Károly JORDAN
b. 16 December 1871 - d. 24 December 1959

Summary. K.Jordan, best known for his work on probability theory and finite differences, was a founder of the Hungarian School of Probability.

Károly Jordan's path to mathematics, and to probability and statistics in particular, was not straightforward. Coming from a well-to-do family, he had the luxury of studying a profession practically wherever he wanted to, and when his interest changed he could go back to study, or to train himself in, a new field. Indeed, after having studied chemistry at École Préparatoire Monge in Paris and at the École Polytechnique in Zurich, and become a chemical engineer in 1893, he accepted an appointment at the University of Geneva where he concurrently studied physics and obtained the degree of Docteur és Sciences Physiques. He then gained the position of Privat Dozent in physical chemistry at Geneva.

When Jordan returned to his birthplace, Budapest, Hungary, in 1899, and could not find a suitable job as a chemical engineer, he entered Pázmány Péter University of Science (the present L. Eötvös University of Budapest) and studied astronomy and seismology. He ultimately became the director of the Seismological Institute of Budapest which position he held up to 1913. During this period his interest turned increasingly towards probability theory and to mathematics in general. This was due to his interest in understanding and scientifically explaining seismological and meteorological data. His mathematical interest was very broadly based, and he distinguished himself in subsequent years not only in probability and statistics but also in the theory of differences and in approximation theory.

The First World War appeared to interrupt Jordan's free movement between subject matters and positions and he was appointed a teacher of mathematics, physics and meteorology at a Military School in Várpalota (close to the Bakony mountains of Hungary). However, it was this teaching experience, combined with his earlier publications on data from meteorology and seismology, which determined the direction of all his subsequent work. After the war he was invited to lecture on statistics at Pázmány Péter University, from which position he quickly switched in 1920 to the University of Economics of Budapest, where he went through the ranks, culminating in his Professorship in 1933. His lectures now extended to probability theory, statistics and the theory of finite differences. He remained at the University of Economics until 1949, a year in which the university was reconstructed into a more structured and politically oriented institution. Jordan just moved on, taking his free-style and very popular lectures to the Technical University of Budapest.

Jordan did pioneering work in Budapest. There was no country other than Hungary in continental Europe where there was systematic teaching of probability and statistics as early as 1920. His lectures always contained new results in probability theory and applied statistics. They inspired a great many people to devote their own lives to probability and statistics: a school was born.

Jordan was born in Budapest on December 16, 1871, and received his primary and secondary education there. Then, during the ten year period 1889 to 1899 he studied and worked abroad as an engineer. Only after his return to Hungary in 1899 did he become a statistician and a mathematician. Apart from his extensive travels to conferences, he remained in Hungary all the rest of his life. He married Marie Blumauer during his stay in Geneva in 1895 and she died at the birth of their third child in 1899. Back in Budapest, in 1900 he married Marthe Lavallée and this marriage also produced three children. The large family was a great happiness to him and they remained very close even when the children had grown up.

Jordan frequently published in Hungarian; he was particularly keen to contribute to mathematical journals read by students. Two of his notable books also had their first publication in Hungarian: one on mathematical statistics in 1927 and one on classical probability theory in 1956. The publication of the probability book was a bitter-sweet experience for Jordan: since it contained his life-long contributions to the foundations of probability theory and statistics, he was glad that it was finally out in 1956, but since he had completed the manuscript in 1946 and submitted it for publication in that same year, the long period of waiting and the associated correspondence on the manuscript made him somewhat bitter. During that period the publication of a manuscript was not judged merely on its merits, but a very few people decided who published what and when. Since Jordan wanted the book to appear in Hungary, he chose to wait rather than translate it and publish it elsewhere.

The year 1956 was a memorable one for Jordan: he had hardly put a copy of his new book into his magnificent library when a tank fired into his house and the whole library, together with all his possessions, burned down. This happened during the short-lived Hungarian uprising. The loss of the irreplaceable Jordan library was a serious blow. One of his hobbies had been to collect original works of mathematicians of historical note, and he had some from the 15th century. Out of his 5000 volumes, about 1000 were rare books. By an agreement between Jordan and the Hungarian Academy of Sciences, the library would have become the property of the Academy after his death.

Another hobby of Jordan was to travel and to explore nature. He participated in the determination of the depth of the lakes Balaton and Héviz, and reached several peaks of the Tátra mountain some of which, as one of his pupils, the distinguished probabilist, Lajos Takács discovered, actually bear his name. He set and kept the speed record by a sailboat for several years on lake Balaton, When he was young, he travelled all over Europe on a bicycle, but he switched to motorcycle when he reached the age of 60. He died in Budapest on December 24, 1959 at the age of 88.

Jordan's work was widely recognised both in Hungary and abroad and he received many honors. He was awarded the König Prize in 1928 by the Eötvös Mathematical and Physical Society of Budapest. He was elected a corresponding member of the Hungarian Academy of Science in 1947 and received the Government's Kossuth Prize in 1956.

The work of Jordan and his contemporaries was done without the benefit of a systematic theory of probability as we know it today. But Jordan and others did not feel that such a theory was lacking. They gave a precise definition of probability and argued using this. Jordan's concept was quite broadly based, and in some respects it comes close to current ideas. This allowed Jordan to be more philosophical about the basis of probability and the theory that he developed than is currently typical, and it made him a natural Bayesian in statistics without him actually making the distinction himself.

In 1927 Jordan established the following general formula on the number of occurrences in a sequence of events A_1, A_2, ..., A_n. Set $S_0 = 1$ and, for $k \geq 1$,

$$S_k = \sum_{1 \leq i_1 < \ldots < i_k \leq n} P\left(A_{i_1} \cap A_{i_2} \cap \ldots \cap A_{i_k}\right).$$

Now, if B_t denotes the event that exactly t of the A_j occur, then

$$P(B_t) = \sum_{k=t}^{n} (-1)^{k-t} \binom{k}{t} S_k, \qquad t = 0, 1, \ldots, n.$$

The above formula now bears Jordan's name. The proof requires only that probability is an additive set function. In the original proof it is implicit that one gets upper or lower bound above if one stops in the summation on the right hand side at an even or odd integer, respectively. Jordan used his formula for obtaining frequency distributions both for independent and dependent repetitions and for combinatorial formulas associated with urn models. He could not foresee the large literature around his formula; see the book by J. Galambos and I. Simonelli (1996).

Another formula that bears his name is an interpolation polynomial. Given that some statistical observations such as meteorological data are measured at equidistant time (daily, weekly, or monthly), he generated a polynomial $f(x)$ whose values are given at points a, $a+h$, $a+2h$, …, $a+nh$. The formula is easy for computation and was very well received by contemporary scientists. He also used the method of least squares to fit polynomials to data. If the approximating polynomial is given by a series expansion of certain orthogonal polynomials then it turns out that the coefficients of the orthogonal terms in the least square polynomial do not depend on the degree of the polynomial, hence tables are easily constructed for computation. Both the interpolation formula and the least square approximation polynomials are expressible as binomial coefficients which in turn can be generated by using finite differences. This led Jordan to study the theory of finite differences in general, not just as a part of statistical approximations. His book on this subject is still widely used.

Jordan published over 90 scientific papers and books. A full list can be found in the two Obituaries by Takács and by Gyires listed below.

References

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