



In Conversation with Prof. Kanti V. Mardia . . .

**“Statistics without science is incomplete,
Science without statistics is imperfect” – K. V. Mardia**

Prof. Kanti V. Mardia is Senior Research Professor at the University of Leeds – a position especially created for him. He was awarded the Silver Medal of the Royal Statistical Society in 2003 (the last recipient of Indian origin was Professor C.R. Rao in 1965!). The citation for the award reads “The Guy Medal in Silver for 2003 is awarded to Kanti Mardia for his many pathbreaking contributions to statistical science, including two fundamental papers read to the Society, his highly acclaimed monographs and his lasting leadership role in interdisciplinary research.”

He founded the LASR Workshops in 1973, which have grown into international conferences. His recent research covers many new challenging fields such as Statistical Bioinformatics.

Prof. Mardia was on IIMA campus to explore the possibility of future exchange visits between the two Institutes and to deliver a research seminar on “Holistic Statistics and Contemporary Life Sciences” on December 15, 2008. Shortly after the seminar, Prof. Goutam Dutta and Prof. Arnab K. Laha caught up with Prof. Mardia for a short discussion on his views on the future directions in statistics, interdisciplinary research and related issues. Here are some excerpts.

AL (Arnab Laha)

What do you foresee will be the main threads of development of statistics in the next 20 years?

KVM (K.V. Mardia)

It is not possible to exactly foresee what will be the development of statistics in the next 20 years. However I may make some predictions based on the developments that have happened in the last decade. In recent years, new methods of acquiring data have become available in many fields like medicine, genetics, engineering, management etc. and this has led to requirement of new statistical methods for analysis of these data.

In this context, I would like to share my experience of working on image analysis. When I started to work on image analysis, the images were very coarse. But over the time with improvement in the technology of capturing images, the images have become lot sharper. The analysis of images over the years has given rise to a large number of problems which required development of new statistical methods. For example, problems of object recognition, classification, and discrimination with image data have all led to development of exciting new statistical methods. For the purpose of object recognition shape is an important attribute. After Kendall and Bookstein gave initial ideas of how to quantify shape a lot of work has been done by me and others regarding the distribution of shapes and analysis of shape data. The Mardia-Dryden distribution is now regarded as an important probability model for

distribution of shapes.

Another area of my recent interest is Proteomics. Very little statistical work had been done in this field before the turn of the century as there was very little communication between the biologists and statisticians. With better communication now, statisticians have been able to lay their hands on challenging problems and huge amounts of data—mostly multivariate and high dimensional—emanating from this field. Analysis of these data is again triggering development of new methods of statistical analysis.

In my opinion, data mining is still largely in the hand of practitioners and this field poses several interesting problems for statisticians which can lead to development of new statistical methods. I think the future trend in statistics will be a hybrid of model based statistics and algorithmic statistics.

Myself and Walter Gilks wrote an article entitled “Meeting the statistical needs of 21st century science” in *Significance* (a Royal Statistical Society journal), December 2005 issue which you may find useful in this regard.

GD (Goutam Dutta)

How do you foresee these developments will impact management as a discipline?

KVM

I am not so familiar with management to be able to exactly foresee the impacts of these in management as a discipline. Having said that,

I have also seen how the works of Taguchi in Design of Experiments and more recently the Six Sigma quality initiative have impacted quality of products and profitability of companies. I am quite confident that some of the new developments in statistics will substantially impact marketing and finance fields.

AL Do you see a convergence of the fields of statistics and data mining (as we know them now)?

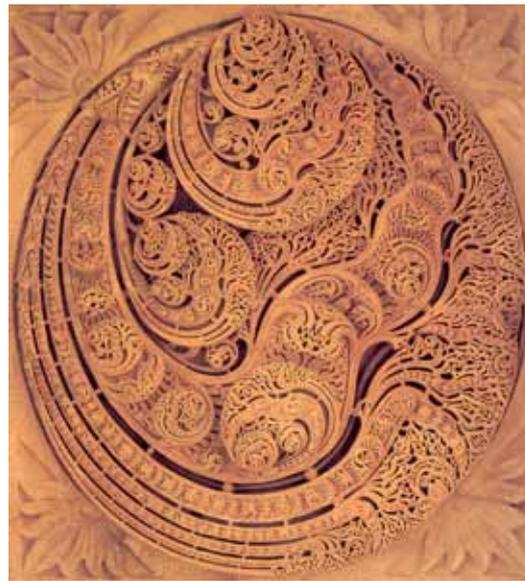
KVM As I have said earlier, new ways of capturing data is leading to creation of huge data sets in many fields like genetics, medicine, engineering, marketing, finance etc. Analysis of these huge volumes of data is presently being done in an ad-hoc manner by practitioners of data mining. Data mining is essentially hunting for patterns in a data set. It has powerful applications in many fields apart from management, like in drug discovery where virtual screening is used to identify molecules having potential for becoming drugs. Over the time new statistical methods are being developed for accurately addressing the data mining problems.

AL How do you think the recent developments in management will impact statistics and statisticians?

KVM Real data arising in any field, including management, is often complex. They are difficult to analyze as they contain outliers, have multimodality, shows skewness, and is a mixture of discrete, continuous, ordinal and nominal measurements. Traditional statistical methods may not always be able to answer questions based on such data. It is, therefore, quite possible that some questions in the fields of marketing management or finance may lead to new developments in the field of statistics. Further, I feel statisticians should go beyond just writing mathematical papers— into development of algorithms, programs and software. They should try to make the new methods developed by them easily accessible to scientists and practitioners of other disciplines.

My paradigm of describing holistic statistics is: New Questions <--> New Data <--> New Methods. New questions raised in management or any other field of study will lead to new data being captured which in turn will lead to new methods of analyzing such data. In this way, other subjects like management will impact statistics and in turn will be impacted by it.

Box I



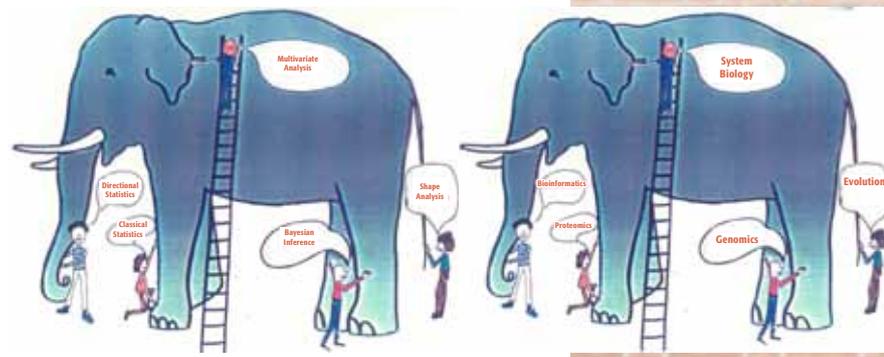
© photo Prof. K V Mardia

Indian architects have produced many intricate geometric shapes from time immemorial. A recent example is of 15th century of tendril circling in varied but replicated forms of delicate tracery (ornamental Kalpavalli). The picture is of marble ceiling panel 4' x 4' of the Ranakpur Jain Temple (Rajasthan). These shapes had influenced me personally from a very early age. Sorry to say that the fractal equation of this particular figure is still eluding experts!

GD How do you value interdisciplinary research? Should it be promoted? If so, how?

KVM: I am the greatest believer of interdisciplinary research. I strongly advocate it. I have during the course of my own career have worked with scientists from various disciplines and have gained immensely from such association. The culture of interdisciplinary collaboration in statistics stems from the times of Karl Pearson and Ronald Fisher, both of whom had worked extensively with scientists from different disciplines. I believe interdisciplinary collaboration can greatly help a scientist in understanding the challenges being faced by the scientists in a different discipline and can spur new developments in his/her own field. However, interdisciplinary research takes time as both parties need to understand the language of the other which may not be an easy task.

Box II



Holistic Statistics

Holistic Science

© photo Prof. K V Mardia

The two elephants show the concept of holistic science. One is related to holistic statistics emphasizing that in researching any scientific problem, one should really use varied tools available to statisticians as well as be ready to go for new developments if the subject does not cover the particular aspect of the problem. Other elephant shows life sciences like other sciences is very vast with lot of sub-fields. Again one should see interaction among different elephants to produce a good holistic science. Knowledge could only evolve through cross-fertilization.