

Arthur Lyon BOWLEY

b. 6 November 1869 - d. 21 January 1957

Summary. Inspired by an early acquaintance with socialists and slums, Bowley, a pioneer in the development of statistical tools for the analysis of matters of economic and social concern, is remembered for his development of sampling techniques as applied in the social sciences.

Questions of foreign trade, wages, poverty, industry, the national income and the general welfare of the citizens of a country have long been of concern to governments. It was only with the development of appropriate statistical tools in the late nineteenth and early twentieth centuries, however, that the analysis of such matters was placed on a more scientific footing. Bowley was one of the pioneers in the development and use of such tools.

The son of James William Lyon Bowley and his second wife Maria Johnson, Arthur Lyon Bowley was born in Bristol, England, where his father was vicar of SS Philip and Jacob. James died in 1870, and Maria was left as mother (or step-mother) to seven children. From 1879 to 1888 the young Arthur (so named because of his mother's fondness for the works of Tennyson) was educated at Christ's Hospital, London, where he won various prizes for classics and mathematics. In later life Bowley pleasurably renewed his ties with the school as a representative of the University of London on the Council of Almoners from 1936 to 1947, being *ipso facto* a governor during that period.

A major scholarship in mathematics took him to Trinity College, Cambridge, where, despite poor health (so poor, in fact, that a trip to Egypt, financed by several dons, had to be taken, and this was followed by a lengthy stay in the more bracing atmosphere of Bournemouth), he was bracketed tenth Wrangler in 1891. His previous ill health necessitated his spending a further term in residence before the degree could be awarded, and so from October 1891 to March 1892 Bowley studied physics, chemistry and economics, following a reading course in the latter under the supervision of Alfred Marshall.

In 1892 Bowley's early interest in economics and statistics was publicly recognized in the award of the Cobden Prize for his essay *A Short Account of England's Foreign Trade in the Nineteenth Century*, and two years later he was awarded the Adam Smith Prize for a paper on changes in average wages.

A bequest of £9,000 from Henry Hunt Hutchison to the Fabian Society in 1895 enabled Sidney and Beatrice Webb, together with like-minded individuals, to found the London School of Economics. Among the part-time lecturers at the start of the first session in October of that year was Bowley (appointed on Marshall's recommendation), who was charged with the giving of lectures in statistics. Bowley fulfilled his obligations by cycling some eighteen miles from St John's School, Leatherhead, where he was a teacher of mathematics, on the afternoons of his Wednesday half-holidays.

On taking up his lectureship, Bowley consulted F.Y. Edgeworth (q.v.) for information on the nature and literature of statistics, starting a friendship which lasted until Edgeworth's death. The lectureship became a Readership in 1908, and in 1915 Bowley was given the title "Professor", becoming, in 1919, the first incumbent of the University of London's newly-created Chair in Statistics, tenable at the London School of Economics. It was on receiving this full-time post that he left his position at University College, Reading, where he had been lecturer in mathematics (1900-1907), in economics (1913-1919) and professor in both (1907-1913). Bowley remained at the London School of Economics until 1936, when he became emeritus professor. But his energy and enthusiasm continued after retirement: he carried on with a number of his activities at the London School of Economics, and from 1940 to 1944 he was acting (and an active) director of the Oxford University Institute of Statistics.

While Bowley may have started his working life as a teacher of mathematics, his two prize essays and the start of a long series of papers (many co-authored with G.H. Wood) in 1898 clearly showed the way of his future career. As a boy Bowley had been acquainted with socialists and slum conditions in Bristol, and at Trinity College he tried, though with indifferent success, to further social equality by entertaining the dining-hall waiters to light refreshments and conversation. Indeed, the contrast between Bristol slums and Trinity wealth did much to sharpen his interest in socialism, and although Bowley never became a socialist in the sense in which the Webbs did, he channelled his liberal concept of progress into his research.

Bowley's Cobden Prize essay was published as a book in 1893. Intending this as an introductory text to provide the reader with easy access to the "fundamental facts of this century's commerce", Bowley set out the more important events and causes affecting the growth of trade with their due prominence, and indicated the more obvious of the social effects of this growth. (One notes, with approval, Bowley's especial use of the comparative degree.)

Here tables of figures were largely eschewed, being replaced by diagrams.

The Adam Smith Prize essay, in a revised form, was presented to the Royal Statistical Society in 1895, and resulted in the award of the Guy Medal in Silver (the Guy Medal in Gold followed in 1935). Here Bowley found the actual changes in the total sum paid in wages and the average money wage, the changes in the gross receipts of profits and interest, and the income of the nation as a whole. Special features were (a) statements of wages were never compared unless they were given by the same authority and (b) ratios, rather than amounts, of wages were considered. The paper is an excellent example of what such a study should be, and it can still be read with profit and enjoyment. Indeed, if some of Bowley's work today seems hackneyed or trite, it is only because it has become commonplace.

Bowley's statistical lectures at the London School of Economics resulted in two text-books. The first of these, *Elements of Statistics* (1901), was intended primarily for those wishing to understand, appraise and criticize official and similar statistics, this word being understood as "the science of the measurement of the social organism, regarded as a whole, in all its manifestations". The contents range from the collection and tabulation of data through moments, graphical methods, correlation and index numbers (in Part 1), to the application of mathematics to statistics (in Part 11), the examples in this part being chosen principally with reference to sociological and economic investigations.

The *Elementary Manual of Statistics* of 1910 is less demanding of the reader: it is concerned more with official than mathematical statistics, the Index leading from "Abatements, income-tax" via the "Panama Canal" to "Zinc production".

In 1913 Bowley published *A General Course of Pure Mathematics*. Designed for those who used "pure mathematics as an instrument in mechanics, engineering, physics, chemistry and economics", this work met with a mixed reception, being received with enthusiasm by E.T. Whittaker but somewhat more coldly by G.H. Hardy.

Bowley's *Mathematical Groundwork of Economics* of 1924 was a laudable attempt to present, in a unified form, the mathematical methods used by some of his economic predecessors. Unlike his mathematical and statistical texts, however, it was intended for the practising (professional) economist rather than the tiro.

Bowley's pioneering activities in economics were two: the first consisted of a number of studies on the definition and measurement of the national

income. while the second was his work with the London and Cambridge Economic Society, which continued until 1953. But his major contribution, as much to statistics as to economics, was his work on the development of sampling techniques as applied in the social sciences.

Until around the turn of the century it was widely held that complete enumeration was the only way to obtain precise results in demographic studies, an attitude criticized by Bowley in his presidential address to the British Association for the Advancement of Science in 1906. Bowley, however, was not one to preach without practising: in 1912 he conducted a sample survey of Reading, one whose design, implementation and analysis still serve as models for such surveys. Similar surveys of Northampton, Warrington and Stanley were conducted by A.R. Burnett-Hurst under Bowley's supervision, and published, together with the Reading survey, in *Livelihood and Poverty* in 1915. A separatum was issued in 1920, giving the results of a similar survey carried out in Bolton. The results obtained about poverty were both surprising and shocking. The accuracy of the results was subjected to careful criticism, and possible sources of error (and the steps taken to avoid them) were discussed. A follow-up study in 1924 resulted in *Has Poverty Diminished?*, a question that was answerable in the affirmative.

Bowley's insistence on the importance of sampling (or the representative method, as it was then called) led to his membership of a committee set up by the International Statistical Institute in 1924, and resulted in his report "Measurement of the precision attained in sampling" in which he set out the first clear statement of the foundation of the modern theory of sample surveys. Here Bowley (a) explained the nature and role of a sampling frame, (b) developed a theory for proportionate stratified sampling, and (c) developed a theory for purposive sampling. There is no doubt that the cause of official statistics would have been advanced had bureaucracy not been obdurate in the acceptance of the wisdom and institution of sampling.

A prominent aspect of this report was the demonstration of the superiority of stratified over simple random sampling, though Bowley was not always careful to distinguish between the latter and cluster, or systematic, sampling. Bowley's continuation with this research culminated in what he himself regarded as his most important work: the *New Survey of London Life and Labour* undertaken from 1930 to 1935. Bowley in a sense moved out of "pure" economics into econometrics in the path-breaking *Family Expenditure*, co-authored with R.D.G. Allen in 1935 (when Bowley was sixty-six). Here the expenditures of individual families were compared with those of in-

dividuals within families, the goodness-of-fit of an empirically derived linear law being examined by a χ^2 test.

In 1913 Bowley received an Sc.D. from Cambridge, while an honorary D.Litt. (Oxon.) and a D.Sc. (Manchester) followed later. He occupied, at various times, high positions in the Royal Statistical Society, the Royal Economic Society (elected Fellow in 1893), the International Statistical Institute, the Econometric Society and the British Association for the Advancement of Science (Section F: economic science and statistics). In 1897-1898 and again in 1927-1928 he was Newmarch Lecturer at University College London. In 1922 he was made a Fellow of the British Academy, in 1937 he was appointed a Commander of the British Empire, and he was knighted in 1950.

In 1904 Bowley married Julia Hilliam, instructress in wood-carving at Reading College, an arithmetic progression of daughters (Ruth, Agatha and Marian) following.

Bowley is painted by those who knew him as “dour” in committees (whether *obstinate*, *sullen* or *grim* I cannot say), a man of discretion, shy and retiring, respected by colleagues and friends but intimate with few. After a life marked by a sincere and sympathetic concern for the human condition, Bowley died on the 21st January 1957 at Haslemere, Surrey.

References

- Allen, R.G.D. (1968). Bowley, Arthur Lyon, pp. 134-137 in D.L. Sills (Ed.), *International Encyclopedia of the Social Sciences*, Vol. 2, The Macmillan Company & The Free Press.
- Allen, R.G.D. & George, R.F. (1957). Obituary. Professor Sir Arthur Lyon Bowley, *Journal of the Royal Statistical Society A*, **120**, 236-241. [Contains a comprehensive list of Bowley’s writings.]
- Darnell, A. (1981). A.L. Bowley, 1869-1957, pp. 140-174 in D.P. O’Brien & J.R. Presley (Eds), *Pioneers of Modern Economics in Britain*, Macmillan.
- Maunder, WY. (1977). Sir Arthur Lyon Bowley, pp. 459-480 in M.G. Kendall & R.L. Plackett (Eds), *Studies in the History of Statistics and Probability*, 11, Charles Griffin.

A.I. Dale