Francis Ysidro EDGEWORTH
b. 8 February 1845 - d. 13 February 1926

Summary. His writings reflecting the advantages of a classical education, Edgeworth made contributions to the moral sciences, economics, probability and statistics. His early and important work on index numbers and utility was followed by later statistical work now perhaps seen as 'Bayesian'.

What is one to make of an author whose disparate writings cover topics from Matthew Arnold's interpretation of Butler to the generalized law of error, via index numbers, the theory of banking, correlation, least squares, the labours of Hymenoptera, hedonism and examination statistics? And how much more difficult is any comprehension, let alone assessment, when classical tags abound, when neologisms are rife, and when an English style awkward to the modern eye prevails! This is the kind of problem besetting one commenting on Edgeworth.

Francis Ysidro Edgeworth (for this is the way the world knows him, despite his Christian names being registered in the reverse order) was born in Edgeworthstown, County Longford, Ireland, on the 8th February 1845. His grandfather, Richard Lovell Edgeworth (1744-1817), keenly interested in the applications of science to industry, perfected a number of inventions which won him gold and silver medals from the Society for the Encouragement of Arts and, in 1761, a Fellowship of the Royal Society. Richard worshipped at the altar of Hymen to the extent of four marriages, with twenty-two offspring issuing in forty-eight years. His second child and eldest daughter, Maria, became a well-known novelist, and their circle of friends included people such as Jeremy Bentham, Sir William Rowan Hamilton, Sir John Herschel, Thomas Malthus (q.v.), David Ricardo and Sir Walter Scott. Francis Ysidro's father, Francis Beaufort (1809-1846), was the son of Richard and his last wife, Frances Anne Beaufort, a woman of Huguenot extraction and the sister of the inventor of the Beaufort Wind Scale. At the age of twenty-two Francis Beaufort married Rosa Florentina Eroles, a sixteen-year-old Catalan refugee. After a few years in Florence and the failure of a private tutoring establishment in Eltham near London, Francis Beaufort returned to Ireland to manage the family estates, where Francis Ysidro was born some eighteen months before his father's death during the Irish Famine.

As might be expected, fecundity such as that described above resulted in complex family ties, and Francis Ysidro was distantly related to Sir George

Gabriel Stokes and Sir Francis Galton (q.v.). However emigration to the New World and mortality took their toll of the bearers of the Edgeworth name, and despite his being only the fifth son of a sixth son, Francis Ysidro inherited the family estates (by then almost impoverished) in 1911. He never married, and his death on the 13th February 1926 saw the end of the male line in Europe.

At seventeen, after having been privately tutored from childhood, Francis Ysidro entered Trinity College Dublin to read modern languages. He seems to have taken no degree there, and in 1867 he moved to Oxford. After short spells at Exeter and Magdalen Halls, he was admitted to Balliol in 1868. A first in Greats (Literae Humaniores) was awarded in 1869, though the degree was not conferred until 1873, the formal M.A. following in 1877.

It appears that Edgeworth moved to London on leaving Oxford, where some private study must have followed; for in 1877 he was admitted to the Bar by the Inner Temple, though he is not known to have practised.

Edgeworth held various minor lecturing posts in London until he became Professor of Political Economy at King's College in 1888, succeeding Thorold Rogers in 1890 as Tooke Professor of Economic Science and Statistics. In 1891 he again followed Rogers, this time as Drummond Professor of Political Economy at Oxford, where he became a Fellow of All Souls College and remained until his retirement with emeritus status in 1922.

The stimulus for Edgeworth's interest in literature, science and mathematics is evident in his family background, and his training at Trinity and Oxford may account for his penchant for classical quotation. He himself wrote "After leaving Oxford, I studied mathematics for some years" (Newman [1987, p. 85]), and his emphasis on the calculus of variations and his aesthetic views on mathematics may both be ascribable to Hamilton's influence (mathematical *reasoning* or *rhetoric* was always important to Edgeworth). Bowley noted, however, that Edgeworth's mathematical work shows a lack of systematic training, with "a want of facility and neatness in his handling of problems", though exhibiting "great insight into the principles of mathematics" [1934, p. 114].

Edgeworth's early interest in ethics resulted in his first major work, *New and Old Methods of Ethics* in 1877. Here a hedonic calculus (divided into economics and utilitarianism) is established, and the importance of optimization stressed.

From the measurement of pleasure Edgeworth was led naturally to the measurement of utility (and consequently to an interest in economics), then

to the measurement of belief, and thence to probability and statistics.

Edgeworth's work in the moral sciences was perhaps first impelled by his contact at Balliol with Benjamin Jowett, though the interest in economics is probably more directly attributable to the association with his close neighbour in Hampstead, William Stanley Jevons (q.v.) (contact with Alfred Marshall followed at a later date). In 1881 Edgeworth published what was perhaps his most important contribution to economics: *Mathematical Psychics: an essay on the application of mathematics to the moral sciences*, a work essential to the understanding of Edgeworth's later writings and described by Keynes (q.v.) as an "amalgam of poetry and pedantry, science and art, wit and learning" [1972, p. 258]. Intended as an essay, from a utilitarian point of view, on "the calculus of *Feeling*, of Pleasure and Pain", the book was divided into two parts, concerned respectively with the applicability and the application of mathematics to sociology. Here Edgeworth disclosed indifference curves and their relation to the contract curve, his own contributions to utility theory being relegated to the appendices.

While Edgeworth's activities were directed in the main to probability and statistics after 1881, three notable contributions to economic theory were made in the 1890s: "The pure theory of international values" (1894), "The pure theory of monopoly" and "The pure theory of taxation", both in 1897. A major contribution to the subject of index numbers was made by Edgeworth as secretary to the British Association for the Advancement of Science.

His third book, *Metretike: or The Method of Measuring Probability and Utility* (1887), dealt with probability as the basis of inductive reasoning, with both weighted means and the most advantageous mean, and although Keynes states [1972, p. 261] that Edgeworth himself was disappointed with this tract, it perhaps gained importance with the later works of F.P. Ramsey and L.J. Savage.

After this Edgeworth turned his attention more and more to probability and statistics. His most important writings on probability *per se* are perhaps "The philosophy of chance" (1884) and the article on probability in the eleventh edition of the *Encyclopedia Britannica*. Edgeworth's first paper on statistics was published in 1883. It was devoted to the law of error (our Normal distribution), a topic that was to concern him to the last, and the whole plan of his statistical work can be seen in his important "Methods of Statistics" of 1885.

In 1891 Edgeworth became the first editor of the *Economic Journal*, and

he continued in one or another editorial capacity until his death. As editor he penned a number of reviews of books and articles, frequently with commentary on contemporary work, his own thoughts often being relegated to footnotes.

Edgeworth did not establish a school of followers: his only disciple seems to have been Sir Arthur Lyon Bowley (q.v.), who, on his appointment to the London School of Economics in 1895, consulted Edgeworth for information on the nature and literature of statistics, starting a friendship which lasted until Edgeworth's death. It was in fact Bowley's 1928 tract on Edgeworth's work in mathematical statistics that probably saved this work from oblivion.

Most of Edgeworth's biographers (even Bowley) got to know him only in his middle age, and so opinions of him as a young man are lacking. In 1889 Beatrice Webb (then Potter) described him as "a gentle-natured and intellectual man with queer cramped nature, excessively polite and diffident in manner" (she also said that he was pathetic and that he bored her). Keynes notes Edgeworth's all-embracing tolerance and says "He was kind, affectionate, modest, self-depreciatory, humorous, with a sharp and candid eye for human nature; he was also reserved, angular, complicated, proud, and touchy, elaborately polite, courteous to the point of artificiality, absolutely unbending and unyielding in himself to the pressure of the outside world" [1972, p. 265]. As a lecturer Edgeworth was apparently not a great success: Bowley notes that "the few courses of lectures he gave were not well attended, for indeed he had no faculty for that method of teaching" [1934, p. 1231, while Schumpeter writes that Edgeworth was "the worst speaker and lecturer imaginable" [1954, p. 831].

Edgeworth was perhaps more a philosopher than a practitioner of statistics. Yet in his statistical work (much of which one would today term "Bayesian") one finds essentially the t-distribution (his "subexponential" distribution, derived as the posterior for a Normal mean with uniform priors for μ and σ^{-1}), the Edgeworth expansion and the Edgeworth series, the method of translation (now called variate transformation) and its extension to bivariate surfaces, the asymptotic theory of maximum likelihood estimates, the rejection of outhers, stochastic models, tests of goodness-of-fit and an anticipation of a two-way analysis of variance. He also introduced a number of statistical terms, some of which, like "modulus" and "fluctuation" (our $\sqrt{2}\sigma$. and $2\sigma^2$ respectively) have to a large extent disappeared, while others, such as the "coefficient of correlation", remain. We are also indebted to him for the 'k' in *Biometrika*. It is fashionable, if not obligatory, when writing

on Edgeworth to comment on the obscurity of his style. However in preparing this note I found that I had to agree with Bowley that "if one studies carefully a treatise as a whole, with some knowledge of Edgeworth's general lines of thought, and then reads it a second time, one finds that the whole is coherent, the arguments valid and consecutive, the theme is made clearer and more vivid by the variations" [1934, pp. 123-124].

Honoured for his work in economics and statistics, Edgeworth received a D.C.L. from Durham University. He was twice president of the Economic Section of the British Association, President of the Royal Statistical Society (receiving the Guy Medal in Gold in 1907), Vice-president of the Royal Economic Society and an original Fellow of the British Academy (1903).

References

Francis Ysidro EDGEWORTH