Berkeley and Indian Statistics

Only recently did I read the 1966 Neyman Festchrift volume, edited by Evelyn Fix and F.N. David. In it, I found a nice overview of generalized inverses by C.R. Rao, and a lovely article by P.V. Sukhatme, with a long section on bias correction of ratio estimates by subsampling. My mind then drifted off to the many other instances of a long and productive connection between Berkeley and Indian statisticians, one that has often surpassed the boundaries of professional collaboration and have turned into abiding friendships. I wanted to reminisce about the little that I am personally aware of, history looking forward.

Early instances that I recall are the PhD dissertations of Ashok Maitra under David Blackwell, Sudhakar Dharmadhikari with Barankin, and Prem Puri with Neyman, and D. Basu's voyage to Berkeley in 1953. The magnificent Maitra-Sudderth text on Discrete Games (1996) is clearly influenced by David Blackwell's seminal contributions to stochastic games. A few other early examples are the articles by Rao, Bahadur, and Basu in the Berkeley symposium proceedings (1965). Although not joint work, the *Rao-Blackwell theorem* is a household name , and such cornerstones of inference such as the *Lehmann-Scheffe theorem* were published in Sankhyā. It is very tempting indeed to conjecture that Sankhyā attracted these revolutionary articles because of the Berkeley-ISI personal bond. Much later, Peter Bickel and J.K. Ghosh wrote a very well-known paper on Bartlett corrections (1990) and the 1982 Blackwell-Ramamoorthi note settled the conjecture that Bayes sufficiency is in general weaker than ordinary sufficiency. The Bahadur-Bickel (2009) paper shows that Bayes procedures possess a large deviation optimality property shared by the LRT. P.K. Sen and J.K. Ghosh contributed an article to the Neyman-Kiefer proceedings (1985) on the LRT for the finite mixture model (Hartigan (1985)). On the other hand, Erich Lehmann and Richard Barlow both wrote wonderful articles for the *Basu Festschrift* of the IMS (1992) and we got numerous papers from Berkeley for the *Basu Memorial Issue* of Sankhyā (2002), all very worthy examples of that Berkeley- India connection.

And then there has been a fairly steady flow of exchange of students and visitors. B.V. Rao was invited to Berkeley after he solved *Ulam's prob-*

lem in his PhD thesis. Dr. Maitra visited Berkeley a few times. Three of Peter Bickel's earliest students were Hira Koul, D.P. Gokhale, and R.K. Aiyar. Erich Lehmann has had nearly countless Indian students, Gouri Bhattacharya, M.L. Puri, M. Raghavachari, to name only a few. Rabi Bhattacharya did some of his most influential work at Berkeley. More recently, Antar Bandyopadhyay, Smarajit Bose, Probal Chaudhuri, and Manjunath Krishnapur, all Berkeley students, have returned to India and Ani Adhikari and Sourav Chatterjee are current members of the Berkeley faculty. Such a long history!

Visits, seminars, and personal conversations are extremely helpful for exchange of ideas and crystallization of what is only a thought. I know that Neyman, Elizabeth Scott, David Blackwell, Peter Bickel, and Terry Speed have come to the ISI; Jeff Wu and Jianqing Fan, both Berkeley PhDs, have too. Few know that Terry Speed went to ISI and taught for *ISEC*, the international wing of ISI. Extraordinarily influential work on machine learning, high dimensional inference, genomics, and random matrices is now going on at Berkeley and students and faculty at the ISI ought to listen to this work face to face. These would be timely topics for the Mahalanobis lectures.

And now a few personal memories. I was a student of Terry at his sufficiency course at the ISI, and just this year he and I worked on putting together Basu's most influential work in a Springer volume. Sandrine Dudoit and I just worked on a survey of sufficiency. David Freedman was advising me on models for fractional data up until six days before his tragic death. I first listened to Peter Bickel in 1980 at a conference at the Delhi ISI. It was an adventure. The responsible ISI official greeted a large contingent of us at the Calcutta central train station with a confident toothy smile and said, *"board this train."* Some twenty minutes later, we were all detained for ticketless travelling and sentenced to a hefty fine. On our return, ISI reimbursed us for the fine money, but it was to be shown as taxi fare. Peter was also taking the train from New Delhi to Calcutta; he was a little late, and at the stairs, I only just shook his hands. I really met Peter for the first time in 1991 at a conference in Ottawa. I gave a very simple talk on extremum efficiencies in some nonparametric problems and he made some useful comments to me personally after the talk. Peter invited me to come to Berkeley that Fall,

and I spent a month at the MSRI. I was interested in some small problems on convolutions at that time and I recall Peter coming to my office at Evans Hall to help me. The little work on t intervals, Basu and DasGupta (1995), also benefitted from that visit.

At Purdue, I learned of the close professional and personal relationship between Shanti Gupta, and Peter Bickel and Lucien Le Cam. Shanti earnestly counted on counsel from Peter and Lucien Le Cam. In the January of 2002, Shanti passed away most unexpectedly after a brief illness. I informed Peter the same evening. I recall Peter writing back "This is a great loss for Purdue. I am very sorry. It is a personal loss for me. He was a friend." That's what I mean; there is a long and treasured friendship between Indian statistics and Berkeley and I so much wish to see it prosper and last.