein lies a vital additional ingredient to his story. It will become evident in the ensuing pages that while the life of this mathematical pioneer is the central theme, there is also an unfolding drama, for such it is, that encompasses what may now be seen as the legacy of the man, and the implications of his work and teaching for mathematics and science in modern times, and for the future. Indeed, the Moore Method has, in recent times, attracted a growing revival of interest, partially because of the activities of former Moore students in places of higher learning throughout the United States of America, Europe, Asia and the Far East. In America, increased emphasis on K–12 education starting in kindergarten through grade 12 following the 1996 review of the National Science Foundation, enshrined in its pamphlet *Shaping the Future*, has contributed to this resurgence.

These chapters, therefore, go beyond a mere biographical study and are intended through closer examination of his personal brand of discovery learning to suggest ideas and possibilities for rekindling mathematical interest and ability among the young. The relevancy of his work on present and future generations in this regard may be discovered by an understanding of the impact of his technique, gleaned from the contributions of those who studied with Moore, while at the same time forging an enlightening and authoritative profile of a man whose influence on the American mathematical community continued over six decades, and remains strong 25 years after his death. That insight, it will be seen, is drawn from some of the most famous mathematical names in America and Europe from the late 1890s onwards, first those who influenced Moore during his own studies, and later those highly respected scholars who had once been his students.

As to his own research, which again was world renowned, he was the first native-born American to become a Visiting Lecturer for the American Mathematical Society, of which he also became president. He published 65 papers and a book which is still referred to 70 years later and which has been the subject of literally hundreds of papers by other mathematicians around the globe. Equally fascinating as a sub-text to his story are the achievements of his students: three of them followed

him as president of the American Mathematical Society, three others became vice-president, and another served as secretary of the AMS for many years. Five served as president of the Mathematical Association of America and three, like Moore, became members of the National Academy of Sciences while most of the rest became highly respected and well published researchers and teachers in leading American universities.

Thus, apart from his personal contribution, Moore had a profound influence on American mathematics and the teaching thereof. Given that the presidencies run for two years, his former students were at the helm of one or another of the two major mathematical organizations in the US for a third of the second half of the twentieth century. In 1938 Moore had his photograph taken for his presidency of the AMS and the photographer suggested that he might airbrush from the print a wart on his subject's face. 'Warts and all,' replied Moore. And thus, in this account, I have followed the same guidance. This then is the extraordinary story of R.L. Moore and how he developed the Moore Method, which was bigger than the man (with all his faults and idiosyncrasies), how it equipped its beneficiaries to excel in fields of excellence other than mathematics, and how it has been modified to meet the educational requirements of today. John W. Green, Principal Research Biostatistician at Dupont, says: 'I attribute whatever measure of success I've had as an industrial statistician to the training and experience that I received working under R.L. Moore. There certainly have been other influences in my life, but what I gained and regained with Dr. Moore has had a very profound influence on many of the decisions I've made and how I conduct myself.'⁴ There were, however, elements of Moore's teaching that drew criticism and on occasion antagonism from observers and students alike. Some were simply not suited to his style, or the man himself, and psychological bruising was not uncommon. On the one hand, he showed immense patience and dedication, while on the other he could be unflinchingly blunt in rejecting students he either disliked or excluded because he felt they had too much knowledge for his classes, where the entry standard was a virgin mind, untainted by earlier exposure to the work Moore would propose in his courses. There were

⁴ From *Topology to Statistics: The Influence of R.L. Moore's Training on an Industrial Statistician*, by John W. Green, Principal Research Biostatistician, Dupont, at the 4th Legacy of R.L. Moore Conference 3–5 May 2001.

personal beliefs and attitudes, too, born out of his Southern upbringing, that caused dissent and argument in his classroom, much of it deliberately inspired by himself as part of his pedagogical experiments. In the main, however, Moore is remembered as a teacher of mathematics with honest affection and appreciation for the manner in which he drew from his students latent talent, even from a number who had no intention of becoming mathematicians but eventually went on to become leaders in their fields. An example of that spirit is engendered in a note written to him by one of his students, John Mohat, who saw a passage in a work of fiction that he felt summed up exactly the way Robert Lee Moore, through his style and ideas, fired up their creative talents. The passage came from John Steinbeck's *East of Eden*, which Mohat sent to Moore shortly before Moore retired at the age of 86:

'Sometimes a kind of glory lights up in the mind of a man. It happens to nearly everyone. You can feel it growing or preparing like a fuse burning toward dynamite. It is a feeling in the stomach, a delight of the nerves, of the forearms ... A man may have lived all of his life in the gray, and the land and trees of him dark and somber. The events, even the important ones, may have trooped by faceless and pale. And then—the glory ... Then a man pours outward, a torrent of him and yet he is not diminished. And I guess a man's importance in the world can be measured by the quality and the number of his glories. It is a lonely thing but it relates us to the world. It is the mother of all creativeness, and it sets each man separate from all other men.'

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Other tape-recordings and transcripts from this archive include those conducted by Douglas Forbes, for his 1971 dissertation: *The Texas System: R.L. Moore Original Edition*. Tape-recorded contributions consulted by the author include those by R.D. Anderson, Steve Armentrout, Joanne Baker, Mrs. B.J. Ball, Lida Barrett, Mary Bing, Ed Burgess, Howard Cook, J.L. Cornette, Jerome Dancis, James Dorroh, W. Eaton, J.W. Green, M.E. Hamstrom, F. Burton Jones, I.W. Lewis, Lee

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R.L. Moore walking down Guadalupe Street in Austin, p. 125. Ca. 1920. Photographer: Unknown, donated by Louis A. Beecherl. Source: R.L. Moore Legacy Collection in the AAM [DI01193].

Fall 1928: Back row, left to right: W. T. Reid, J. H. Roberts, C. M. Cleveland, Norman E. Rutt, and J. R. Dorrow; front row, left to right: Lucille Whyburn, G.T. Whyburn, R.L. Moore, R.G. Lubben, p. 129. Source: R.G. Lubben Papers in the AAM [DI01198].

Gordon T. Whyburn, p. 133. Source: On EAF website. From: Pitcher, E. (1988), *A History of the Second Fifty Years, American Mathematical Society, 1939–1988*. American Mathematical Society, Providence.

R.L. Moore, p. 136. October 1930. Photographer: Jenson Studio, Austin, TX. Source: R.L. Moore Legacy Collection in the AAM [DI01386].

Taken at the Mathematical Association of America/American Mathematical Society/American Association for the Advancement of Science meetings in Cleveland Ohio, December 1930; left to right, disregarding row: Wilfrid Wilson, J. W. Alexander, W. L. Ayres, G. T. Whyburn, R. L. Wilder, P. M. Swingle, C. N. Reynolds, W. W. Flexner, R.L. Moore, T.C. Benton, K. Menger, S. Lefschetz, p. 139. Source: R.L. Moore Papers in the AAM [DI00785].

R.L. Moore in his office, p. 143. Ca. 1930s. Photographer: R.G. Lubben. Source: R.G. Lubben Papers in the AAM [DI01197].

Raymond L. Wilder, p. 146. Ca. 1965. Source: Mathematical Association of America Records in the AAM [DI01235].

Robert E. Greenwood, p. 149. November 1974. Source: R.L. Moore Legacy Collection in the AAM [DI01396].

Spring 1931: Karl Menger, Milton B. Porter, J. H. Roberts, and R. G. Lubben, p. 153. Source: R. G. Lubben Papers in the AAM [DI01381].

R.E. Basye and E.C. Klipple, p. 158. Ca. 1930s. Photographer: R.G. Lubben. Source: R.G. Lubben Papers in the AAM [DI01393].

R.L. Moore, p. 161. Ca. 1935. Photographer: R.G. Lubben. Source: R.G. Lubben Papers in the AAM [DI01384].

Possibly taken in the Moore home. Back row, left to right: R. E. Bayse, E. C. Klipple, F. Burton Jones; front row, left to right: C. W. Vickery, R. L. Moore, R. G. Lubben, p. 164. Ca. 1935. Source: R.G. Lubben Papers in the AAM [DI01191].

R.G. Lubben, C.W. Vickery and F.C. Biesele, p. 169. Ca. 1936. Source: R.G. Lubben Papers in the AAM [DI01383].

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Moore at his desk, p. 177. 1935. Photographer: R.G. Lubben. Source: R.G. Lubben Papers in the AAM [DI01196].

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R.L. Moore during registration at UT, p. 193. September 1939. Photographer: Dr. H.F. Kuehne. Source: R.L. Moore Papers in the AAM [DI01192].

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Page 5 of the letter from R.L. Moore to Mary-Elizabeth Hamstrom, p. 247. 05/07/48. Source: R.L. Moore Legacy Collection in the AAM [DI01388].

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Mary Ellen and Walter Rudin, p. 252. Source: Donald J. Albers, G.L. Alexanderson, and Constance Reid, *More Mathematical People*, Harcourt, Brace, Jovanovich, 1990.

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R. L. Moore Hall on the UT campus, p. 331. May 1973. Photographer: unknown. Source: Prints and Photographs Collection, Center for American History, The University of Texas at Austin. [DI01390]

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British author **John Parker** has been a journalist and writer all his working life. He went straight from Kettering Grammar School to join *Northampton Chronicle and Echo* as a trainee reporter and remained in local newspapers in the UK until securing a position with the *Nassau Daily Tribune* in the Bahamas.

He later worked for *Life* magazine, New York, before returning to the UK to join the *Daily Mirror*, then one of Britain's foremost and highly respected daily newspapers as a sub-editor. Hometown beckoned again when at 30, he was appointed editor of *Northamptonshire Evening Telegraph*, the country's youngest evening newspaper editor at that time.

Towards the 1980s, he returned to Fleet Street, rejoining the Mirror Group to become night editor of the *Daily Mirror* and later deputy editor of the *Sunday Mirror*. Along with a number of other Mirror stalwarts, he resigned during the reign of Robert Maxwell to concentrate wholly on his writing. To date, he has published 30 books in hardback which have appeared in 64 editions in the UK and more than 40 international editions.

R. L. MOORE

Mathematician & Teacher

John Parker

R. L. Moore: Mathematician and Teacher presents a full and frank biography of a mathematician recognized as one of the principal figures in the 20th Century progression of the American school of point set topology. He was equally well known as creator of the Moore Method (no textbooks, no lectures, no conferring) in which there is a current and growing revival of interest and modified application under inquiry-based learning projects in both the United States and the United Kingdom. Parker draws on oral history, with first-person recollections from many leading figures in the American mathematics community of the last half-century. The story embraces some of the most famous and influential mathematical names in America and Europe from the late 1900s in what is undoubtedly a lively account of this controversial figure once described as 'Mr. Chips with Attitude.'