Anton MEYER
b. 31 May 1801 - 29 April 1857

Summary. Meyer, a Belgian professor of Luxemburg origin, was the author of one of the few treatises of probability theory in the 19th century. He propagated the methods of Gauss, Bessel and Baeyer among geodesists of the French tradition.

Anton Meyer was born in Luxemburg, but became a naturalised Belgian on 2 April 1839. Although from a family of modest means (his father was a shoemaker), he completed his secondary schooling in the humanities in 1818, and then pursued his scientific studies with brilliance at Liège University. During this period, in order to earn a living, he taught and also catalogued the scientific books at the University's academic library. He worked towards a doctor's degree in the Mathematical and Physical Sciences, completing his thesis on "Maxima and minima" on 29 November 1823, though his defence only took place on 16 June 1832. In 1824-25, Meyer travelled to Paris to listen to the eminent scientists of the day. On his return to Belgium, he taught at the Echternach College and later at the Military School of Bréda. In 1827, he published a paper in Quetelet's (q.v.) *La correspondance mathématique et physique*, about an instrument he had invented for drawing in perspective. In 1831 he taught at the Louvain College, and later from 1832 to 1837 at the Institut Gaggia in Brussels, where he prepared students for the Military School.

In 1834, he also became Professor of Analysis and Mechanics at the Brussels Military School, which had just opened, but he resigned from this position in 1836. In 1838, he was appointed to the Chair of Mathematical Analysis at the Université Libre de Bruxelles, and later he replaced Lemaire in the Chair of Differential and Integral Calculus, Higher Analysis and Calculus of Probabilities at Liège University from 1849 until his death. Under Meyer, two distinct subjects were taught, analysis, and probability theory and political arithmetic.

Meyer was clearly a dedicated teacher: his lessons, according to the reports of his pupils, were very appealing. After 1838, having achieved a stable position, he wrote a dozen text books. These were original, and written in simple and precise language; furthermore, Meyer was quick and accurate in his calculations, which were carried out with great ability. His lectures on probability were published only many years after his death, in 1874 by F.

Folie, based on the author's manuscripts, as the *Cours de Calcul des Probabilités fait à l'Université de Liège de 1849 à 1857* (F. Hayez, Bruxelles). This work, given the relative dearth of treatises on probability at the time, created something of a stir, and was translated into German in 1879 by E. Czuber under the title *Vorlesungen über Wahrscheinlichkeitsrechnung*. It contains a thoroughly researched account of the theory of errors. In the preface, F. Folie points out: "This book by Meyer is a very complete summary of the most important works of Bernoulli (q.v), de Moivre (q.v.), Laplace (q.v.), Poisson (q.v.), Gauss (q.v.), Encke, Bienaymé (q.v.)... on the calculus of probabilities. One might well suggest that there does not exist a broader treatise on the subject, except for Laplace's *Théorie analytique des probabilités* ...".

The treatise is very theoretical, even in his chapters concerned with the theory of errors, concentrating essentially on his proofs. This is in contrast to J.B.J. Liagre (1815-1891), who, in his *Calcul des probabilités et théorie des erreurs* published in 1852, gave a large number of applications of the theory of errors, particularly in geodesy.

Meyer was nevertheless interested in applications of mathematics, most particularly to geodesy. In 1835, while he was at the Military School in Brussels, Meyer's colleagues were Quetelet, Professor of Geodesy and Astronomy and Nerenburger, Professor of Descriptive Geometry. He collaborated with cartographic officers, and with the astronomer Houzeau, Quetelet's assistant. From the 1830's, he personally carried out triangulations, working out the calculations which were involved in them. Traces of his notes are to be found in the *Leçons de trigonométrie rectiligne* and the *Leçons de trigonométrie sphérique* published in 1844, as well as his *Cours de géodésie* dated 1845, which faithfully followed the French mathematical tradition. It is well known that since the 17th Century, particularly with the measurement of the metre during the French Revolution, France had played a leading role in the area of geodesy. But, from around 1820-1830, leadership passed fairly rapidly to Germany with the works of Gauss, Bessel and Baeyer who made systematic and relevant use of the method of least squares. Belgian scholars like Quetelet, Liagre, Nerenburger and Meyer, trained by the French, but open to other traditions, fostered the spread of German methods in Europe. A direct consequence of Meyer's travel to Germany in 1846 was the modification of his lectures on geodesy, and then of lecture material by other geodesists formerly written in the French tradition. Among these modifications are a section concerning the theory of errors, some lines on the personal equation, the use of the theory of least squares to obtain most probable values, an

iteration method for the observation of angles, the use of the method of least squares as it arises in the calculation of most probable directions, and in the compensation theory for a network of triangles. The notation used for the solution by the method of indeterminate coefficients was that introduced by Gauss, and the weight equations correspond to those of Baeyer, as does also the study of their influence on the initial direction.

On February 6, 1847, Meyer presented a report on the application of the calculus of probabilities in operations of topographic surveying, to the science Section ("Classe") of the Royal Academy of Belgium. In this, he discussed an example of the use of the method of least squares. It was rejected by the Academy and never published. The bibliography of a thesis by L. Bouvier entitled *Dissertation sur la théorie des moindres carrés* which appeared in 1848 is identical with that of Meyer's report. Thus Meyer attempted to spread the information he had gathered in Germany on the method of least squares and its application to geodesy by channels other than those of Academic recognition. Bouvier remarked that there existed no special text describing the method of least squares, and that he hoped to fill this gap by giving an exposition from a practical viewpoint. Liagre's later work in 1852 would accomplish this on a larger scale. Bouvier does not discuss the foundations of the method. He concentrates essentially on the "method of equations" which are to be satisified. The author describes Gauss' two methods: he gives as an example the content of Meyer's note rejected by the Academy, and compares the formulae used by Gauss and Laplace to estimate the precision of arithmetic means. Both the importance of Meyer's contribution to geodesy and the obstacles which he encountered, as well as the militant devices he had to use to put his views, are evident.

Meyer's scientific opus consists of 30 papers and 12 textbooks. His publications on the calculus of probabilities were written in the latter part of his life, some of them appearing posthumously. In particular, we note his *Essai sur une exposition nouvelle de la théorie des probabilités a posteriori*, 1857. This work was at the printer's when Meyer died. The author goes over the enunciations and proofs of Bayes' theorem in the continuous case, Laplace's theorem and the inverse theorem to J. Bernoulli's; but one cannot honestly claim that he brings much that is new to probabilistic thinking.

Also in 1857, Meyer published his reaction "Examen critique de la notice de M. Liagre" to a memoir entitled "Sur la probabilité de l'existence d'une cause d'erreur régulière", which Liagre had presented to the Royal Academy of Belgium in 1855. The topic is the use of the calculus of probabilities to de-

tect systematic errors, and is the precursor of a statistical test for the random nature of observations (the turning-point test). Liagre's article, which discusses the combinatorial aspects of the topic, is certainly subject to criticism, but so also is Meyer's reponse. This note, as well as another in 1856, was published at the author's expense; and provides further evidence of Meyer's disagreements with the science Section of the Royal Academy of Belgium, to which he had been elected a corresponding member on 16 December 1846. An account of this conflict, in which Meyer invoked the support of the leading authority of the day on statistical matters, I.J.Bienaymé (q.v.), is given by Breny, Jongmans and Seneta (1992). Bienaymé, himself no stranger to controversies, recalled it in a paper of 1875, which linked his name with the turning-points test.

Meyer was not a creator of originality in probability and statistics; but rather an interpreter, able to clarify, simplify and make rigorous in an age not noted for mathematical lucidity. He is better known in Luxemburg as the first poet of the Luxemburg language, and a man who fostered the development of national culture.

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