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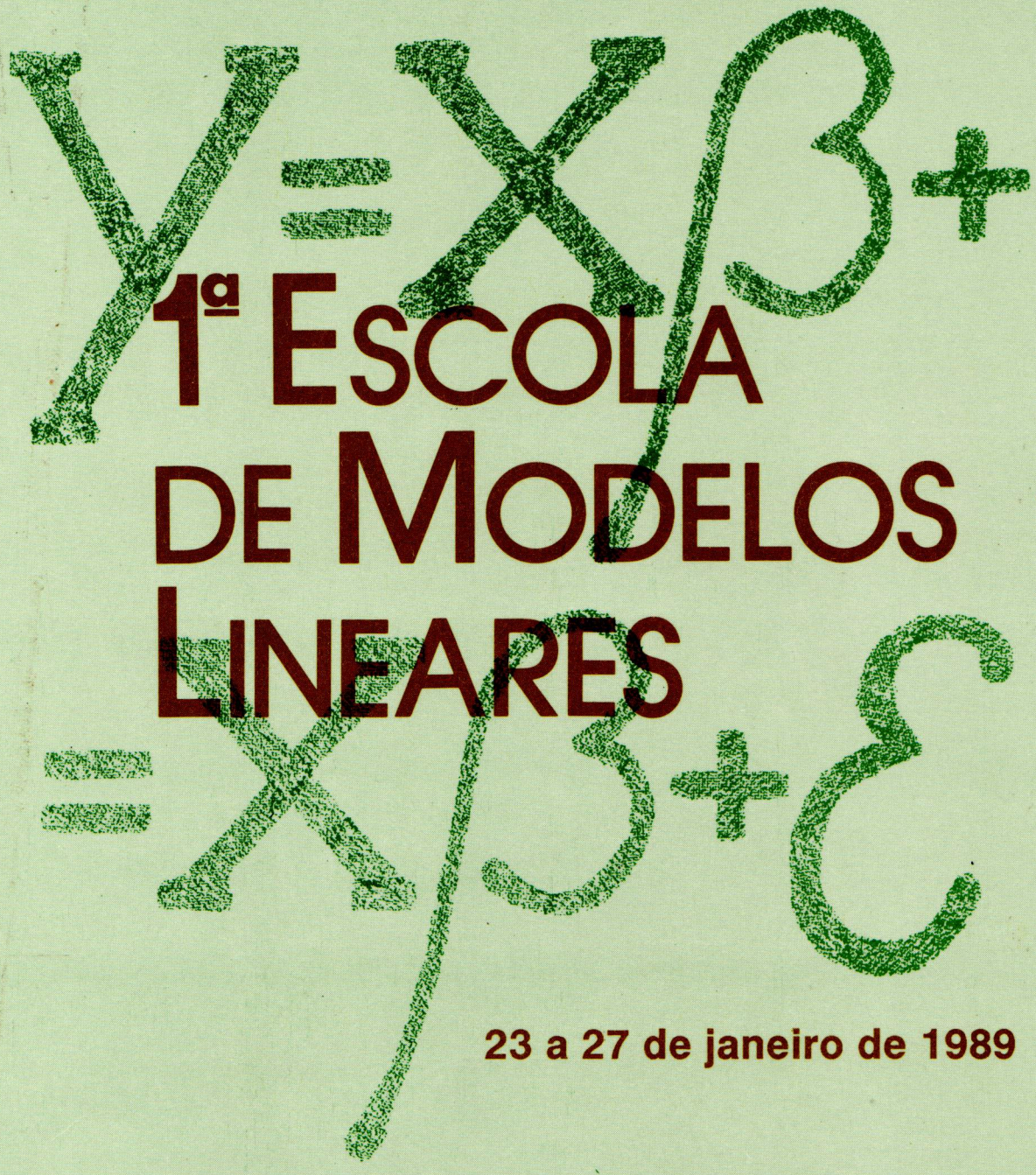
IME-INSTITUTO DE MATEMÁTICA E ESTATÍSTICA/USP



1ª ESCOLA DE MODELOS LINEARES

23 a 27 de janeiro de 1989

ATAS

ENTREVISTA COM O PROF. JOHN NELDER

O Prof. John Nelder foi um dos convidados estrangeiros da 1a. Escola de Modelos Lineares, onde ministrou mini-curso. Ele é internacionalmente conhecido por seus trabalhos em modelos de regressão e em planejamento de experimentos. O Prof. Nelder foi presidente da Royal Statistical Society (1985-1986) e é membro da Royal Society, uma distinção concedida exclusivamente aos grandes cientistas do Reino Unido. A edição do texto em inglês a partir da entrevista concedida ao Prof. Gauss Cordeiro no IME/USP em 26/1/89 foi feita pela **Profa. Mariluci Pessoa**, a quem a Comissão Organizadora da 1a. Escola de Modelos Lineares agradece o excelente trabalho.

Gauss - I would like to interview Prof. John Nelder. I am going to ask some questions about his career and what he thinks about the general situation in Statistics. Prof. Nelder, please, where were you born?

Nelder - I was born in a small village in Southwestern England in 1924; my parents kept a family hotel there. I went to school in Titon, which is a nearby town, then I went to University in Cambridge, split by the Second World War. I spent three years away in the Royal Air Force.

Gauss - Where did you undertake your high school and undergraduate studies?

Nelder - As I mentioned, I went to a school in Titon (it was called Blundell's) and then got a place at Cambridge to study Mathematics. I did a Mathematics degree there, and then I did a one-year diploma in Mathematical Statistics, also at Cambridge. There were a very interesting group of teachers there at that time. They included Wishart, of the Wishart distribution, Frank Anscombe, Denis Lindley and Henry Daniels.

Gauss - So this was the beginning of your interest in Statistics?

Nelder - Yes, at the end of my course in Mathematics I was still not sure of what I wanted to do. I had always been interested in Natural History; then there was a chance

to go into agricultural research where I could combine Mathematics with my interests in Biology and Natural History. That is why I chose to go into Agricultural Statistics.

Gauss - Did you always work as a part time lecturer with your main activities at Rothamsted Station?

Nelder - Well, my first station was not Rothamsted, it was the National Vegetable Research Station at Wellsbourne, in Central England. When I first went there, the Station was just beginning and we had no electricity. I had an electric calculating machine which I couldn't use! So we began very much from the bottom, and it gradually built up from there. I was always a full-time research worker there later on I became an external lecturer at Birmingham University where I gave a course on the Design and Analysis of Experiments. I went to Rothamsted in 1968, and soon after that, I became visiting professor at Imperial College where I gave a Course to the M. Sc. students on Statistical computing. I have, though, no experience of undergraduate teaching.

Gauss - Did you work with Fisher and his coworkers?

Nelder - No, I didn't work with Fisher. In fact I only met him one or two occasions. One occasion I remember, was the first International Conference I ever went to, which was the Genetical one at Bellagio, in 1953. I did, for a short time, work at Rothamsted before I went to the Vegetable Research Station, but by then, of course, the Department was run by Frank Yates whom I was later to succeed, and I got to know him quite well. I met Haldane on one or two occasions, but I didn't work with him.

Gauss - In your opinion who where the outstanding statisticians in the past?

Nelder - In the past? How far back? Well, Gauss, obviously, because of his discovery of Least Squares among many other things in Mathematics. Fisher, obviously to me, is the outstanding man for the wealth of his ideas, which are still bearing fruit in various directions. Beyond that I don't think I want to make comparisons.

Gauss - I appreciate that. But how about nowadays?

Nelder - Oh dear! I'm not going to make a pecking order of statisticians, I'm afraid.

Gauss - Which papers do you consider to be the most important contributions to Statistics?

Nelder - One remarkable one was Fisher's 1918 paper about the correlation between relatives on the supposition of Mendelian Inheritance, because that solved a bitter controversy that had been going on between the biometricians and the geneticists, and effectively showed that there was no quarrel. There are also, of course, his early papers on Likelihood and Sufficiency, which I think have been extremely powerful in the results that they have given. Those are just two that I particularly remember.

Gauss - Do you agree that all your papers have little Mathematics and much more emphasis on new ideas in Statistics?

Nelder - Well, what I have tried to do, and hope that I have succeeded in doing, is to make synthesis, that is to say, to put together things that have been treated separately in the past and to show that they are or can be treated as special cases of some more general structures. This was true of the two papers I wrote in 1965 about General Balance for Experimental Designs, which gave a single framework for a gret many designs; there was also the Generalized Linear Model synthesis, which again was to show that a number of hitherto distinct types of Statistical Models could be thought of as being instances of a more general class. And I suppose that has been my main interest.

Gauss - Do microcomputures improve the theoretical research and practical applications of the regressions models?

Nelder - Computers allow you to do things badly or well. In that sense they are neutral. Certainly people have gone a lot of bad things with existing packages, partly because the packages have not been able to warn them against doing bad things, partly because they don't wish to know about all the details and simply want an answer. So, I think computers give you more opportunity to do things: more opportunity to do things well, but also more opportunity to do things badly. They could, however, be much more useful than they are. We need much better graphics. The ability to loook at cross sections of likelihood surfaces

easily, for example, would be a great help. The ability to experiment with transformations to produce quadratic shapes in likelihood functions is another example. I hope that we shall see easy small algebraic-manipulation packages so that when we have a nonlinear model we can actually write out the variance-covariance matrix in its algebraic form easily. I am sure that these improvements will come before long.

Gauss - You were one of the discussants of the Box-Cox 1964 paper and you also introduced the idea of inverse polinomials in 1966. How did you get the idea of Generalized Linear Models?

Nelder - That's an interesting question. I don't really think I know the answer to it. There is a paper that I wrote in 1970 which was published in Biometrics; in this I drew attention to the fact that there was a considerable similarity between a model with gamma errors and an inverse linear response curve and the model for Probit Analysis. I didn't understand at that time exactly what the connection was, though I could see there was one. Then in the subsequent two years somehow the idea jelled, so that Wedderburn and I could see what was common to these models. That's how it came about, but exactly how I did it I don't know. Similarly in the General Balance papers I first had the idea in a kind of shadowy form in about 1950, when I was trying to work out how to analyse some extremely complex multifactorial designs and derive the analysis of variance. I began to wonder what the rules were that I was using to find this analysis of variance. But then it took fifteen years before I discovered what the central idea was.

Gauss - Do you think there is a "best" statistical package?

Nelder - That is unfair because I am the originator of two packages, namely GLIM and GENSTAT so, obviously, I prefer them. Also I haven't first-hand experience of many of the other ones. I do think though that a good package is characterized by having a good structure to the classes of models which it can fit. I don't like the kind of package which has one subprogram for model 1, a second for model 2, a third for model 3, etc. I call this linear programming. The packages grow enormously in relation to the power which they

actually have. The great advantage of GLIM is that by reducing a large class of models to the specification of just three things, the link function, the variance functin and the linear predictor, one is able to do very many things with a small or relatively small amount of code. This is why for its power GLIM is so much smaller than any of the other packages that do comparable things.

Gauss - How do you see the great number of papers published on Generalized Linear Models in the last five years?

Nelder - Obviously I am very gratified to think that the original idea has had so many applications, and I welcome the work that has been done and the extensions that have been made in varios fields. I think we still have quite a long way to go to find out all the possible ramifications of the basic idea.

Gauss - Do you think this has happened because your book has become a best-seller in the area?

Nelder - Well, I am not sure if it is a best-seller. I don't know what a best-seller for a technical monograph is in terms of total numbers of copies sold. I think the book has helped a lot, and perhaps we should have written it earlier than we actually did.

Gauss - What are the branches of research on Generalized Linear Models in the near future?

Nelder - One that particularly interests me has been the work initiated by Hastie and Tibshirani on what they call Generalized Additive Models. In these the shape of the response surface subject to the restriction of additive effects is determined by a smoothing technique applied to the actual data. This gives you the possibility of exploring what the data are saying about the shape of the response and then tailoring your parametric models initially to form a better class from which to select. I am very interested in the work that is being done, initiated by Heyde and Godambe on the extensions of Quasi-Likelihood to Stochastic Processes; I thing there is also more useful work to be done on Longitudinal Models, extended to other distributions than the Normal.

Gauss - In your opinion what are the main active groups and people working on Generalized Linear Models?

Nelder - There are certainly people in the University of Washington. Peter McCullagh of course in Chicago, is very active in pursuing this. Scott Zeger at John Hopkins is doing interesting work on Longitudinal Models. There is the Quasi-Likelihood and other work that I have just mentioned. I am sure there are others that I ought to include, and I hope no one will be offended if I've left them out.

Gauss - There are a lot of Journals that are specialized in some areas of Statistics, for instance: Time-Series. Do you thing that a Journal specialized on Generalized Linear Models will appear in the near future?

Nelder - About two years ago I was asked whether I would edit such a Journal. But my own belief is that we have too many Journals already and I am very unhappy about the increasing specialization of Journals in Statistics. So I still think that I would not favour having a Journal specifically attuned to this particular area. I think it inhibits the exchange of ideas between different branches of Statistics, something we ought to encourage.

Gauss - How do you see Statistics in Brazil? Could you make any suggestions for improving it?

Nelder - I am very impressed by the enthusiasm and the knowledge of Brazilian statisticians; and they're clearly a very active group and I'd like to do anything that I can to encourage collaboration and exchange, particularly between Great Britain and Brazil. Our Royal Society of London has a scheme for scientific interchange betweeen the two countries, and I intend to pursue, when I get home, what could be done to encourage the use of this scheme in the area of Statistics. I think short-term visits are always useful, if they can be arranged; very often they are profitable to both sides and that perhaps is something that we could look at first.

Gauss - Now for my last question. Did you enjoy your stay in Brazil?

Nelder - Oh, yes indeed. I've been here twice before and one of the organizers of this

Conference who was working at Imperial College, heard me say how much I would like to go back again. I am extremely grateful to her and the other organizers for making it possible for me to come, and again I have enjoyed myself very much. I hope that I may come back again before too long.

Gauss - Thank you very much Prof. Nelder for this interview.