

Recollections of Prof. Václav Fabian

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Last November, Prof. RNDr. Václav Fabian, CSc. passed away at the age of 78. An eminent specialist in mathematical statistics and probability theory, he was professor emeritus of statistics at Michigan State University (East Lansing, MI), and visiting professor at Charles University (Prague).

He was born on June 27, 1929, into the family of Fabians in Všetaty (Czech Republic), well-known for introducing and cultivating the famous Všetaty onion. He attended the high school in Mělník, and graduated there in 1948. He had obvious mathematical abilities, but was also well-endowed musically. He was tutored privately by the prominent music pedagogue Hoffmeister, and seriously considered becoming a professional pianist; but mathematics won out. Václav entered the Faculty of Mathematics and Physics (then still the Faculty of Science) of Charles University, where he graduated in 1952. The following year he presented a doctoral thesis, on the topic of structural relations, and he was granted the degree of RNDr. (Rerum Naturalium Doctor). Subsequently he was an assistant professor in the department of Prof. Vyčichlo in the Faculty of Civil Engineering of the Czech Technical University (ČVUT), and in 1954 he joined the Mathematical Institute of the Czechoslovak Academy of Sciences (MÚ ČSAV). Without attending graduate studies, he successfully defended an independent candidate of science thesis, on measures having as values classes of measurable functions, in 1956, and was granted the CSc. degree. Fabian's scientific potential was so obvious to the authorities that it transcended the embarrassing fact of his origin from a wealthy land-holding family. Nonetheless he was fired from the Mathematical Institute in the 1958 'class' purges. He was then employed in the Inorganic Chemistry Institute in Ústí nad Labem, and then in the Research Institute for Mathematical Machines (VÚMS) in Prague. After the mild relaxation of political pressures in 1965, he joined the Institute of Information Theory and Automation (ÚTIA ČSAV). Shortly after the Soviet invasion of Czechoslovakia in August 1968, in fear of subsequent developments, he left Czechoslovakia with his family. After a short while he was admitted to the USA, and appointed professor at Michigan State University, where he held a visiting position in 1966/1967. There he remained as teacher, scientist, and thesis advisor until his retirement in 2000.

In recognition of this work he was named Fellow of the Institute of Mathematical Statistics. Among his doctoral students we mention the prominent mathematicians A. Schick and D. Ruppert.

After the Velvet Revolution in Czechoslovakia in 1989, Fabian made yearly visits to Prague and the Faculty of Mathematics and Physics of Charles University. In 1992 he was a Fulbright fellow there, and lectured at seminars for graduate students and researchers. He assisted in the graduate study at MSU for several of Czech students. In Prague he participated in Conferences on Information Theory, Random Processes, and Statistical Decision Functions organised by ÚTIA, and also in

the conference Prague Stochastics 1998, within the commemorations of the 650th anniversary of the founding of Charles University. In 1997 he was appointed a visiting professor of the University, which he much appreciated. In later years health problems interfered with his research. He continued to love music. On November 8, 2007, he passed away while playing the piano.

Fabian's research appears in 59 publications, among them three books; these have been cited more than 600 times. The width of his range of interests is surprising. He did not confine himself to a single area, but felt impelled to look into varied areas of mathematical statistics and probability theory whenever some problem piqued his attention, whether positively or negatively; he did not avoid controversy.

The most frequent topic, stochastic approximation theory, appears in 17 papers. This concerns iterative processes to determine a zero or a minimum of a function f when this function is not known precisely but its values at chosen points can be determined up to a random error. Robbins and Monro (1951) suggested, for finding a zero of f , the iterative process $x_{n+1} = x_n + a_n y_n$, where y_n is the value of f at x_n plus a random error, and the a_n are appropriately chosen coefficients. To determine the minimum, Kiefer and Wolfowitz modified this by letting y_n be $(f(x_n + c_n) - f(x_n - c_n))/2c_n$, again plus a random error. Several authors determined conditions on f and the coefficients a_n and c_n under which these processes converge (almost surely, or mean-square), what is then the rate of convergence, and whether the approximations x_n are asymptotically normally distributed; all this extended to functions of several variables. It is this question of asymptotic normality that is the subject of Fabian's frequently cited 1968 paper in *The Annals of Mathematical Statistics*. A referee wrote that this is an elegant proof of a result from which follow all preceding results of this topic.

In subsequent papers Fabian replaced the difference quotient in the Kiefer-Wolfowitz method by a more refined choice of observation points; this eliminated the effect of some higher derivatives of f and thus improved the rate of convergence. If the probability distribution of the random errors is known, the convergence rate can be improved further. A refined result of Fabian is that, even when it is unknown, it can be estimated in the course of the iterative process run. The adaptive methods are then optimal in the sense of Hájek's local asymptotic minimax. Stochastic approximation methods seek local minima; in one of his last papers, Fabian together with J. Dippon suggested a combination of stochastic approximation and non-parametric regression techniques to determine even global minima.

Our description of the remaining papers will be in abbreviated form, and roughly in chronological order. Several of the later papers were written jointly with James Hannan. The topics are structural relations, decision functions, random measures, round-off effect in computation, interval estimates for the binomial distribution, selection of a population with the largest mean, the Halperin's method, moment inequalities for martingales (the Dharmadhikari-Fabian-Jodgeo inequality), the Kolmogorov inequality, estimate of the logarithmic derivative of density, the maximum likelihood method, vague convergence of stochastic processes, the Cramér-Rao inequality, locally asymptotically normal estimates, polynomial regression estimates with the supremum norm, splines in non-parametric regression, the problem of interactions in analysis of variance, estimate of the derivative of an error-bearing

function, learning models, Blackwell's minimax theorem, the simulated annealing method.

The books authored by Václav Fabian are interesting. 'Basic Statistical Methods' (Publishing House of the Czechoslovak Academy of Sciences, 1963) is a study text and handbook for experimenters in the natural sciences. It differs from the usual form of these: where possible, decision procedures are preferred over the classical tests. He incorporated modern methods, which had not found their way into textbooks yet; for example, two-step interval estimates of prescribed width are widely used. This text subsequently appeared in German translation, 'Statistische Methoden', VEB, 1968. 'Introduction to Probability and Mathematical Statistics', written with James Hannan (Wiley, 1985), is of another type: it is not an elementary textbook, as might be suggested by the title, but rather a mathematically sophisticated text intended for graduate students; many presented results here were available in journal form only.

Václav Fabian was not only a prominent mathematician and an excellent pianist. He was also our close friend, and every inch a gentleman. We shall remember him often.