



# VASANT SHANKAR HUZURBAZAR

1919 - 1991

Elected Fellow 1957

VASANT SHANKAR HUZURBAZAR was born on 15th Sept., 1919 in the princely state of Kolhapur to Shri Shankar Abaji and Shrimati Gangabai Huzurbazar. His forefathers had hereditary appointments with the Kolhapur State administration. He was the third among five brothers. His elder sister was married to the Late Professor V V Narlikar, the distinguished expert on Relativity and Gravitation. The wellknown mathematician, the late Professor M S Huzurbazar was his younger brother. Huzurbazar completed his high school and undergraduate education with great distinction in Kolhapur and went to Banaras Hindu University for his post-graduate education in Mathematics in 1940. He obtained the MA degree in 1942 in the first Class.

## CAREER

While still a postgraduate student at BHU, Huzurbazar wrote a research note on Rolle's Theorem which was subsequently published in the Journal of the Banaras Hindu University with comments from V V Narlikar. At BHU he was exposed to lectures by Mahalanobis, Sukhatme and interestingly by CV Raman on Probability and Statistics at a session of the Science Congress which kindled an interest in him in research in these areas. In the forties the opportunities for research in Statistics were very limited in India and were confined only to Calcutta. Due to the second World War it was impossible to proceed abroad for higher studies either. Huzurbazar therefore took up a position as Lecturer in Rajaram College, Kolhapur from 1942 to 1946. At the end of the World War II he proceeded to Cambridge, UK as a research student and decided to choose the area of Statistics for his research. He was fortunate in being accepted as a research student by Sir Harold Jeffreys, the famous savant, who was well known for his interest in inverse probability and statistical inference based on it. This branch of inference though originated in the work of Rev Thomas Bayes in the 18th Century had become unpopular partially due to its indiscriminate applications in unsuitable conditions, leading to erroneous and unsupportable conclusions. However, Sir Harold Jeffreys in England, B DeFinetti on the continent and LJ Savage in the US were instrumental in restoring credibility to



inferences by carefully laying down the principles and their scope of applicability. The most controversial aspect of the practice of these methods was the use of mathematically convenient prior distributions to quantify the degrees of one's subjective beliefs in the possible values of the unknown parameters. Jeffreys brought into use invariant prior distributions which have the property that any arbitrariness in the form in which the probability distribution is expressed has no effect on the eventual inference. Huzurbazar investigated the relationship between the concepts of sufficient statistic and the exponential (Koopman-Pitman -Darmois) family on the one hand and the concepts of invariant prior distributions on the other hand. In two important papers (*Proc. Cambridge Phil Soc.* 1950) and *Biometrika* (1949) he generalized to the entire exponential family the invariants which Jeffreys had proposed for special cases like Binomial, Poisson, Gaussian, etc. Jeffreys was greatly impressed by this work and included it in the third edition (1961) of his celebrated treatise, *Theory of Probability* published by Oxford University Press. He named these 'Huzurbazar's Invariants'.

Besides the above theory of invariants Huzurbazar simultaneously worked on properties of the maximum likelihood method of estimation. He could show (*Ann. Enginies*, 1948) that the probability that the likelihood function attains its maximum at a consistent solution of the likelihood equation approaches 1 as the sample size tends to and that a consistent solution of the likelihood equation is unique. This work filled a significant gap in the theory of likelihood as developed by Fisher and the followers of the frequentist or objective school of Statistics. This work was appreciated by Wald and other leading mathematical statisticians of the time. It is now included in basic statistical theory and taught in post-graduate courses on Mathematical Statistics all over the world. The above constituted the research Huzurbazar carried out at Cambridge and submitted for the PhD degree. Huzurbazar had the distinction of being the only research student ever supervised by Jeffreys in the era of Probability and Statistics.

Huzurbazar spent the period 1948-49 at Cambridge, where his contemporaries included CR Rao, AK Gayen, RP Bambah and others from India. He returned to India in 1949 and joined the University of Gauhati for a short period. He also worked with the Bureau of Economics and Statistics, Bombay and Lucknow University for a while before joining the University of Poona in 1953 as Professor and Head of the Department of Mathematics and Statistics.

Poona has been a political, cultural and educational centre for several countries. After the collapse of the Maratha State, the British established several schools and colleges to impart Western scientific and liberal education at Pune. Political and social visionaries like Lokamanya Tilak also helped in this endeavour by forming voluntary societies which also established schools and colleges. This development culminated in the carving out of the University of Poona from the domain of the University of Bombay in 1949. MR Jayakar, a senior Barrister and statesman with deep interests in cultural and educational matters was appointed the first Vice-Chancellor of the new University. While looking



for distinguished scholars to lead the various faculties in the University he cast his net far and wide and was able to attract SK Jatkar from Indian Institute of Science for Chemistry, RN Dandekar from Fergusson College for Sanskrit, TS Mahabale from Government of Bombay for Botany as full time members and DR Gadgil from Gokhale Institute for Economics, among others as part time faculty. In this search he contacted Huzurbazar at Lucknow and persuaded him to take over the responsibility of leading the Department of Mathematics and Statistics as Professor and Head. Thus Huzurbazar continued to do with distinction till 1976 when he went to Canada as a Visiting Professor and retired from the University of Poona in 1976 while still abroad.

These 23 years must be seen as the period over which Huzurbazar made numerous contributions to the teaching, guiding research and other organizational aspects of the academic scene regarding Statistics and Mathematics in India. He felt that a Mathematics Department should encompass various branches like pure and applied Mathematics, Statistics, Computer Science, Biometry, Operations Research, etc., under one umbrella. From the very beginning he tried to develop the Department at Poona along these lines. The first appointments of Readers made by Huzurbazar were those of VP Bhapkar in Statistics and VV Rao in Pure Mathematics. The UGC, however decided to develop Pure Mathematics at Chandigarh, Bombay and Madras, Applied Mathematics at Calcutta and thus the development of Statistics came to the lot of the Department at Poone. In 1972 the UGC sanctioned the Special Assistance programme for Statistics to the University of Poone. It has now continued through four phases and till today this Department continues to be the only University Department to have this support. As a consequence Huzurbazar was able to build a viable group of committed research statisticians of international repute in his Department. The fact that this group continues to be a vigorous and influential group seventeen years after Huzurbazar's departure is testimony to the firm foundations he laid. Side by side the University of Poone had decided to develop other branches of Mathematics as well. At Huzurbazar's instance it established the Lokamanya Tilak Chair of Applied Mathematics which was held by BS Madhava Rao and VV Harlikar for five year periods in succession. Towards the end of his career the University of Poona separated the two Departments of Statistics and Mathematics in spite of opposition from Huzurbazar, with SS Abhyankar as the Head of the Mathematics Department.

Anybody who is familiar with Indian Universities set-up knows the tremendous difficulties one encounters while establishing a new programme. These difficulties range right from finding class room and office accommodation to purchase of books and equipment and recruiting faculty. It is to his great credit that Huzurbazar unreservedly spent all his energies towards this goal. A department which started only with him and a class IV employee in 1953 had more than 25 faculty members and 10 supporting staff in 1976.

His personal research contributions continued in this period to the area of Statistical Inference. His three long research papers on general forms of distributions admitting



sufficient statistics, location and scale parameters and sufficient statistics, and invariance theory of prior probabilities were published together as a monograph entitled 'Sufficient Statistics' by Marcel Dekker in 1976. He also published sixteen papers in research journals in this period. The work he did on orthogonal parameters in this period is especially well known and is always referred in later work on statistical manifolds by Amari, Cox, Efron and others. His work and remarks on equivalence of the basic definition of sufficiency and marginal sufficiency were taken up by JK Ghosh and Sudakov who provided complete proofs and by Kudo who provided a generalized version. He guided several research students for the PhD degree including BR Rao, BK Kale, PS Swamy, SR Adke, AV Kharshikar and others. To numerous MSc. and PhD students Huzurbazar provided timely help and advice. Many of them would not have reached their present positions without his encouragement and active support.

### AWARDS AND HONOURS

Huzurbazar was elected a Fellow of the Indian National Science Academy in 1957. He was also a Fellow of the Indian Academy of Sciences of Bangalore. He was awarded the coveted Adams prize by the University of Cambridge for outstanding research in Mathematics along with WJ Smith of the University of North Carolina in 1960. He was elected the President of the Statistics section of the Indian Science Congress during 1966-67. In 1974 the Government of India awarded him Padma Bhushan for his multifarious contributions to the cause of Indian education. He was a UGC National Lecturer in 1975-76. The American Statistical Association selected him a fellow for his various contributions to Statistics and for creating an excellent school of research in Statistics at Pune.

During 1964-65 the UGC had formed the Mathematics Syllabus Reform Committee. Huzurbazar was a member of this committee and his influence was responsible in modernizing the postgraduate syllabii in Statistics. Rigorous measure, theoretic probability and statistical inference became part of the mainstream teaching of statistics at this time.

Huzurbazar was totally immersed in the mathematical scene in the country through his research, guidance, administration of the Department and his activities on various committees of the Government, UGC, UPSC, ISI, ICAR and others from 1953 to 1976. He conducted several summer institutes and workshops for research scholars and teachers of Mathematics and Statistics at Pune. Many potential researchers who had missed the opportunity of getting involved in mathematical research initially got a second chance through these workshops.

MC Chakrabarti had established the Indian Statistical Association and its Journal at the University of Bombay in 1963. However, these institutions were orphaned due to



his untimely death in 1972. Huzurbazar happened to be the President of the Association at this critical juncture. He transferred the headquarters of the Association and the activity of the Journal to the University of Poone. This transfer in fact turned about to be beneficial to the Journal in many ways. A larger pool of referees became available at Pune; the financial affairs of the journal got stabilized and the academic stature achieved a reasonable standing in the discipline. It is a matter of pride that the Journal, now in 31st year, is being published regularly from the Department at Pune. The 1979 issue of the Journal was published as *Professor VS Huzurbazar Felicitation Volume*.

Huzurbazar had taught at the Iowa State University in USA from 1962-64 as a Fulbright Visiting Professor. In 1976 he went to the University of Manitoba in Canada as a Visiting Professor and continued there till 1979. From 1979 to 1991 he was a Visiting Professor at the University of Denver in USA. During these 15 years he continued to be active in the area of Bayesian Statistics and invariants. His last paper was published on bayesian inference and invariant prior probabilities in the Sir Harold Jeffreys Festschrift published in 1980. He passed away due to cancer in November 1991 in Colorado, USA. He had married Prabhavati Gadgil of Nagpur in 1960. Unfortunately she predeceased him in 1985. They are survived by two daughters Snehlata and Aparna, both budding statisticians in the USA.

In his time Huzurbazar filled an important position in the Mathematical - Statistical scene in the country. He was instrumental in starting and nurturing to good health an excellent centre of research in Statistics in India. The statistical community in India will always remember his contributions with gratitude.

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