

Personal Photographic Glimpses of Professor C. Radhakrishna Rao

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Abstract. We consider some personal C.R. Rao-related glimpses of our research careers and illustrate these with several photographs. Over the years, we have met Professor Rao in numerous conferences and workshops, taking place, e.g., in Canada, Estonia, . . . , New Zealand (when obviously Covid-19 was no problem!). Among these are three conferences held in Tampere, Finland: 1983, 1987, and 1990. Moreover, from Tampere University, Professor Rao received an Honorary PhD in 1985.

In particular, Professor Rao's role in the International Workshops on Matrices and Statistics, IWMS series, has been instrumental. Rao's research interest in matrices and linear models has overlapped strongly with ours, i.e., we have met a good bunch of the same matrices we have enjoyed and been crazy for. Professor Rao, *The Architect of the Linear Statistical Models*, has been an extremely inspiring person for us, and in this nontechnical article our aim is to provide some personal reminiscences of meetings with him.

1 Background, 1976–1983

First, while spending his sabbatical in Finland from September 1975 to August 1976, the second author, George, visited Professor C.R. Rao in the spring of 1976 in New Delhi. He sent a postcard to Simo:

En route, Calcutta – Bombay, 27 March 1976. Unbelievable that we've been gone six weeks already & will be back in two. Spent a hectic month in Delhi; wrote two papers. Hope C.R. Rao will visit Helsinki in mid-June. Relaxed for three days in Kathmandu, . . . Greetings, George.

C.R. Rao did not come to Finland in 1976 but indeed he did so in 1983, 1985, 1987 (twice), and 1990. He attended three conferences organized in

Tampere and in 1985 received an Honorary PhD. In June 1987 he attended a conference but in January he was an opponent on the thesis defence of Simo. The thesis was entitled “On the relative goodness of ordinary least squares estimation in the general linear model”. That is the area where Rao was a Real Master; see Rao (1967), Puntanen & Styan (1989), and Markiewicz, Puntanen & Styan (2020).

Actually Simo met C.R. Rao for the first time in Sheffield, UK, in August 1982, at the ICOTS Conference which George also attended. During this conference Simo invited C.R. Rao to be a keynote speaker in a statistical conference in Tampere in 1983. Rao replied: “I’ll come if you George will come too.” So they both certainly came—and in addition, wrote papers for the *Proceedings*, see the paper by George P.H. Styan and by C.R. Rao.

As for the good old days, on 13 January 1988 Simo wrote a letter to Jerzy K. Baksalary (1944–2005) to Poznań (who in summer 1988 spent several weeks visiting C.R. Rao in Pennsylvania State University): “Dear Jerzy: ... I have an extremely convenient and fast communication way with George: *electronic mail*. Since last summer we have been using it almost daily. On best days I have sent a memo to George in the morning, he has received it and replied and once again I have replied to him—and all this within one day!”

2 IWMS 1990 onwards, New Delhi 1990–1993

Then some words about the International Workshop on Matrices and Statistics, IWMS. The first IWMS was held in Tampere, Finland, in 1990. Soon it became a series of workshops, so that the next one, the 28th IWMS, will be held in Manipal Academy of Higher Education, South India, 13–15 December 2021. The day of 15 December 2021 will be a *CRR Day*; here is the Brochure. Professor Rao has been an active attendant of the IWMS meetings: Tampere (1990), Montréal (1995), Istanbul (1997), Fort Lauderdale (1998), Hyderabad (2000), and Auckland (2005). His contributions on building up the IWMS series have been fundamental.

Videos from the conferences in statistics in Tampere in 1987 and 1990, prepared by Jarmo Niemelä and Reijo Sund, are available in YouTube. Rao’s talks have been watched nearly 7000 times. Further info on the IWMS series is in the IWMS-website and in A short history of the IWMS.

Simo’s first visit to India was in December 1990, attending C.G. Khatri (1931–1989) Memorial Conference. Most of the period December 1992 to February 1993 Simo was in Delhi with George (on sabbatical).

While in Delhi, we prepared an interesting interview with Sujit Kumar Mitra (1932–2004); see Puntanen & Styan (2012). Below is a piece of conversation.

And then you wrote your thesis with Professor S.N. Roy, in USA, in 1954–56. Did you feel homesick in Chapel Hill?

“I felt terribly homesick. I don’t know if it was my homesickness which was responsible for even thinking that I may come

back without the degree. So I wrote to Professor P.C. Mahalanobis asking whether he would take me from the USA back to the ISI, without a degree.

But in the middle of the arrangements, I got two letters, one from D. Basu and the other from C.R. Rao. Both of them told me that I was silly and that I must first complete my PhD degree and then come to the ISI."

3 New Zealand 2005, P.C. Mahalanobis 1968

Here is a piece of emailing between C.R. Rao and Simo Puntanen on 7 October 2003.

- ◆ SP → CRR: We will celebrate Ingram Olkin's 80th Birthday in the IWMS in Bedlewo, Poland, in August 2004, ...
- ◆ CRR → SP: August 2004 is a bad time for me. We are planning to have a huge conference in Hyderabad, India, towards the end of December 2004. This keeps me busy. ...
- ◆ SP → CRR: I fully understand the timing problem. ... One further thing: the 14th IWMS will be held in Auckland, New Zealand, in March 2005. Do you have any chance for you to come to Auckland? Would be really great to have you there!

Then on 10 October 2003,

- ◆ CRR → SP: I am interested in visiting New Zealand in March 2005. I know that you visit some university there. Do you think I can get an invitation to visit the university? I can give some lectures or a short course prior to matrix meeting.

We missed you in Berlin's ISI Meeting. I am forwarding an email which tells you why we went to Berlin. [See Figure 28] Best wishes
-CR

Let's return back to P.C. Mahalanobis (1889–1972) and the year 1967.

On 5 April 1967, C.R. Rao left Calcutta for London and attended the induction ceremony to the Fellowship of the Royal Society. This made Professor P.C. Mahalanobis to use the following words in his speech on 12 February 1968, see Mahalanobis (1969, p. 239):

I should now like to say, briefly, how proud I feel that C.R. Rao was elected a Fellow of the Royal Society last year. He came to the Institute in January 1941 to learn statistics. I feel proud that my direct pupil is now in the Royal Society. In India, we have a saying *Putrat ichhyet parajayam*. One wishes for defeat by his son. I have no children.

In India there is also the alternative version *Sishyat ichhyet parajayam*. One wishes for defeat by his pupil. It is my great happiness to admit defeat by my pupil.

4 Photographs



Figure 1. Pyynikki, Tampere, 28 August 1983.

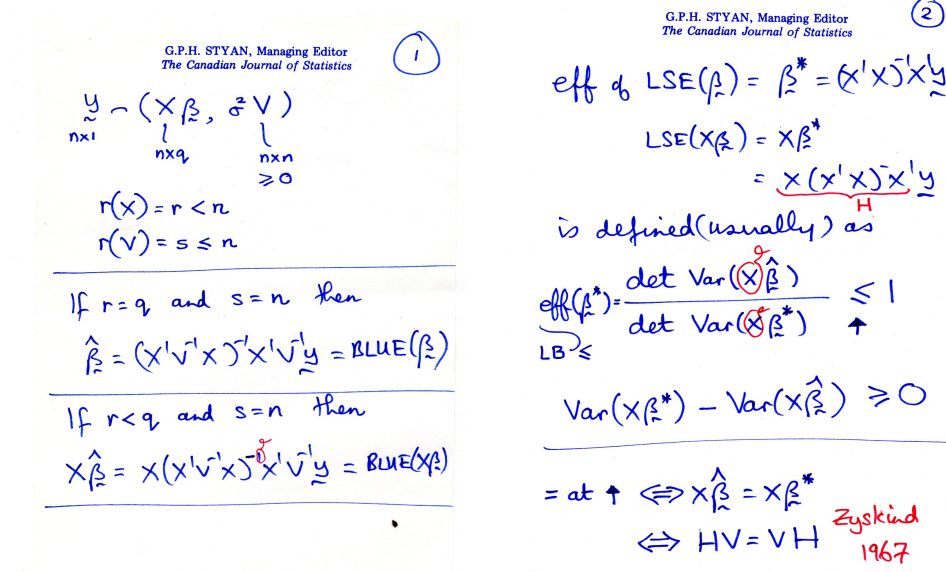


Figure 2. Here are some hints that George gave Simo for his thesis in Sheffield in August 1982. It's all about OLSE vs BLUE.

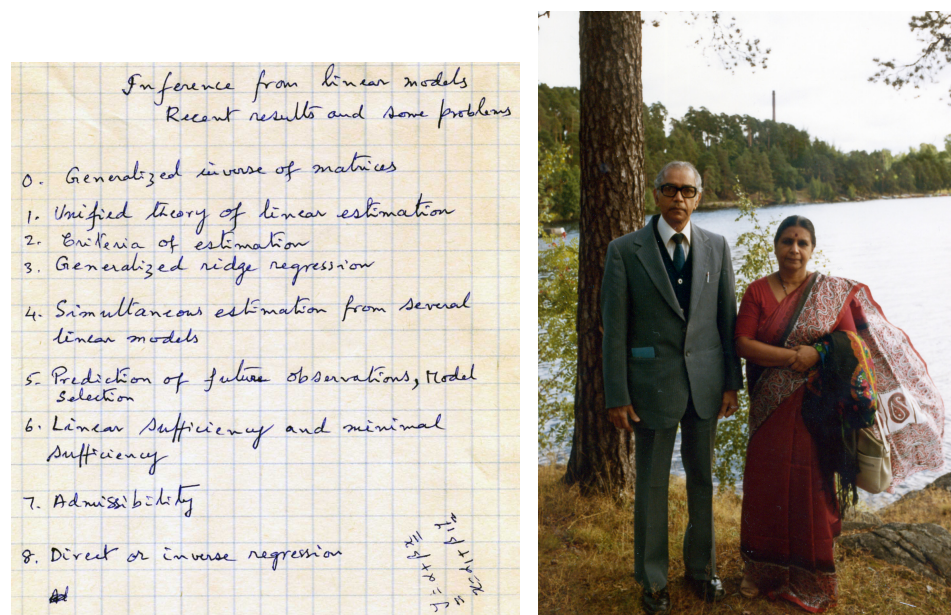




Figure 4. Standing from left: Gustav Elfving, C.R. Rao, Tarmo Pukkila. Conference dinner, Tampere, 31 August 1983. Can you catch Antti Kanto and Dietrich von Rosen?



Figure 5. C.R. Rao, Götz & Birgit Trenkler, Helga Bunke, Bhargavi Rao. Tampere, 1 September 1983.



Figure 6. Sway with me, when marimba rhythms start to play! George singing to C.R. Rao in Professor Eino Haikala's country farm after the conference. Tampere, 2 September 1983.



Figure 7. Erkki and Antti Liski (3 years) greeting C.R. Rao, Tampere, 28 August 1983. Then, 30 years later ... Antti Liski defending his thesis, opponent Jianxin Pan. Tampere, 12 April 2013.



Figure 8. C.R. Rao and Mrs Bhargavi Rao + 3 small Puntaset. Tampere, 28 August 1983. Authentic statement: “I can tell you these kids are not anymore at our home, opposite to me.”



Figure 9. Honorary PhD, Tampere, May 1985; Tomar, Portugal, September 2006. Notice: George received the Honorary PhD in Tampere University in May 2000.

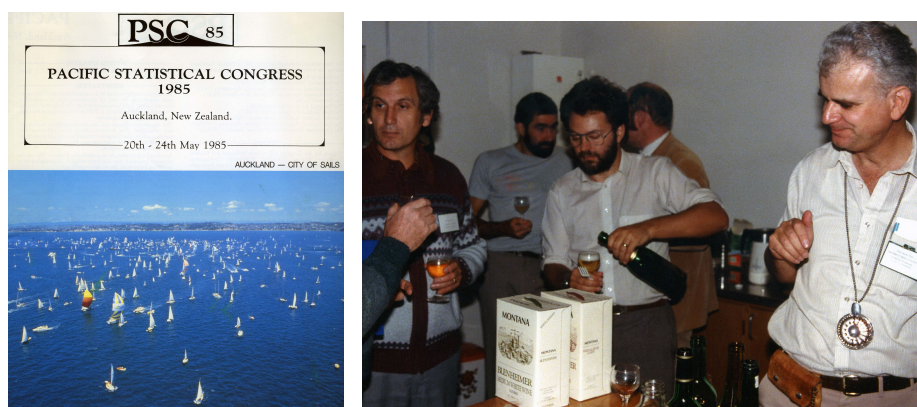


Figure 10. Simo was not present in C.R. Rao's promotion in Tampere in May 1985 (but was in Tomar 2006). Instead, he hit the road to NZ, where George was spending his sabbatical. —Wonderful coffee breaks in Auckland!



Figure 11. In 1986 Simo had an opportunity to visit Professor Rao in Pittsburgh. At the same time he could meet Tarmo Pukkila & Family who spent the academic year 1985–86 in Pittsburgh.

T.W. Anderson	G.E.P. Box	E.J. Hannan	C.R. Rao
Chair:	Chair:	Chair:	Chair:
G.P.H. Styan	T. Teräsvirta	M. Deistler	T. Pukkila
Discussant:	Discussant:	Discussant:	Discussant:
M.D. Perlman	S. Kounias	K. Conradsen	C.G. Khatri



Figure 12. In 1987 we had a conference in Tampere, where the plenary speakers were George E.P. Box, T.W. Anderson, Edward J. Hannan and C.R. Rao. Professor Rao's conference talk in 1987, "Estimation in linear models with mixed effects: a unified theory", can be watched from YouTube-1987. His talks in 1990 in Tampere on "Uncertainty, statistics and creation of new knowledge", and on "Some recent contributions to estimation of parameters in a linear model" are available in YouTube-1990.



Figure 13. Herman Chernoff, Bhargavi Rao, D.R. Cox (opposite to CRR). Conference in Honor of C.R. Rao, Neuchâtel, 21-24 August 1989.



Figure 14. Group of participants in IWMS-1990, Tampere; C.R. Rao inviting more people to the picture. He's been already able to catch, among others, Tarmo & Helena Pukkila, Yadolah Dodge, Program.

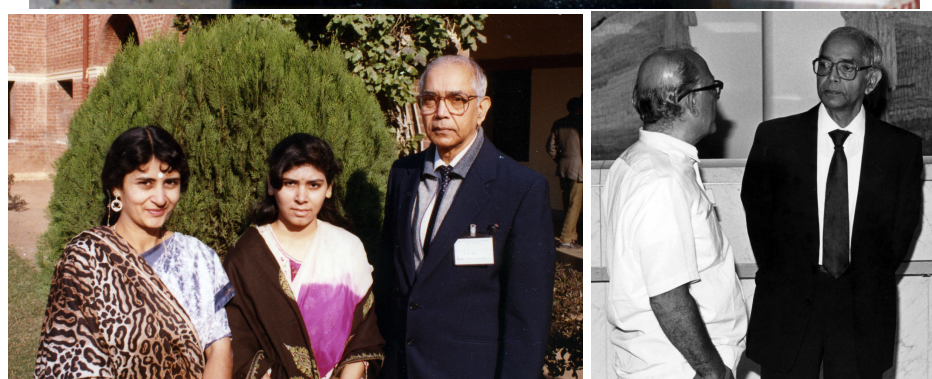
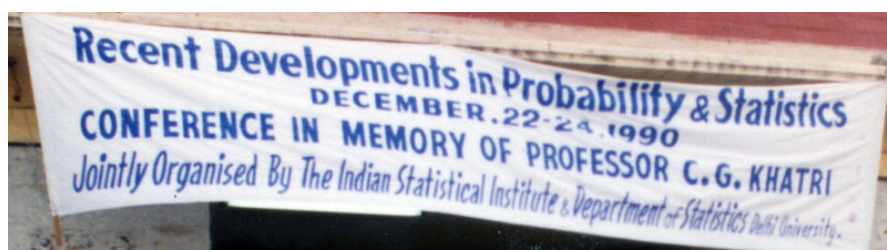


Figure 15. Simo's first visit to India was in December 1990, attending C.G. Khatri (1931–1989) Memorial Conference. Left: C.R. Rao & two daughters of C.G. Khatri, right: C.R. Rao & C.G. Khatri in Tampere, 1987.



Figure 16. December 1992. Most of the period December 1992 to February 1993 Simo was in Delhi with George who was again on sabbatical. Also Simo's family could stay in Delhi for some time.

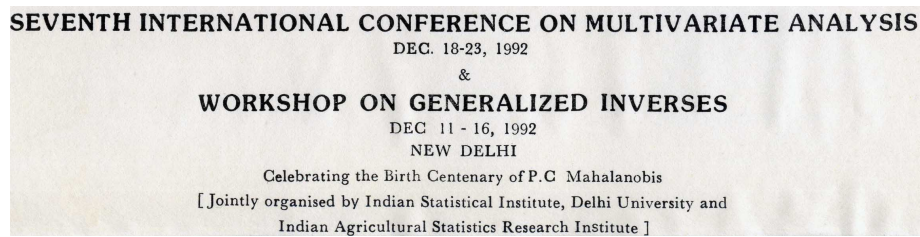


Figure 17. Workshop on Generalized Inverses, New Delhi, 11–16 Dec 1992. You can see plenty of celebrities: in the front row C.R. Rao, S.K. Mitra, and John S. Chipman. [Notice K.M. Prasad: second row, first guy.]



Figure 18. George, Madan L. Puri, C.R. Rao, Jim Rosenberger, New Delhi, Dec 1992.



Figure 19. Michael P. Drazin. C.R. Rao, George, New Delhi, Dec1992.

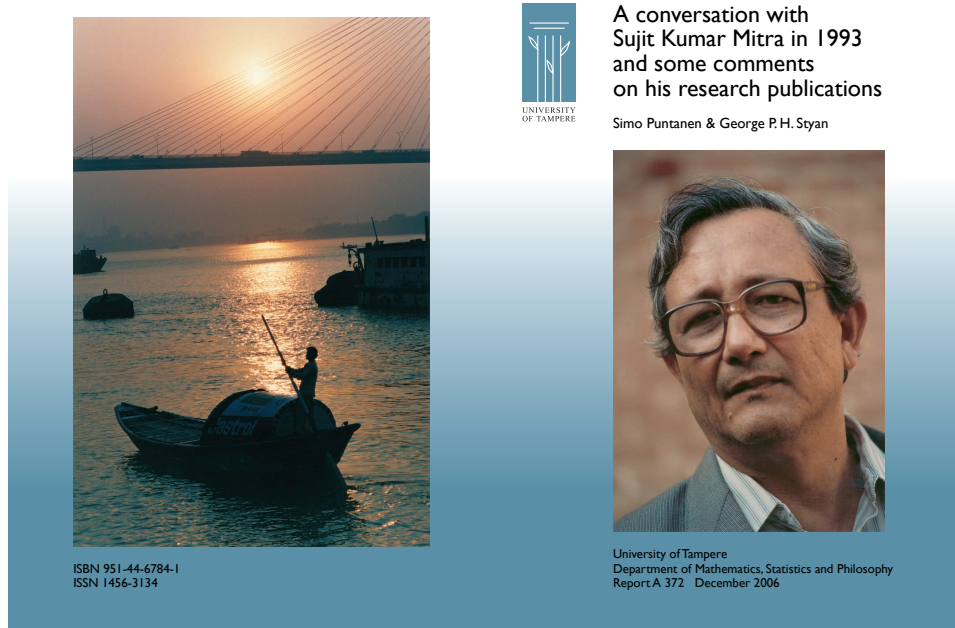


Figure 20. An interview with S.K. Mitra. See Puntanen & Styan (2012).



Figure 21. Sujit Kumar Mitra & C. Radhakrishna Rao, New Delhi, December 1992.

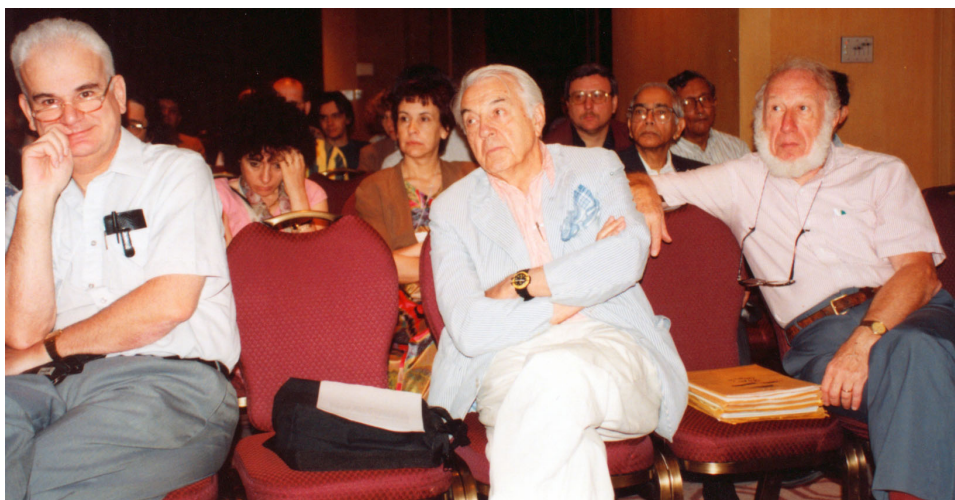


Figure 22. IWMS #4, Montréal, 15–16 July 1995: Geoffrey S. Watson, C.R. Rao (2nd row), Ingram Olkin. Program. [By the way, K.M. Prasad gave a talk on “Rank 1 factors, minus order and shorted matrices”.]

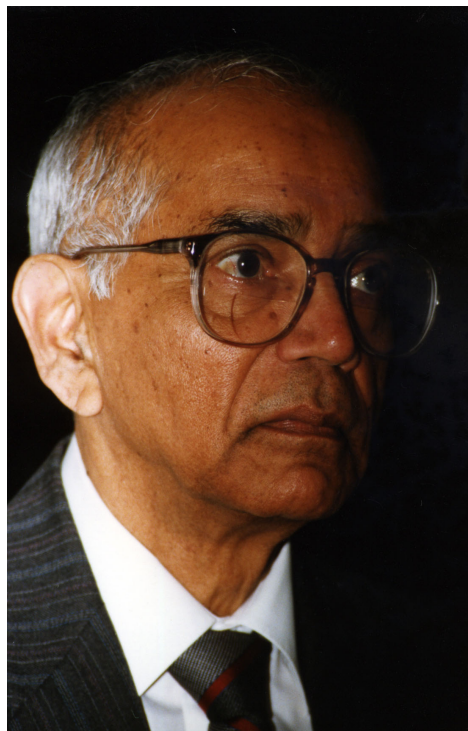
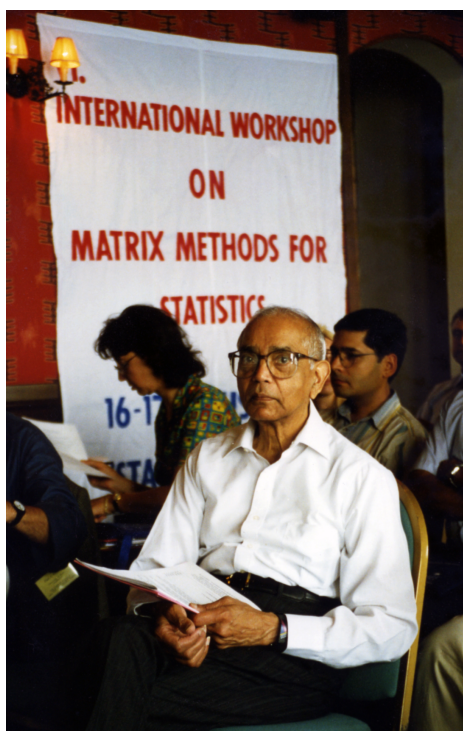


Figure 23. IWMS #6, Istanbul, 16–17 August 1997. Program.



Figure 24. T.W. Anderson & C.R. Rao, Istanbul, August 1997.



Figure 25. IWMS #7, Fort Lauderdale, Florida, 11–14 December 1998. Back: Michael A. Stephens, James Durbin, Bhargavi Rao, C.R. Rao, Evelyn Matheson Styan. Front: T.W. Anderson, Dorothy Anderson, Knut Conradsen. That meeting was dedicated to T.W. Anderson's 80th birthday. Program.

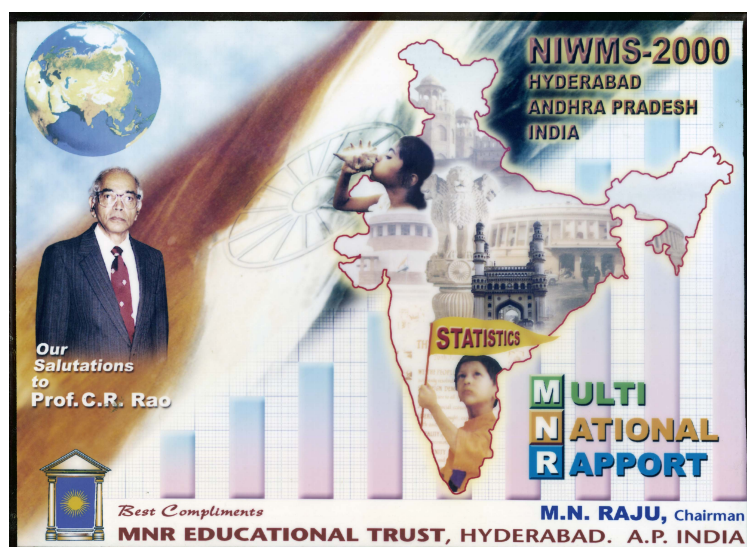


Figure 26. IWMS #9, Hyderabad, India, 9–13 December 2000. To celebrate C.R. Rao's 80th birthday.

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SOME COMMENTS ON SEVERAL MATRIX INEQUALITIES
 WITH APPLICATIONS TO CANONICAL CORRELATIONS:
 HISTORICAL BACKGROUND AND RECENT DEVELOPMENTS

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Figure 27. The above paper by Drury et al. (2002) (55 pages!) was completed in 2000 (when George visited Tampere three times). On page 453 of this paper is the following interesting footnote:

The result (5.39) [*in this paper*] was discovered and proved by Drury in August 2000. In a personal communication in December 2000, however, C.R. Rao pointed out (to Puntanen and Styan) that in 1981 he had given the result (5.39) *with proof* to C.G. Khatri (1931–1989); in the correction note by Khatri (1982), however, it is only noted that “some corrections are necessary in the proof” of (5.37) given earlier by Khatri (1978) and that “this can be done”. We believe that no proof of (5.39) has been published to date.

Related references:

Khatri, C.G. (1978). Some optimization problems with applications to canonical correlations and sphericity tests. *J. Multivariate Anal.*, 8, 453–467. (Corrected by Khatri, 1982, 12, p. 612.) DOI

Khatri, C.G. & Rao, C.R. (1981). Some extensions of the Kantorovich inequality and statistical applications. *J. Multivariate Anal.*, 11, 498–505. DOI

Khatri, C.G. & Rao, C.R. (1982). Some generalizations of Kantorovich inequality. *Sankhyā Ser. A*, 44, 91–102. DOI

First International Mahalanobis Prize Awarded to C.R. Rao

The first international Mahalanobis Prize established by the Indian government two years ago through its Ministry for Statistics and Program Implementation, has been awarded to Professor C.R. Rao in recognition of his lifetime achievements in Statistics.

C.R. Rao has been among the world leaders in statistical science over the last 60 years. He spent 40 years of his prime life in India, promoting the study of Statistics, developing research and training programs and producing outstanding students which “put India not far from the central statistical map of the world.” He received the Mahalanobis Prize from the International Statistical Institute at its 54th session in Berlin for his fundamental contributions to Statistics and, especially for developing Statistics in the South East Asian region.



Figure 28. International Mahalanobis Prize in 2003, 54th Session of the ISI, Berlin.



Figure 29. IWMS #14, Auckland, New Zealand, 29 March – 1 April 2005. (Photo: Harold V. Henderson.)



Figure 30. Left: Jeffrey J. Hunter, C.R. Rao; right: C.R. Rao, George, background: Jarkko Isotalo, Götz Trenkler. Auckland, April 2005. In Auckland, Rao was *the Nokia Lecturer*. (Photos: Harold V. Henderson.)

NZSA Visiting Lecturer

Professor CR Rao is the 2005 NZSA Visting Lecturer. See http://nzsa.rsnz.org/visiting_lecturer_2005.shtml for details of his visit, and contact Prof. Jeff Hunter (j.hunter@massey.ac.nz) for any further information.



Public Itinerary

14 March: U. Otago seminar.
 15 March: U. Canterbury seminar.
 17 March: Victoria U. seminar.
 18 March: Massey U. Palmerston North seminar.
 22 March: WCAS workshop (see below).
 23 March: U. Auckland seminar.
 29 - 31 March: Public Lecture and 14th IWSM, Massey U., Albany (see page 4).



Figure 31. Before the IWMS in Auckland, C.R. Rao was touring in New Zealand like the Rolling Stones; tour manager Jeffrey J. Hunter. See CRR in NZ and NZSA-News Sep 2004.



Figure 32. George, Bhargavi Rao, Shayle R. Searle (back), C.R. Rao, Karl Gustafson. Auckland, April 2005. (Photo: Eric Im.)

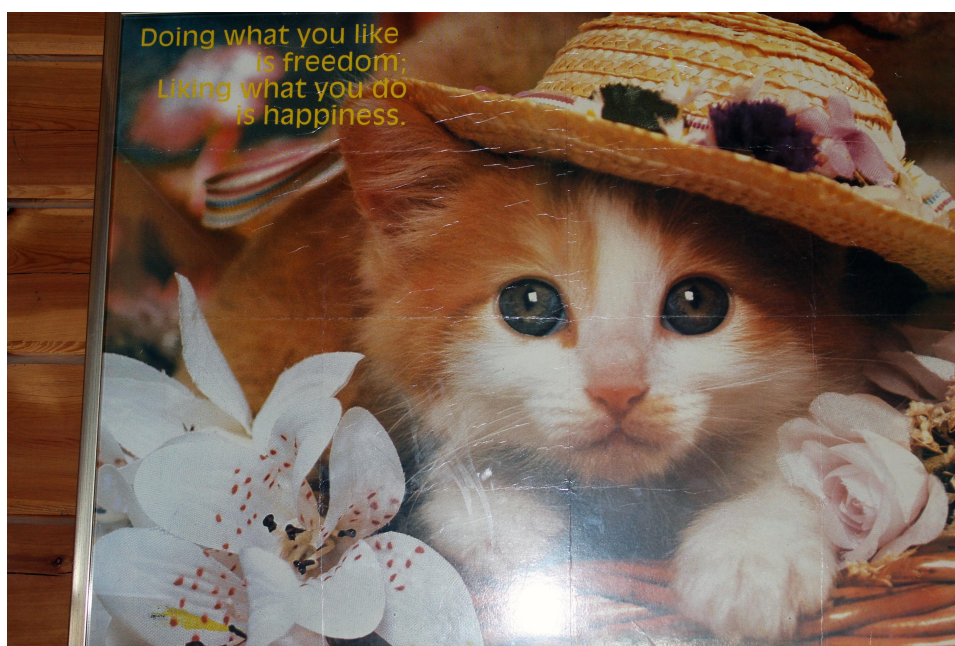


Figure 33. A poster bought in Connaught Place, Delhi, December 1990.

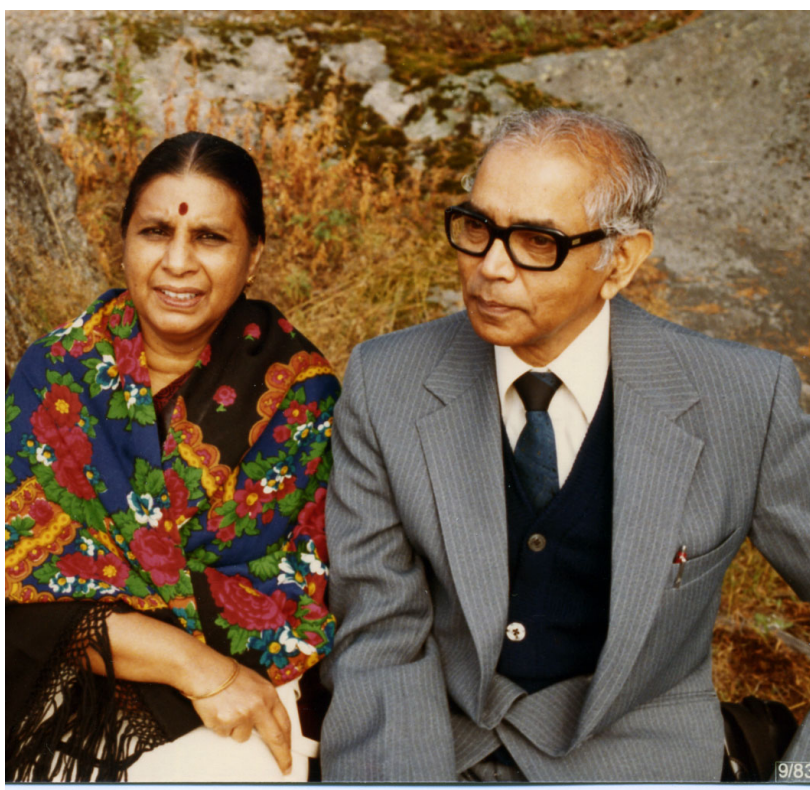


Figure 34. Sincerest Thanks! Kiitos paljon, for the inspiration, Professor Rao!

5 Acknowledgements

This article is based on the online presentation entitled *100 Photographs of Professor C.R. Rao*, to be given by Simo Puntanen in the ALAPS-2020 conference on 18 December 2020, and on the article by Markiewicz, Puntanen & Styan (2020). Almost all photographs are taken by Simo Puntanen, with exceptions mentioned; thanks go to Harold V. Henderson and Eric Im. Special thanks go to Evelyn Matheson Styan for her comments and to Jarmo Niemelä for very helpful L^AT_EX assistance.

This file was compiled on 19 December 2020.

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