THE ISBA NEWSLETTER

Vol. 6 No. 3 *September 1999*

The official newsletter of the International Society for Bayesian Analysis

ISBA ELECTIONS

by Susie Bayarri
Chair, ISBA Nominations Committee
susie.bayarri@uv.es

The Nominations Committee was appointed by the Board under the direction of President John Geweke. The members of the Committee were *Susie Bayarri*, Chair (University of Valencia, Spain), *Kathryn Chaloner* (University of Minnesota, U.S.A.), *Daniel Peña* (Carlos III University, Spain), *Raquel Prado* (Simon Bolivar University, Venezuela), *Jim Press* (University of California, U.S.A.) and *Fabrizio Ruggeri* (CNR-IAMI, Italy).
We began the first contacts at the beginning of September and we established the rules to follow in the nominations and voting. In the next elections, we shall be choosing the President Elect and four members of the Board. The Nominations Committee is thus presenting two candidates for President Elect and eight candidates for members of the Board, so as to meet the requirement in ISBA Constitution. The candidates (in alphabetical order) are:

```
For President Elect:

Alicia Carriquiry (USA)
Luis Pericchi (Venezuela)
```

```
For Members of the Board:

Deborah Ashby (UK)
Dani Gamerman (Brasil)
Eduardo Gutierrez-Pena(Mexico)
Irwin Guttman (USA)
David Heckerman (USA)
Elias Moreno (Spain)
Dalene Stangl (USA)
Mark Steel (UK)
```

The system was as follows.
Each member of the Nominations Committee proposed one candidate for President Elect and four for the Board. Each proposal for President Elect could be followed by a defence of the proposed person as adequate for the task. All the prospective candidates had to be ISBA members to be considered, and we tried to avoid gross under-representation in the final Board. Once the list with all the proposals was circulated, each of us voted for two candidates for President Elect and six for Board members. If a prospective candidate declined, a new votation was taken among the rest of candidates. If a tie occurred, again a new votation was taken to break the tie.
You will find a short description of the candidates for President Elect and for board members below. Each candidate was asked to provide: affiliation, current status, web page, areas of interest (up to 4), most important journals (or books) in which s/he has published (up to 6) and previous services to ISBA. Candidates for President Elect could add two areas of interest and another two journals/books, as well as Honors received and positions held in other societies.

Contents

They were also asked to include a statement about what they intend to accomplish if they become elected. This information is also accessible in our Web page, and it will be included along with the ballots, which will be mailed to you in due course by the Executive Secretary of ISBA.
From here I want to express my most sincere thanks to all the members of the Nominations Committee for their inputs, comments, and enthusiastic response. They have done a most thoughtful and responsible job, and made my Chairing a smooth and easy task. I would also like to thank the candidates for their fast and positive responses, and for being willing to devote a most needed portion of their time and efforts to contribute to the growth of ISBA. I would like to invite you all to participate in the next elections.

A WORD FROM THE EDITOR

by Fabrizio Ruggeri
ISBA Newsletter Editor
fabrizio@iami.mi.cnr.it

Welcome to Raquel Prado, the new Associate Editor for the Section on Bayesian history.

INFORMATION ON CANDIDATES

President Elect

Alicia Carriquiry

• *Affiliation:* Iowa State University

• *Current Status:* Associate Professor of Statistics

• *Web Page and e-mail Address:* www.stat.iastate.edu/˜alicia; alicia@iastate.edu

• *Areas of Interest:* Dietary assessment, animal breeding and genetics, forensic statistics, filtering, econometrics.

• *Most Important Journals or Books:* Journal of the American Statistical Association, Biometrics, Journal of the Royal Statistical Society, IEEE Transactions on Aeronautics and Electronic Control, Brain Research, Bulletin of Mathematical Biology, Journal of Nutrition, International Journal of Evidence and Proof.

• *Honors:* Member of the International Statistical Institute, Fellow of the American Statistical Association.

• *Previous Services to ISBA:* Program Chair, 1997; Board of Directors, 1998; Nominating Committee, 1998; Co-chair, Finance Committee, ISBA 2000, 1999-2000; Member, Scientific Committee for ISBA 2000, 1999-2000.

• *Services to other Societies:* ASA: Committee on Meetings, Editor of the Proceedings of the Biometrics Section, JSM Program Chair for Biometrics, JSM overall Program Chair. IMS: Executive Secretary, Nominations Committee, Elizabeth Scott Award Committee, Editor of Statistical Science. ENAR: Regional Advisory Board member. Bernoulli Society: Scientific Committee member for CLAPEM Chile and CLAPEM Argentina. NISS: Board of Trustees member.

My view of ISBA

The number of substantive applications that rely on innovative Bayesian methods has exploded this decade, and there is increased awareness of Bayesian techniques among non-statisticians. ISBA has provided leadership to a growing community of Bayesians worldwide, but we face a number of challenges in the years ahead. As only a fraction of Bayesians belong to ISBA, recruiting and retaining new members is an obvious priority. Our much re-vitalized newsletter is one positive step in this direction, as is our plan for the upcoming world meetings. Yet, we need to be creative in providing expanded outlets and expanded intellectual opportunities for the Society's members. We need to forge closer links to other international statistical societies such as IMS and the Bernoulli Society, e.g., by co-sponsoring meetings. More importantly, now is the time to begin planning for electronic publications to complement the array of existing professional journals and offer ISBA members new outlets for sharing their research results and educational materials. Finally, we need to return to ISBA's mission, by increasing the use of Bayesian methods in other fields, and by opening our doors to researchers in other areas. For the past eight years, ISBA has been my intellectual home, and I am honored to be a candidate for President-Elect.

Luis Raúl Pericchi

• *Affiliation:* Departamento de Cómputo Científico y Estadística and Centro de Estadística y Software Matemático (CESMa), Universidad Simón Bolívar, Caracas, Venezuela.

• *Current Status:* Full Professor

• *Web Page and e-mail Address:* www.cesma.usb.ve/~pericchi; pericchi@cesma.usb.ve

• *Areas of Interest:* Bayesian Model Determination; Robust Bayes; Decision Analysis; Foundations of Statistics; Applications of Bayesian Statistics.

• *Most Important Journals or Books:* Biometrika, Applied Statistics, Journal of the Royal Statistical Society Series B, International Statistical Review, Journal of the American Statistical Association, Journal of Cardiology, TEST, Sankhȳa, Bayesian Statistics Volumes: 3, 4, 5 and 6.

• *Honors:* Elected Member of the International Statistical Institute (1989), Guggenheim Fellowship.

• *Previous Services to ISBA:* Member of the Board.

• *Services to other Societies:* Course in Bayesian Statistics sponsored by the Bernoulli Society, Mexico, 1990. President of the Latin-American Chapter of the Bernoulli Society for Probability and Mathematical Statistics, 1997-1999.

My view of ISBA

Ours is, and should ever be, a friendly and open minded society which gives a sense of belonging to an intellectual movement. Bayesianism is a service to science and technology. As such, growth in applications is of paramount importance but also is its formidable power to formalize the scientific method and to keep its momentous drive to enlarge the theory of statistics and decision sciences. In John Earman's words ("Bayes or Bust?", MIT press, 1992)*"This (book) explores one dimension of this impasse"* (the failure of contemporary Philosophy of Science to understand how the results of observation serve to support or undermine scientific conjectures) *"by providing a critical evaluation of the approach I take to provide the best good hope for a comprehensive and unified treatment of induction, confirmation, and scientific inference: Bayesianism"*.
Ours should be a society to which all interested in the Bayesian approach would be eager to belong to. ISBA should give more to its members, the Newsletter is a wonderful example, as might be a comprehensive directory and discounts in ISBA-sponsored local or thematic conferences and courses, and in publications. Active search for books and article reviews and the creation of a new series of Monographs ought to be considered. Above all the members should have privileged information of Bayesian ideas and contributions in every field, from Accounting to Zoology.

Board Members

Deborah Ashby

I hold the Chair of Medical Statistics at Queen Mary and Westfield College in the University of London (`www.mds.qmw.ac.uk/wolfson/`). My main areas of interest are epidemiology, clinical trials, evidence-based medicine and, of course, applied Bayesian statistics. I have published in many places, including the Lancet, Paediatric Pulmonology, Statistics in Medicine, Bayesian Biostatistics (eds Berry & Stangl) and the Cochrane Database of Systematic Reviews.

Dani Gamerman

Since I got my PhD from Warwick in 1987, I've been working at the Instituto de Matematica from the Universidade Federal do Rio de Janeiro in Brazil. I'm currently Professor and Director of Graduate Studies at the Department of Statistical Methods of the Institute. My main areas of interest are dynamic models, Bayesian computation, hierarchical models and, more recently, spatial models. I have published papers in JRSS B, Biometrika, Applied Statistics, Journal of Forecasting, Statistics and Computing and IEEE Trans on Reliability. I have published a book on MCMC with Chapman & Hall in 1997 and a book on statistical inference with Arnold in 1999 (with Helio S. Migon). Further information about me (including postscript versions of unpublished papers) can be obtained from my Web page address `www.ufrj.br/~dani`

Eduardo Gutierrez-Peña

Eduardo Gutiérrez-Peña is Researcher at the Department of Probability and Statistics, IIMAS, National University of Mexico. His main areas of interest are: (a) the study of the properties of Bayesian conjugate families for exponential models, and (b) the problem of model selection. He has published work in several journals, including the Journal of the American Statistical Association, Biometrika, Scandinavian Journal of Statistics, Journal of Statistical Planning and Inference, and Test. (`www.dpye.iimas.unam.mx/eduardo`)

Irwin Guttman

Irwin Guttman is Professor, Department of Mathematics, SUNY at Buffalo. His current research interests are Bayesian Inference; Volatile time series and their analyses; Design of experiments; Meta Analysis. His most recent publications can been found in JASA, Annals of Statistics, Technometrics; Biometrika, Statistica Sinica.

David Heckerman

David Heckerman is Senior Researcher at Microsoft Research. His main areas of interest are Bayesian model averaging, Bayesian model selection, graphical models, decision making. The main journals (or books) in which he has published include Annals of Statistics, IEEE PAMI, Bayesian Statistics 6, Machine Learning, AI. You can find more about his research and publications in his Web page `research.microsoft.com/~heckerman`

Elias Moreno

Elias Moreno is Professor, Department of Statistics. University of Granada (Spain). His main areas of interest are: Bayesian inference with partial prior information on observable variables, Bayesian robustness, Model Selection and Hypothesis Testing, Applications of Bayesian Statistics and Decision Theory to Medical Problems (automatic diagnosis). The main journals (or books) in which he has published include Bayesian Statistics (Proceedings of the Valencia meetings), IMS Lectures Notes-Monograph Series, International Statistical Review, Journal of the American Statistical Association, Journal of the Royal Statistical Society (Series B), Journal of Statistical Planning and Inference. As for previous services to ISBA, he has been in the Organizing Committee of an ISBA meeting.

Dalene K. Stangl

Dalene K. Stangl (Ph.D. '91, Carnegie Mellon University) is on the faculty of the Institute of Statistics and Decision Sciences at Duke University (`www.stat.duke.edu/~dalene`). As an assistant professor she has co-edited two books on Bayesian methods: Bayesian Biostatistics, 1996, Marcel Dekker and Meta-Analysis in Medicine and Health Policy, to appear late 1999 or early 2000, Marcel Dekker. Her professional interests are hierarchical survival models, decision analysis, and the reform of statistical-education and statistical-practice. In addition to the two books mentioned, recent statistical publications have appeared in Statistics in Medicine, Sankhya, and Lifetime Data Analysis as well as substantive research journals in medicine and health policy. She served as the '98 program chair for the ASA Section on Bayesian Statistics.

Mark Steel

Mark F.J. Steel (Ph.D. at CORE, Universite Catholique de Louvain) is a Professor of Economics at the University of Edinburgh since January 1998. Over the course of his career, his interests have shifted gradually from econometrics more towards statistics, and his current research covers both econometric and statistical topics. Some current areas of interest are environmental statistics, model uncertainty, stochastic frontier models and modelling with continuous distributions. He has published in a variety of journals, such as Journal of the American Statistical Association, Biometrika, Journal of Econometrics, Journal of Business and Economic Statistics, Econometric Theory and Review of Economics and Statistics. More details can be found on his webpage at `www.ed.ac.uk/~msteel/`. He has served as ISBA Vice Program Chair in 1997, Program Chair in 1998, and is currently Past Program Chair.

ISBA 2000 Co-Chairs

Philip Dawid
and Photis Nanopoulos
ISBA President Elect
and EUROSTAT Director
dawid@stats.ucl.ac.uk
photis.nanopoulos@
eurostat.cec.be

The ISBA 2000 meeting in Crete, co-sponsored by EUROSTAT and the Association of Balkan Statisticians, looks set to start off the new Bayesian millennium with a bang. Our hard-working Programme Committee has been inundated with high-quality proposals for sessions and speakers, and an exciting conference of the highest scientific interest and quality seems assured. The programme will feature a wide range of up-to-the-minute theoretical and methodological advances over the whole field of Bayesian Statistics. The power of Bayesian thinking and analysis to further our understanding of the world will be demonstrated across a broad swathe of applied problem areas. And there will be a special emphasis on highlighting opportunities for interdisciplinary interaction. A number of sessions will be devoted to the systematic exploration of the potential of the Bayesian approach for solving important practical problems of government, official statistics and public policy. The Bayesian approach has a substantial contribution to make towards meeting the challenges faced by Official Statistics, as it strives to balance calls for more and better data against the costs and burdens of providing these services. To this end, ISBA has decided to make Official Statistics a leading theme of its Sixth World Meeting, with the following aims:

a) To bring together Bayesian scientists and official statisticians, to exchange information and views on the state of the Bayesian art.

b) To identify problem areas in official statistics, broadly interpreted, where the application of Bayesian tools and methods appears most promising.

c) To lay the foundations for collaborative research to address issues of concern.

To address these aims, as well as similar issues in other areas, the meeting will tackle fundamental implementational issues such as the role and validity of subjective judgement in the construction of models and priors, the feasibility of the elicitation process, and computational practicalities. It will take stock of a wide range of methodological tools, such as MCMC computation, model-averaging, influence diagrams and belief nets, and hierarchical modeling. It will present and study late-breaking original new developments in Bayesian theory and methodology. And it will explore a wide range of actual and possible applications, especially where relevant to the theme topic of official statistics — whether generic, or in particular domains such as health education and environment. We look forward to welcoming you to Hersonissos next summer.

Scientific Programme

by Mike West
Chair, ISBA 2000 Scientific Committee
mw@isds.duke.edu

Program planning for ISBA 2000 approaches completion. Following an amazing, world-wide response to the call for proposals earlier this year, the Scientific Committee has now finalised the formal scientific program.
ISBA 2000 will feature:

• Over 40 technical sessions of oral presentations, featuring more than 120 individual talks, and 3 evening poster sessions featuring a similar number of individual poster presentations.

• A range of "Theme" related sessions covering applied Bayesian work in official statistics and policy arenas, and challenges and opportunities in these areas. In addition to official, policy and governmental statistics, a further subset of sessions is devoted to Bayesian methods in public policy more broadly, including public health, environment and agriculture.

• A wide range of "General" sessions of talks on Bayesian theory, methodology and application in many diverse areas – highlighting current research frontiers, and, consistent with one of ISBA's primary institutional goals, showcasing important interdisciplinary applications of Bayesian methods. There will be something for everyone, and much more than enough for most.

• An incredible range of topics

to be presented in evening poster sessions. As has become the norm in Bayesian research meetings, the evening poster sessions will be vibrant scientific events, with a number of Theme-related presentations as well as topics spanning the spectrum of Bayesian research and application.
In the very near future, full details of scheduled oral and poster sessions will be listed on the ISBA 2000 web site,

`www.ntua.gr/ISBA2000/`

This can also be accessed through the ISBA web site `www.bayesian.org` and provides all conference information, including registration and travel, in addition to the scientific program.
We invite you to browse the web site, register for ISBA 2000, and encourage your colleagues, students and friends to do so too. We anticipate an unusually active, informative and productive meeting, and look forward to seeing fellow ISBA members and many other Bayesian colleagues in Crete next May.

LOCATION AND SOCIAL PROGRAMME

by George Kokolakis
Chair, ISBA 2000 Local Organising Committee
kokolakis@math.ntua.gr

➤ Location and Venue

The ISBA 2000 Conference will be held at Hersonissos, a popular summer resort on the north coast of Crete, just 25 km from Heraklion International airport. The Knossos Royal Village and the Royal Mare Village hotels have been selected as Conference Sites. Both of them are luxury class purpose built villages. The Conference Hall belongs to the Knossos Royal Village. It has all the required facilities and it has been the venue of international congresses many time in the past. The two hotels are next to each other. The Royal Mare Village hotel can be considered as more luxurious and modern but delegates may need to walk up to 6 min. to reach the Conference Hall from their rooms.

➤ Social events and Local Information

Trips are being organised to Knossos, Heraklion Archaeological museum and Matala beach.
Crete is the largest of the Greek islands and the fifth in size of all the islands of the Mediterranean Sea. It is also the most southern point of Europe. It lies at the Southern Aegean Sea and at the crossroads of three continents Europe, Asia and Africa. Crete covers an area of 8336 sq.km. The length of the island is 260 km, but the shore-length is 1046 km. A high mountain range crosses the island from West to East, formed by three different groups of mountains. To the West the White Mountains (2452 m), in the middle the mountain of Idi (2456 m) and to the East the mountain of Dikti (2148 m). These mountains gifted Crete with fertile plateaus like Lasithi, Omalos and Nidha, caves like Diktaion and Idaion and the famous Gorge of Samaria. The Gorge of Samaria is the longest in Europe, measuring some 18-km and can be covered in about 7 hours on foot. It is well known for its awesome beauty. At some points the passage is just 3 meters wide and at times the steep sides rise to a height of 600 meters. A stream that flows cuts the gorge between the highest peak of the White Mountains and the mountain of Volikas.
A place with a great history from ancient times, Crete offers visitors a priceless wealth of findings of all the civilizations that flourished on the island in its museums and in its archeological sites. Knossos contains the ruins of the largest and most luxurious Minoan palace, built in the middle of a large town. The impressive Minoan Palace of Knossos is famous throughout the world for its association with the myths of the Minotaur, the Labyrinth, Daedalus, Ikarus and of course of Theseus, and the most ancient civilization in Europe.
The Archaeological Museum is one of the most outstanding museums in the world. It contains findings from all over Crete, focused primarily on the prehistoric Minoan civilization that ruled the island for over 1200 years.
Matala was the port of Phaistos during the Minoan period. Ruins of the ancient city are still visible on the seabed as the ancient city was sunk in the sea. Due to its exceptional natural beauty, Matala became the meeting place of the "Flower Children" in 1968. Although their conference failed to realize, yet they were compensated by the incomparable beauty of the area, which so much contrasts with the concept of destruction and war.

PETER MÜLLER

by Michael Wiper
`mwiper@est-econ.uc3m.es`

Peter Müller is an Associate Professor at the ISDS in Duke University. He has produced innovative work in a number of areas of Bayesian Statistics, in particular in Bayesian non-parametrics and utility and decision problems.
Part of this interview was conducted live with our editor in attendance before the wedding of our co-interviewer David Rios Insua. Congratulations to David for finally using his Bayesian judgements to get married to someone who doesn't have anything to do with statistics.

`1) Why did you decide to become a statistician?`

Like many statisticians, probably by coincidence. I went to the US for graduate studies having taken Math/Phys in Austria, so statistics seemed like a reasonable choice, if not a conscious choice.

`And why Bayesian? There aren't too many Bayesians in Austria`

As I came to Purdue to study statistics I met many Bayesians there. Jim Berger was a big influence.
As for Austria, it is not exactly a Bayesian free zone. There was Wolfgang Polasek at the University of Vienna at that time. And there are now Klaus Pötzelberger, Klaus Felsenstein, Frühwirth-Schnatter and colleagues at the Wirtschaftsuniversität Wien.

`2) Who are the people who have had the strongest influence on your statistical career?`

Jim Berger. I studied for my doctorate with him at Purdue and he gave me some good ideas on what's important in statistics. I can identify very strongly with his views on reconciling Bayesian statistics with practical analyses. Although he does not work a lot in computational methods, he was very supportive. It's also because of him (indirectly, as he had a sabbatical there and I went with him) that I ended up at Duke. While in the sabbatical year there I took a class with Mike West which greatly impressed me. Also John Geweke has taught me a lot. Meeting them helped to push me further down the road of computational Bayes. Also this was just the right time for starting to work in computational Bayes, just year 2BG (before Gibbs).

`3) You have worked on a number of areas of Bayesian non-parametrics; Dirichlet processes, wavelets, neural nets etc. Can you tell us something about this work?`

The work on Dirichlet processes (DP) has not been me alone, but many people have contributed. My interests were mainly in applying DP models to parametrize mixture models used to generalize fully parametric models for random effects distributions, measurement error models; non-linear autoregression, etc. Also, the problem of implementing posterior simulation for non-conjugate DP mixtures kept us puzzling for a while.
As for wavelets, having an office only two doors down from Brani Vidakovic, I have to be interested in them. They seem a very natural way of modelling functions that leads to more robust modelling opportunities. It seems a safe guess to assume that wavelet transformation will become as commonly used a tool in statistical inference as Fourier decomposition is now.
I see wavelet based modeling as the exact opposite of another non-parametric modeling approach which interested me a while ago, namely neural networks. While wavelets provide parsimonious parametrization of random functions, neural networks follow the exact opposite paradigm and throw intentionally massively overparametrized models at the data. It still intrigues me trying to understand what is the correct way of approaching such models.

`4) What do you think is your most important contribution to Bayesian statistics?`

I wouldn't like to pick out any single thing. I think I've made many small contributions to computational problems, though nothing revolutionary. Some of the more fun things to work on were an algorithm for posterior simulation for non-conjugate Dirichlet process mixtures (MacEachern and Müller 1998), semi-parametric models for longitudinal data (Müller and Rosner 1997), Bayes in case-control studies (Müller and Roeder 1997), simulation based approaches to decision problems (Bielza, Müller and Rios Insua 1999).

`5) What are the major advances in statistics you've seen in your statistical career?`

Well, it has not been that long! In Bayesian computation, Gibbs sampling, Tierney's MCMC paper.

`6) And if you had a crystal ball to look into the future?`

I can answer only from my very subjective perspective – going beyond traditional parameter estimation to solving decision problems, moving towards more meaningful problems, clinical trials etc.

`7) What about your own future research plans?`

I'd like to work on some interesting decision problems, extending some of the methodology which we have developed over the last 10 years for parameter estimation. In many computational approaches, there are an infinite number of possible extensions, but it is often very hard to focus without a meaningful practical application.

`8) Do you have any advice for teachers of Bayesian statistics?`

I don't have any real tips. My main advice would be not to have excessive expectations and to keep things in perspective. I do find computers useful in teaching though. I use the web a lot and email to address concerns in large classes.

`9) What do you enjoy most about your work?`

It's fun to work with people from other fields. I think the level and diversity of interdisciplinary collaborations in statistics in general, and Bayesian statistics in particular, is quite exceptional compared to many other fields. On the less academic side, being able to visit collaborators or go to conferences in nice places is often a treat. Bayesian statisticians are a friendly bunch. `And least?`

Working on revisions for manuscripts when you don't at all agree with referees, but have to somehow try to read sense into the comments. And on the other side, I find it very painful to referee bad papers.

`10) What is your favourite statistics book?`

Some random answers; Jim's book, Chris Robert's Bayesian Choice and Brani's wavelet book; Thisted's Computational Statistics book.

`11) What is your favourite Bayesian statistics joke?`

I don't really know any Bayesian statistics joke. Here is the closest I can think of. You want to find the solution to $1 + 1$. Ask an engineer and he'll tell you $1 + 1 = 2$, ask a statistician and he'll say 2 ± 0.1, ask a mathematician and he'll go away and come back in a few days and tell you that the solution exists. Finally, if you ask an accountant, he'll close the door and ask you how much you want it to be.

`12) As a member of ISBA, what are your views about the Society and what, if any changes would you like to see?`

I know some people are sceptical about a society based on methodological focus but I see nothing wrong with that, especially as I see that the next conference has a very specific theme. I identify strongly with the aims of ISBA such as encouraging collaboration, support for young researchers etc. The focus of ISBA I like most is it's international orientation. I'd like to see this continue, drawing in more people from diverse backgrounds and different countries.

References given in Peter's talk are ...

Bielza, C., Müller, P., and Rios Insua, D. (1999). "Monte Carlo Methods for Decision Analysis with Applications to Influence Diagrams," *Management Science*, 45 (7), 995-1007.

MacEachern, S.N. and Müller, P. (1998). "Estimating Mixture of Dirichlet Process Models," *Journal of Computational and Graphical Statistics*, **7**, 223–239.

Müller, P. and Roeder, K. (1997). "A Bayesian Semiparametric Model for Case-Control Studies With Errors in Variables," *Biometrika*, **84**, 523-537.

Müller, P. and Rosner, G. (1997). "A Bayesian population model with hierarchical mixture priors applied to blood count data," *Journal of the American Statistical Association*, **92**, 1279-1292.

Special Functions

by Eugenio Regazzini

eugenio@iami.mi.cnr.it

We present applications of multiple hypergeometric functions in Bayesian nonparametrics.

1. The theory of hypergeometric series began in a systematic way with Gauss's thesis on the ${}_2F_1$ series presented at Göttingen in 1812, although some important results had been found by Euler and Pfaff. Cf., for example, the recent book by Andrew, Askey and Roy (1999). The confluent form ${}_1F_1$ was first discussed in detail by Kummer in 1836. Appell was the first author to deal with hypergeometric functions of two variables, and Lauricella generalised the four Appell functions to several variables in 1893. Cf. Exton (1976). A number of limiting forms of the Lauricella functions exist which may be obtained by limiting processes similar to those used to deduce the confluent forms of the Appell functions.

2. The memoir *Sulle funzioni ipergeometriche a più variabili*, published in 1893, is the first item in the list of the scientific works of the Sicilian mathematician Giuseppe Lauricella (1867-1913). Beginning with the four Appell functions, Lauricella proceeded to define and study the four functions which bear his name. In particular, the fourth of these functions, denoted by $F_D^{(n)}$, was introduced by the following series

$$F_D^{(n)}(a, b_1, \dots, b_n; c; x_1, \dots, x_n) = \sum \frac{(a, m_1 + \dots + m_n)(b_1, m_1) \dots (b_n, m_n)}{(c, m_1 + \dots + m_n)} \frac{x_1^{m_1} \dots x_n^{m_n}}{m_1! \dots m_n!}$$

which converges when $|x_1| < 1, \dots, |x_n| < 1$. Note that $(a, n) := \dfrac{\Gamma(a+n)}{\Gamma(a)}$ for any positive a and integer n.

Lauricella obtained interesting integral representations for his functions. As far as $F_D^{(n)}$ is concerned, he found that

$$F_D^{(n)}(a, b_1, \dots, b_n; c; x_1, \dots, x_n) = \int_{R^n} f_n(u_1, \dots, u_n)(1 - u_1x_1 - \dots - u_nx_n)^{-a} du_1 \dots du_n \tag{1}$$

holds true for $\mathcal{R}e(b_1), \dots, \mathcal{R}e(b_n), \mathcal{R}e(c - b_1 - \dots - b_n) > 0$ with

$$T_n = \{(u_1, \dots, u_n) \in R^n : u_i > 0 \text{ for } i = 1, \dots, n \text{ and } \sum_{k=1}^n u_k < 1\}$$

and

$$f_n(u_1, \dots, u_n) = \frac{\Gamma(c)}{\Gamma(b_1) \dots \Gamma(b_n)\Gamma(c - b_1 - \dots - b_n)} u_1^{b_1 - 1} \dots u_n^{b_n - 1}(1 - u_1 - \dots - u_n)^{c - b_1 - \dots - b_n - 1} \mathbb{1}_{T_n}(u_1, \dots, u_n).$$

Moreover, Lauricella proved that

$$F_D^{(n)}(a, b_1, \dots, b_n; c; x_1, \dots, x_n) = \frac{\Gamma(c)}{\Gamma(a)\Gamma(c-a)} \int_0^1 u^{a-1}(1-u)^{c-a-1}(1-ux_1)^{-b_1} \dots (1-ux_n)^{-b_n} du \tag{2}$$

is valid when $\mathcal{R}e(a)$ and $\mathcal{R}e(c - a)$ are strictly positive. Thus

$$\begin{aligned} &\int_{T_n} f_n(u_1, \dots, u_n)(1 - u_1x_1 - \dots - u_nx_n)^{-a} du_1 \dots du_n \\ &= \frac{\Gamma(c)}{\Gamma(a)\Gamma(c-a)} \int_0^1 u^{a-1}(1-u)^{c-a-1}(1-ux_1)^{-b_1} \dots (1-ux_n)^{-b_n} du \end{aligned} \tag{3a}$$

holds true when $\mathcal{R}e(b_1), \dots, \mathcal{R}e(b_n), \mathcal{R}e(c - b_1 - \dots - b_n), \mathcal{R}e(a)$ and $\mathcal{R}e(c - a)$ are strictly positive. Whilst, under the very same conditions with $a = c$, we have

(3b) $$\int_{T_n} f_n(u_1,\ldots,u_n)(1-u_1x_1-\ldots-u_nx_n)^{-c}du_1\ldots du_n = (1-x_1)^{b_1}\ldots(1-x_n)^{-b_n}.$$

3. The previous relations can be used to solve the problem of characterising the probability distribution μ of $\int_R xP(dx)$ when P is a Dirichlet process on the real line, with parameter α defined by $\alpha(\{x_j\}) = \alpha_j > 0$ for $j = 1,\ldots,n+1$ and $x_1 < x_2 < \ldots < x_{n+1}$, $\alpha(R) = c = \sum_{j=1}^{n+1}\alpha_j$.

For example, some of the Lauricella classical results allow us to obtain the expression of the Stieltjes transform (of order c) of μ in a much more direct and simple way than that originally exhibited in Cifarelli and Regazzini (1990). Indeed, after indicating that transform by σ_c, we have

$$\sigma_c := \int_R \{s+x\}^{-c}\mu(dx) = \int_{T_n}\{s+\sum_1^n x_ku_k + x_{n+1}(1-u_1-\ldots-u_n)\}^{-c} f_n(u_1,\ldots,u_n)du_1,\ldots,du_n$$

$$s \notin [-x_{n+1}, -x_1]$$

$$= (s+x_{n+1})^{-c}F_D^{(n)}(c,b_1,\ldots,b_n;c;\frac{x_{n+1}-x_1}{s+x_{n+1}},\ldots,\frac{x_{n+1}-x_n}{s+x_{n+1}})$$

[from (1)]

$$= (s+x_{n+1})^{-c}\prod_{k=1}^n(1-\frac{x_{n+1}-x_k}{s+x_{n+1}})^{-b_k}$$

[from (3.b)]

$$= e^{-\int_R \log(s+x)\alpha(dx)}.$$

Other examples, of applications of the theory of Lauricella's functions to the study of μ, can be found in Regazzini (1998).

References

- Andrew, G.E., Askey, R. and Roy, R. (1999). *Special Functions*, Cambridge University Press.
- Cifarelli, D.M. and Regazzini, E. (1990). Distribution functions of means of a Dirichlet process. *Annals of Statistics*, **18** 429-442 (Correction in *Annals of Statistics*, **22**, 1633-1634).
- Exton, H. (1976). *Multiple hypergeometric functions and applications*, Ellis Horwood Limited.
- Lauricella, G. (1893). Sulle funzioni ipergeometriche a più variabili. *Rendiconti del Circolo Matematico di Palermo*, **7** 111-158.
- Regazzini, E. (1998). An example of the interplay between statistics and special functions. In *Tricomi's ideas and contemporary applied mathematics*, 303-320. Atti dei Convegni Lincei, **147**, Accademia Nazionale dei Lincei, Roma.

THOUGHTS

by Kass and Wasserman
kass(larry)@stat.cmu.edu

What is the bare minimum that someone interested in applying Bayesian methods must know, just to get started? This is the first question we have asked ourselves in the context of both a half-semester class for first-year graduate students and a one-day short-course for practicing statisticians. A second question follows closely on the first: What difficulties will students have in trying to learn these essentials in such compressed time-frames? Our strategy has been to try to emphasize (i) the nature of Bayesian data analysis, and (ii) the specific technique of hierarchical modeling. Along the way we talk about (iii) the choice of prior distributions, (iv) computation (mainly, posterior simulation), and here and there (v) a little philosophy. It is of course important to keep in mind the great effectiveness in Statistics (as well as in other fields) of teaching via examples: they make concepts concrete, and force the instructor to follow through with claims of how the Bayesian approach is supposed to provide insight. In this introductory context we keep things as simple as possible: all computations are done in S-PLUS. We begin with a one-sample Binomial example, partly because we have found that students rarely question the use of a uniform prior for the Binomial parameter—we question it ourselves, but not at the outset. In the context of the Binomial, we talk about data-domination in large samples, and the way that a Normal distribution then provides a good approximation to the posterior, even when it is based on Maximum Likelihood. We consider this crucial pedagogically: it is helpful to students to make a connection with something familiar, and they must also understand the similarities and distinctions between Bayesian and frequentist inferences. We next talk about the use of marginalization (integration) to eliminate nuisance parameters, and we illustrate with an example in which we compare two Binomials. Only after presenting results and their interpretation do we ask how this integration may be carried out. We describe posterior simulation in this very simple case (where we can generate the joint posterior—a product of independent Betas—directly). We then review some of the appealing aspects of Bayesian inference, including its intuitiveness, which we illustrate with the example of interpreting a thermometer reading, taken from the famous 1963 paper by Edwards, Lindman, and Savage. We also review in a very cursory manner some basic foundational notions, including the meaning of probability and the indeterminacy of confidence, and we point out that, in applications, Bayesian inference is often used in conjunction with frequentist (often exploratory) methods. It is our view that what we've described so far constitutes the core of the material, yet we can move through it quickly: in just two or perhaps three classes in the case of the half-semester course, or a couple of hours when we're whipping through the day-long version. On the other hand, everything else should reinforce these basic ideas, and we say so as we progress through the remainder. A couple more comments may help. Our attitude about MCMC is that in principle students really shouldn't have to know much about it, but in our current reality they must have a basic understanding. So we remind them of the basics of Markov chains (in the discrete case) and go through the Metropolis algorithm and Gibbs sampling. We use examples involving only a few parameters, and we derive the Metropolis algorithm constructively, thereby answering the natural question, How did anyone think it up? Then we go on to Hierarchical modeling, where we present the simplest Normal-Normal model in great detail, discussing both empirical Bayes and fully Bayes approaches, together with interpretation of a simple data set. We briefly indicate that the power of all this stuff comes from our ability to attack complicated problems, but in fact we're done: the course is already over. Those who wish to pursue more interesting examples will, we hope, be reasonably well-equipped to do so on their own. We are trying to finish a book that supports this minimalist presentation. It is called *A Short Course on Bayesian Statistics* and should be available from Springer next August.

RELIABILITY

by Siva Sivaganesan
siva@math.uc.edu

We present an annotated bibliography of the Bayesian applications in Reliability.

Statistical reliability theory is the study of the failure of systems through probability. By defining 'system' in a broad sense, reliability can therefore include such diverse topics as fault tree analysis, failure lifetime modeling, product development and testing, aspects of biometrics, risk analysis and insurance. Here, some recent papers in several different areas of reliability that use Bayesian methods are given. Papers on reliability appear in all the major statistical journals, mainly in the applications section (i.e. more likely Applied Statistics than JRSS B). The IEEE Transactions on Reliability is another good source, as is the IEEE Transactions on Software Engineering for papers in software reliability and testing. Although not particularly Bayesian, the classic methodological text in reliability is

• R. E. BARLOW AND F. PROSCHAN(1981). *Statistical Theory of Reliability and Life Testing* , 2nd edition, Silver Spring.

There are two volumes, the first dealing with models and the second with inference. Perhaps a better place to start is

• N. D. SINGPURWALLA (1988). **Foundational issues in reliability and risk analysis**, *SIAM Review*, vol. 30, no. 2, pp. 264-282,

which lays out the foundational issues in reliability from a Bayesian perspective, heavily motivated by the work of de Finetti. Like all areas of Bayesian application, Markov Chain Monte Carlo has considerably widened the class of models that can be practically used, and has also allowed the issue of prior choice and specification to be addressed more satisfactorily. This is one strength of Bayesian methods in reliability, particularly engineering applications where there is usually a large body of expert opinion. A good example of prior elicitation with application to reliability testing is:

• G. A. WHITMORE, K. D. S. YOUNG AND A. C. KIMBER(1994). **Two-stage reliability tests with technological evolution: a Bayesian analysis**. *Applied Statistics*, vol. 43, no. 2, pp. 295-307.

Closely related is the area of product development. The following paper demonstrates that Bayesian methods are easy and natural to use in this area also.

• T. A. MAZZUCHI AND R. SOYER(1993). **A Bayes method for assessing product reliability during development testing**. *IEEE Transactions on Reliability*, vol. 42, no. 3, pp. 503-510.

The proportional hazards model of Cox is probably the most widely used approach to lifetime modeling in the presence of covariates. A good reference using this model via the Bayesian approach, is:

• C. T. VOLINSKY, D. MADIGAN, A. E. RAFTERY, AND R. A. KRONMAL(1997). **Bayesian model averaging in proportional hazards models: assessing the risk of a stroke**. *Applied Statistics*, vol. 46, no. 4, pp. 433-448.

There is a good description of how to apply the proportional hazards model in a Bayesian setting here.

Another area of reliability that is provoking a lot of interest is software reliability and testing. The following book sets out the Bayesian approach to software engineering in general, as well as devoting considerable space to software reliability and testing.

• N. D. SINGPURWALLA AND S. P. WILSON(1999). *Statistical Methods in Software Engineering: Reliability and Risk*. Springer-Verlag, New York.

Some more articles with specific applications are given below.

Development and analysis of both attribute- and variable-data reliability growth models are covered in the following paper.

• A. ERKANLI, T.A. MAZZUCHI AND R. SOYER(1998). **Bayesian computations for a class of reliability growth models.** *Technometrics*, 40, pp. 14-23.

This paper begins with an overview of a Bayesian attribute-data reliability growth model and illustrates how this model can be extended to cover the variable-data growth models as well. Bayesian analysis of these models requires inference over ordered regions, and even though closed-form results for posterior quantities can be obtained in the attribute-data case, variable-data models prove difficult. The paper illustrates how the difficulties in the posterior and predictive analyses can be overcome using Markov-chain Monte Carlo methods.

In the article below, a Bayesian approach is developed for determining an optimal age replacement policy with minimal repair.

• S.-H. SHEU, R.H. YEH, Y.-B. LIN, AND M.-G. JUANG(1999). **A Bayesian perspective on age replacement with minimal repair.** *Reliability Engineering and System Safety*, 65, pp. 55-64

By incorporating minimal repair, planned replacement, and unplanned replacement, the mathematical formulas of the expected cost per unit time are obtained, and it shown that there exists a unique and finite optimal age for replacement. Using the Weibull distribution with uncertain parameters for failure time, the above article develops a Bayesian approach to formally express and update the uncertain parameters for determining an optimal age replacement policy.

Two statistical approaches to on-line prediction of cutting tool life are presented and discussed in the following article.

• H. WIKLUND(1998). **Bayesian and regression approaches to on-line prediction of residual tool life.** *Quality and Reliability Engineering International*, 14 (5), pp. 303-309.

A Bayesian approach utilizing in-process information about cutting tool state, and a second approach based on the cutting forces are presented in the above article.

The following article uses Bayesian approach to develop significance tests for testing for a reduction of the Modulated Power Law process(MPLP) to simpler models, namely the Gamma Renewal and the Power Law processes, which are special cases of the MPLP model.

• R. CALABRIA, G. PULCINI(1999). **On testing for repair effect and time trend in repairable mechanical units.** *Communications in Statistics - Theory and Methods*, 28 (2), pp. 367-387.

Furthermore, significance tests to compare the effect of the repair actions on the future reliability or the time trend in two independent MPLP samples are proposed and studied in the above article.

The Galileo spacecraft deployed a probe, during 1995, to investigate the atmosphere of Jupiter and it was powered by Li/SO2 batteries. The fundamental problem for the decision-makers during the mission was the uncertainty in knowing whether the batteries had sufficient capacity left to perform the planned mission. Accounting for all identified uncertainties, the following article employed a Bayesian Weibull analysis using a Monte Carlo solution technique, and determined the confidence that the battery set on-board the Galileo probe would perform adequately.

• M.V. FRANK, K. SILKE (1998). **Galileo-Probe battery-lifetime estimation.** *1998 Proceedings of the Annual Reliability and Maintainability Symposium*, pp. 76-81.

In the following report, a general class of Accelerated life tests(ALT) models are proposed, which are motivated by actual failure process of units from a limited failure population with a positive probability of not failing during the technological lifetime.

• D. SINHA, K. PATRA, AND D. DEY(1999). **New Bayesian Approaches for Accelerated Life Test Data.** Technical Report, Department of Statistics, University of Connecticut. Correspondence: sinha@purabi.unh.edu.

The following paper deals with computational techniques to estimate the parameters and the reliability function of complex life distributions using complete and Type-II censored samples.

• D. DEY AND T. LEE(1992). **Bayes Computation for Life Testing and Reliability Estimation.** *IEEE Transactions on Reliability*, Vol. 41, No. 4, pp621-626.

Thanks to Simon Wilson, Maurizio Guida, Gianpaolo Pulcini and Dipak Dey for their valuable help with the collection of the references.

Recent Research

by Sudipto Banerjee
sudipto@stat.uconn.edu

We present some abstracts by Ph.D. students.

We present in this issue four abstracts. Jennifer Hills is a Ph.D candidate under the supervision of Dr.Donald Rubin in Harvard. Jennifer has worked on Bayesian modelling applied to estimation of propensity scores for causal inference. Sarah Michalak is also doing her Ph.D. in Harvard under Dr. Carl Morris. She deals with the problem of ascertaining whether the outcome of patients in different groups are comparable with respect to mortality. Our third contributor from Harvard, Riouxi Tang, is a Ph.D. candidate under Dr. Carl Morris. For the work in the abstract she has worked with Dr. David Van Dyk on improved E-M type algorithms, in terms of faster convergence, in the context of dynamic linear systems. We have our last contribution from Thomas Nichols of Carnegie Mellon University, Pittsburgh. He worked on his thesis with Dr. Christopher Genovese on functional magnetic resonance imaging of the human brain. We are grateful to Sarah Michalak for collecting the abstracts from Harvard and to Dr. Genovese for sending in Nichols' abstract while he was out of town.

Jennifer Hill
hill@stat.harvard.edu
Reducing Bias in Treatment Effect Estimation in Observational Studies Suffering from Missing Data
Advisor: Dr. Donald Rubin

Matching based on propensity scores (i.e. the conditional probability of being treated) has become increasingly popular for causal inference over the past decade. By balancing all observed covariates, propensity score methods reduce the risk of confounding causal processes. Estimation of propensity scores in the complete data case is generally straightforward since it uses standard methods (logistic regression or discriminant analysis) and relies on diagnostics which are easy to calculate and interpret. However, most real studies have missing data. Placing the problem within the framework of the Rubin Causal Model makes the assumptions explicit by illustrating the interaction between the treatment assignment mechanism and the missing data mechanism. A principled approach to handling missing data when estimating propensity scores is facilitated by a Bayesian approach. A model for incomplete covariate data, including both categorical and continuous variables, can be fit using Data Augmentation specifying a general location model for the complete data. This technique has the advantage over naive approaches of weaker assumptions for ignorability of the missing data mechanism. Its advantages over a competing pattern mixture approach (D'Agostino & Rubin, 1999) include weaker assumptions for ignorability of the assignment mechanism, ability to use outcomes when imputing the missing data, and easy extension to the preferred Mahalanobis-metric matching and propensity score combined methodology. Simulation results demonstrate improved efficacy over existing methodology. These advantages include greater bias reduction and increased facility in model choice. Subsequent work will test the comparative efficacy of various approaches in the context of a real example in which randomized experiments were performed. An observational study context will be created by discarding the randomized control group from a given experiment and creating a propensity-matched control group using a reservoir of individuals pooled from the control groups of other, similar experiments. Treatment effect estimates from the propensity-score approaches then can be compared to the "true" answer obtained from the randomized experiment.

Sarah Michalak
michalak@hustat.harvard.edu
Assessing Group Differences in Health Outcomes
Advisor: Dr. Carl Morris

The investigation of group differences in health outcomes has received much attention in the medical literature. This study explores group differences in health outcomes in a profiling context. In particular, we seek to assess whether or not different groups of patients within Department of Veterans Affairs (VA) hospitals are experiencing comparable outcomes with

respect to mortality. Such information provides a refinement of profiling information at the hospital level. For example, if patients are grouped based on diagnosis, then hospital administrators may focus quality efforts on underperforming medical staffs in each hospital. For our study, we consider two groups of patients: those with circulatory diagnoses and those with respiratory diagnoses. We use a hierarchical logistic regression model to analyze the data. The Level I distribution is at the patient level, and the logit of the patient-level probability of mortality is modeled as a linear function of a measure of the patient's risk of mortality. Since it is likely that the outcomes for the two groups of patients within a given hospital are correlated, we model them together, explicitly allowing the effect of patient risk of mortality for the two groups to be correlated within each hospital. We also allow the mean effect of risk of mortality to vary as a function of hospital type (teaching or general). Studies involving 12 of the 144 hospitals in the database indicate that profiling at the group level may provide useful information for hospital administrators. In particular, 4 of the 12 hospitals exhibit practically significant performance differences for the circulatory patients and the respiratory patients. In addition, these analyses imply that performance for the two groups within a given hospital may be correlated and that the mean effect of patient-level risk of mortality may be different for the teaching and general hospitals.

Ruoxi Tang
rtang@stat.harvard.edu
Computational Improvements to the Kalman Filter Using Fast New EM-type Algorithms
Advisor: Dr. Carl Morris

Dynamic linear models are powerful tools for Bayesian learning, inference, and forecasting in a dynamic system. Unfortunately, current methods for exact posterior sampling using the Gibbs sampler and for computing posterior modes, using the EM algorithm can be slow to converge. In recent years, however, developments in data augmentation methodology have improved the convergence rate of these algorithms while maintaining their attractive convergence properties and without adding significantly to the computational complexity of the algorithms. In particular, a fast PXEM algorithm for computing posterior modes and a marginal data augmentation method resulting in a fast mixing Gibbs sampler can be developed for the dynamic linear model. Models with both univariate and multivariate system equations including a polynomial growth model and a seasonal effects model illustrate the faster convergence. Variants of these algorithms allow fully Bayesian analysis which allow explicit inclusion of prior information and lead to more interpretable results than the more vague inclusion of prior information popularized by variance discounting.

Thomas Nichols
nicholst@stat.cmu.edu
Role of Context in Visual Perception: A Functional Magnetic Resonance Imaging Study
Advisor: Dr. Christopher Genovese

We use functional magnetic resonance imaging (fMRI) of the human brain to test competing models of visual perception. One model, the bottom up model, predicts that context plays a "post-perceptual" role, outside of the primary visual cortex (V1). The other model, the interactive activation model [McClelland & Rumelhard (1981) Psych. Rev. 88:375-407], predicts that context actually alters perception, a process that occurs in V1. Hence we look for context-dependent changes in V1. We model our fMRI data using the continuous response modeling framework of Genovese & Sweeney [Case Studies in Bayesian Statistics, (1998) Vol 4, p 59-132]: At each voxel the data are modeled as the sum of slowly varying drift term and an experimental response; the drift is parametrized as a cubic spline and the response as a product of polynomial bells. Spline smoothness is enforced through the standard integrated squared curvature penalty and response parameters all have proper prior distributions which reflect the current understanding of fMRI response. A study of 4 subjects yielded usable data from only two subjects; one subject showed a suggestion of context depended changes, but in an unexpected fashion, the other subject showed no context dependent changes. We are studying more subjects in pursuit of a more conclusive result.

BAYESIANS IN CHILE

by Fernando A. Quintana
quintana@mat.puc.cl

The development of Bayesian statistics in Chile started only a few years ago. We all agree that Pilar Iglesias has been the spiritual leader of the group. After working with Carlos Pereira, she received the Doctoral degree from the U. of São Paulo (USP), Brazil. She later became a faculty member in the Department of Statistics of the P. U. Católica de Chile (PUC) in 1994.
From the very day of her arrival at PUC, Pilar started making contact with faculty members at other universities.
Consequently, the U. of La Serena, Chile hosted the First Bayesian Workshop, in January of 1996. It was a short event, with a very reduced number of participants, but being the first entirely Bayesian meeting in Chile, it had a special relevance. The workshop came as the result of a joint effort of Pilar, Victor Salinas from the U. de Santiago de Chile (USACH), another former student of C. Pereira in USP, and some local faculty members. Certainly, the whole project was strongly motivated by the Brazilian tradition.
Later, in May of 1996, the U. of Valparaíso (UV) hosted the First Workshop on Models with Errors in Variables and Bayesian Inference. Again, Pilar was at the heart of the organization, sharing responsibilities with Manuel Galea of the UV, and Reinaldo Arellano (PUC), both former students of Heleno Bolfarine in USP. This was also the first time that the Journal of the Chilean Statistical Society (SOCHE) edited a special issue, completely devoted to the papers presented in this meeting.
The Second Workshop was hosted by the U. of Antofagasta (UA) in January of 1997. The local organizers were Héctor Varela, Guillermo Mondaca (former students of Vicente Quesada at U. Complutense de Madrid), and Juan Duarte (former student of Domingo Morales, also at U. Complutense de Madrid), all of them faculty members of the UA.
The Third Workshop was held at the U. Austral de Chile in Valdivia (UAV) in January of 1998, where it was decided that the future versions would take place biannually. The local host was Eliana Scheihing from UAV (former student of Michel Mouchart in the U. of Louvain). A future issue of the SOCHE journal will concentrate on papers presented in Valdivia, this time including discussion. The Third Workshop had the largest international attendance so far, including Manuel Mendoza from ITAM in Mexico, Michel Mouchart and Heleno Bolfarine.
The Chilean chapter of ISBA was established in 1997. We currently have about 25 members from nearly all the universities in Chile, including some local graduate students and some current and former doctoral students in USP. The reader is kindly invited to guess who has been the chair of our organization right from its birth.
The main topics of research conducted by Chilean Bayesians are: de Finetti-type Theorems (Pilar Iglesias); Bayesian modeling with errors in variables and with elliptical errors (Reinaldo Arellano, Pilar Iglesias, PUC; Manuel Galea, UV); nonparametric Bayesian methods (Héctor Varela, Juan Duarte, Guillermo Mondaca, UA; Eliana Scheihing, UAV; Victor Salinas, USACH; Fernando Quintana, PUC); Bayesian modeling (Arturo Mora, María Elena Valenzuela, U. de Concepción; Ernesto San Martín, currently in U. Louvain). We also have to mention Alicia Carriquiry, from Iowa State U., Heleno Bolfarine, and Guido del Pino (PUC) who have repeatedly given us their support and encouragement in our research activities.
Bayesian statistics in Chile is at its early stages, but starting to grow and develop. Indeed, Pilar and Reinaldo have advised a number of Master theses at PUC, and some Ph. D. theses at USP. We expect to keep climbing the ladder in the coming years.

ENHANCING OLD RECORDINGS USING BAYES

by Simon Godsill
sjg@eng.cam.ac.uk

I describe techniques for the digital processing of archived gramophone recordings using Bayesian models and computational methods.

It is perhaps unfortunate that Bayes died before the advent of recorded sound in the mid-nineteenth century. If he had been alive then it might now be possible to enhance a recording of his voice using Bayesian inference, as it has been with early archive material of Queen Victoria, Florence Nightingale and other great figures of history.

This article is concerned with the computer restoration of degraded sound recordings stored on tape, 78rpm disks or even the very early wax cylinder recording media. The Signal Processing Group at Cambridge University has carried out pioneering work in this area over the last fifteen years and details of some of our recent research can be found in the recent Springer book 'Digital Audio Restoration' by Simon Godsill and Peter Rayner. In addition, a wide range of processed sound examples and further information can be found at the website `www-sigproc.eng.cam.ac.uk/~sjg/springer`.

Research from the Cambridge lab has led to the foundation of a world-leading company, CEDAR Audio Ltd., specialising in restoration of sound recordings for record companies, and there is on-going interaction between academic research and the development of improved commercial algorithms. Recent high profile projects worked on by CEDAR include the remastering of the Star Wars movie sound track.

Audio signal time series are obtained directly from the analogue sound source by careful analogue-to-digital conversion, usually performed at the CD sampling rate of 44.1 kHz and 16-bit resolution to ensure an accurate transcription of wide bandwidth audio signals (high quality music extends in bandwidth beyond 20kHz – above the range of human hearing!). The datasets involved are thus huge, typically requiring the processing of many millions of data points within a single recording. In recent years, however, with the rapid improvements in cheap computing power, it has been possible to incorporate many aspects of Bayesian computational methodology into audio processing algorithms, and it is various aspects of this work within the gramophone field which I will now describe.

There is a wide range of defects which can occur in gramophone recordings, especially when the medium, whether cylinder, disk or tape, has been subjected to wear and tear or poor storage over a period of years. The good news from a Bayesian perspective is that there is usually an abundance of subjective or objective prior information about the mechanisms which degrade a recording.

Take, for example, the characteristic click and crackle noise associated with early 78rpm recordings. We know that these defects are caused by 'bumps' and scratches on the surface of the groove walls, some present even when the disk was brand new, and others appearing with time as part of the general ageing process. It is thus anticipated that the corrupting noise will be approximately additive to the musical signal encoded in the groove wall, and will be intermittent or 'impulsive' in nature over the audio time series. It is also expected that this noise will act over a wide range of amplitude scales, corresponding to a range of physical defects from microscopic scratches and surface irregularities up to relatively deep gouges or large dust particles adhering to the surface. Thus the distribution of noise amplitudes should be quite heavy-tailed in order to to model all of these features adequately. In fact, these considerations are all borne out by the observed time series, which are clearly seen to have intermittent additive noise disturbances at a wide range of scales. It is these very short bursts of interference that the ear detects as clicks and crackles in an old recording.

We are now in a position to postulate Bayesian models for the noise processes. The models we have found most successful include a two-state switching or 'indicator' process which selects whether noise is present or absent at a particular time instant. This process is modelled as a two-state Markov chain, which allows a range of durations for the interfering noise. Secondly, a heavy-tailed noise distribution is chosen to model the distribution of amplitudes during a noise disturbance. We have found that Student or stable law distributions are a good empirical fit to the noise amplitude data. To complete the noise modelling picture, we add a Gaussian noise of fixed or very slowly varying variance to the intermittent noise process in order to capture the general background noise that will be present at all time instants.

Having specified noise distributions, the full Bayesian picture is completed by a model for the musical signal itself. This is a highly complex issue, as there is such a wide variety of possible types. A very sophisticated approach to modelling of musical signals would model each note played by each instrument in terms of its attack, pitch and harmonic series. We then need to add to this considerations of timbre and all possible performance fluctuations. While such models are now being investigated for the challenging task of automatic transcription of sound recordings (essentially, the process of writing down the musical score of a piece of music directly from the raw audio time series), it usually suffices to use a far simpler signal model for the music which captures the salient features for noise reduction purposes. To this end, autoregressive or autoregressive moving-average models have been found to be useful approximations to reality which offer a suitable trade-off between complexity and utility.

Given the full Bayesian model, including priors for unknown hyperparameters in the noise and signal models, the task is now a large scale optimisation for the reconstructed signal values conditional upon the observed data recording. This is far too complex to perform analytically and so we adopt state-of-the-art Markov chain Monte Carlo (MCMC) sampling methods for simulation of the reconstructed data from its posterior distribution. The result is a more accurate detection and elimination of clicks and crackle than was previously possible.

Removal of click and crackle noise is just one aspect of the restoration and analysis of sound recordings. We mentioned earlier the possibility of automated transcription of sound. Here it is crucial to incorporate a very high level model of the sound that includes as parameters the pitches of individual notes played and all of their specific characteristics. This is an interesting problem of variable dimension, since at any time the number of notes playing is unknown *a priori*. Our initial exploration of this problem, once again using a Bayesian model implemented with MCMC sampling, has given promising results, even for cases where several instruments are sounding simultaneously, so we can anticipate that Bayesian methods will be indispensable in this important area too.

Another problem where the techniques can be usefully employed is the correction of pitch deviation defects, or 'wow' as it is known. These can occur through a number of mechanisms, including unevenly stretched tape or warped gramophone disks. In either case, the effect on playback is an unpleasant time-varying pitch variation in the music. Correction of the problem involves modelling of the pitches present in the music and tracking any changes over time of these pitches. Bayesian priors are incorporated for the regularisation of this problem, and can incorporate specific information such as the frequency of variation or very vague information about the expected smoothness of the variation, depending on the degree of our prior knowledge about the the history of a particular recording. Having identified the pitch variations, the final stage in pitch correction involves performing a digital 'stretching' of the time axis in order to invert the effect of the identified pitch variations. Results of this procedure are remarkably successful and can be listened to on the web page listed above.

We have summarised here just a few of the applications of Bayesian methods to sound signals. To find details of other audio applications, see the Springer book referenced above. It is hoped that the discussion has highlighted that this is a Bayesian success story, in that a wide range of good physical prior information is readily available in various forms, both about the sound signals themselves and the mechanisms behind any distortions of those signals. The models arrived at are complex, with very many unknown parameters (often with dimensionality far greater than the number of data points), and so the methods of choice for solution are currently Monte Carlo based. The high computational complexity of these methods means that most of the techniques devised will not yet run in real-time (i.e. processing takes longer than the length of the recording); however, the quality of an audio signal is regarded as so critical by the industry that even relatively small improvements over earlier procedures can sometimes justify a much heavier computational burden.

BAYESIAN OUTPUT ANALYSIS

by Gabriel Huerta
ghuerta@spin.com.mx

We review software developed by Brian Smith at the University of Iowa.

The Bayesian Output Analysis Program (BOA) is a set of S-PLUS/R functions that carry out convergence diagnostics, statistical and graphical analysis of Monte Carlo sampling output in a similar fashion as CODA, developed by N. Best, K. Coles and K. Vines. The software can be used as an output processor for BUGS or other programs that produce Markov Chain Monte Carlo (MCMC) output. The main features of BOA include menu-driven interface with a stand-alone library of functions. Also, there is a flexible data management which permits analysis of MCMC output in standard format ASCII text files or as S-PLUS/R matrices. The MCMC sequences may have varying lengths and number of parameters. Additionally, BOA is implemented with faster algorithms, less memory usage and corrects for some breakdowns of CODA with S-PLUS version 5.0. Available functions in BOA produce different summary statistics of the MCMC samples, autocorrelations, cross autocorrelations and the same convergence diagnostics of CODA, with the implementation of the Brooks and Gelman multivariate shrink factor approach. It also allows a display of plots that visualize lag-autocorrelations, density estimators for parameters, univariate and multivariate shrink factors, the Geweke convergence diagnostic and individual trace plots. Most of the development for BOA has been done in S-PLUS 5.0 for Linux, but the software has been successfully tested on S-PLUS 3.4 for Unix, S-PLUS 4.0/4.5 for Microsoft Windows; as well as on R 0.64 for UNIX and Microsoft Windows. BOA and related documentation are free for academic purposes and downloadable at:

`www.public-health.uiowa.edu/boa`

NEWS FROM THE WORLD

by Antonio Pievatolo
marco@iami.mi.cnr.it

✻ *denotes an ISBA activity*

➤ Events

International Conference on Survey Nonresponse. *October 28-31, 1999. Portland Hilton, Portland, Oregon.*
This conference is the latest in a severals year series of international gatherings of researchers in the survey field. However, there has been no international scientific meeting devoted to survey nonresponse since the early 1980's, and there is no single printed volume describing these developments, despite the field has changed in important ways in the 13 years since then. The conference aims to stimulate the assembly of documentation of state of the art practice, in order to produce a volume that describes the state of the art in social science and statistical theory and practice in nonresponse rate reduction, nonresponse error measurement, and postsurvey compensation for nonresponse. The volume will not be an ordinary proceedings book, but an integrated treatment of the field, also suitable for university use. See the conference web page at `www.jpsm.umd.edu/icsn99/`.

Workshop on Computational Statistics and Probability Friday. *December 6-10, 1999. Merida, Venezuela*. Highly structured models, transfer functions and neural networks for time series analysis, together with statistical models for environmental data, are the subject of the four-day course and workshop on Computational statistics (in Spanish), followed by a one-day conference on recent developments in Probability (in English). Read the detailed program and the names of the organizing institutions at `www.cesma.usb.ve`.

Mathematical Methods in Reliability 2000. *July 4-7, 2000, Bordeaux, France*. This conference covers a wide range of topics in reliability, and a session devoted to Bayesian methods is also included. The deadline for the submission of abstracts is November 12, 1999; more info at `www.mass.u-bordeaux2.fr/MI2S/MMR2000/`.

Knowledge Discovery and Data Mining 2000. *August 20-23, 2000, Boston, MA, USA*. This is the sixth ACM conference on KDD. In addition to fundamental research, the organizers solicit papers fostering cross-fertilization and interdisciplinary integration, as well as papers that describe significant experiences and implementation lessons (deadline for abstracts: February 29, 2000; web page: `www.acm.org/sigkdd/kdd2000`).

➤ Internet Resources

ASC software register. The Association for Survey Computing's Register of software for statistical and social survey analysis is browsable through the ASC's web site (`www.asc.org.uk`). The register content is listed by package, by main function, by feature and by supplier and is quite rich. The main topics that appear in the by-feature list are survey design, data capture, data management, statistical analysis, presentation, and operating system. The information about the software has been provided by various organizations completing the on-line register questionnaire.

➤ Research Opportunities

Post-Doctoral Research Position. An opportunity now exists to join a team of researchers in Trinity College Dublin on a project in the field of medical image processing. The project, which is now in its third year, involves researchers from the Departments of Electronic Engineering, Statistics and Medical Physics. The challenge being addressed is the provision of cutting-edge Computer-Aided Diagnosis techniques in a busy gastroenterology referral centre at St. James's Hospital in Dublin. Our expertise in Bayesian methodologies for segmentation of textured images is being employed for this challenging task. In particular, we are emphasizing the development of data-driven Markov Chain Monte Carlo techniques, and Markov Random Field modelling. The initial contract will be for one year, and will commence as soon as possible. Remuneration will be in the region of 18,000 Irish pounds (22,900 Euros) per year. The successful candidate will take charge of adapting and steering the research in a manner that best addresses the needs of the end-users in medical endoscopy. In particular, they will be responsible for theory and algorithm developments which make possible the implementation of the algorithms in this environment. It is expected, therefore, that the researcher will have a strong background in an appropriate technical area (Bayesian methods, image segmentation), but also have the practical aptitude to work directly on the implementational challenge. Applicants should contact Dr Anthony Quinn (`aquinn@tcd.ie`) at Dept. of Electronic and Electrical Engineering, Trinity College, Dublin 2, Ireland, providing a CV, a statement of research background, and the names of three referees.

➤ Awards and Prizes

✻ **Savage Award**. Antonietta Mira, U. of Insubria, Italy, won the 1998 Savage Award Competition for her thesis, "Ordering, Splicing and Splitting Monte Carlo Markov Chains", completed at the U. of Minnesota under the direction of Luke Tierney. A honorable mention was given to Jaelong Lee, National Institute of Statistical Science, for his thesis, "Semiparametric Bayesian

Analysis: Selection Models and Meteorological Applications", completed at Purdue U. under the direction of James O. Berger. As regards the 1999 Savage Thesis Award Competition, members of the Board of the Professor Leonard J. Savage Memorial Fund, Inc., have decided to institute two Savage Thesis Awards of $750 for the 1999 competition, one for a "mainly theoretical" thesis and the other for a "mainly empirical" thesis. Thesis supervisors are requested to submit two copies of a student's thesis, a short summary of the thesis's main findings and a designation of it, "theoretical" or "empirical", before November 15, 1999 to: Prof. Arnold Zellner, Graduate School of Business, U. of Chicago, 1101 E. 58th Street, Chicago, IL 60637, USA. The winners of the 1999 competition will be announced at a social function after the Savage Award Session of the Joint Statistical Meetings, August, 2000. Sponsorship and financial support for the annual Savage Thesis Award competitions are provided by the Professor Leonard J. Savage Memorial Fund, Inc., the NBER-NSF Seminar on Bayesian Econometrics and Statistics, the SBSS of the ASA and the ISBA.

1999 ASA Outstanding Statistical Application Award. During the 1999 Joint Statistical Meetings in Baltimore, the award was conferred on Mike West, Raquel Prado, and Andrew Krystal for their paper on latent structure in electroencephalographic traces of depressed patients (JASA, vol. 94). This is one of a series of articles on statistical time series methods, motivated by the need to aid clinicians in refining and improving therapies, as well as in contributing to the understanding of the underlying neurophysiology.

✻ **Mitchell Prize 1999**. The 1999 Mitchell Prize has been awarded to Alan L. Montgomery of the University of Pennsylvania and Peter E. Rossi of the University of Chicago for their paper "Estimating Price Elasticities with Theory-based Priors", to appear in the Journal of Marketing Research. The announcement of the award was made at the August 1999 Joint Statistical Meetings in Baltimore. Members of this year's prize selection committee were Gary Koop, Mike West, and Max Morris (chair).

✻ **Mitchell Prize 2000: Announcement and solicitation**. The Mitchell Prize is awarded in recognition of an outstanding paper that describes how a Bayesian analysis has solved an important applied problem. The 2000 Prize includes an award of $1000 and a commemorative plaque, and will be announced and presented at the ISBA 2000 meeting in Crete (May 28-June 1 2000).

The Mitchell Prize is named for Toby J. Mitchell and was established by his friends and colleagues following his death from leukemia in 1993. Toby was a Senior Research Staff Member at Oak Ridge National Laboratory throughout his career, aside from leaves of absence spent at the University of Wisconsin and at the National Institute of Environmental Health Sciences. Toby won the Snedecor Award in 1978 (with co-author Bruce Turnbull), made incisive contributions to statistics, especially in biometry and engineering applications, and was a marvelous collaborator and an especially thoughtful scientist. Toby was a dedicated Bayesian, hence the focus of the prize.

This is the fourth Mitchell Prize, the first three having been awarded in 1994, 1997 and 1999. Since 1999 the Prize is awarded annually under the cosponsorship of the ASA Section on Bayesian Statistical Science (SBSS), the International Society for Bayesian Analysis (ISBA), and the Mitchell Prize Founders' Committee. The awarding of the Mitchell Prize is governed by the Mitchell Prize charter, established in 1999 (and available at the Mitchell Prize web site, noted below). Under this charter, the sponsors annually establish a selection committee; the 2000 Prize selection committee members are Gary Koop, Henry Wynn and Mike West (chair).

To be eligible for the 2000 Prize, a paper will either have appeared in a refereed journal or refereed conference proceedings since January 1 1998, or be scheduled for future publication in a refereed outlet. Candidate papers will be accepted from nominators and from authors. In reviewing submissions, emphasis will be placed on evidence that the application has truly benefited from a Bayesian analysis respecting the individual character of the problem at hand. There is no restriction as to approach taken, except that it be Bayesian in some sense, and that it carefully and appropriately justifies models, priors and methodologies adopted. To be considered for this year's Prize, please submit the following:

- FOUR reprints or copies of the manuscript
- A cover letter, with two copies, containing the following elements:
  - ➟ A brief statement of the impact of the work
  - ➟ Contact information for the authors and nominator (if not an author)
  - ➟ Full email and postal addresses, plus telephone numbers, for TWO individuals who can be contacted for an evaluation of the importance of the work in the applied field. The named individuals should be experts in the applied field in question, but must not be either statisticians or coauthors/collaborators of those named on the submission.

Submissions should be mailed to
`Mike West,`
`Mitchell Prize Selection Committee Chair`
`Institute of Statistics & Decision Sciences`
`Duke University`
`Durham, NC 27708-0251 USA`
Entries must be received at this address by JANUARY 31st 2000 in order to receive consideration. Visit the web site `www.stat.duke.edu/sites/mitchell.html` to learn more about the Mitchell Prize and the sponsoring organizations.

➤ Miscellanea

ESIAS. A European Society for Industrial and Applied Statistics (ESIAS) is being formed. A draft proposal for the mission of ESIAS is to: foster and facilitate the use of statistics to the benefit of European industry and other organizations; provide a forum for networking among all users of statistics whether they are professional statisticians, practitioners or interested users; provide mechanisms for the professional development of statistical practitioners and applied statisticians in Europe; nurture the friendly and collegial interaction among and professional development of statistical practitioners. A list of a few representatives who will be committed to develop the network in their respective countries is under construction. See `www.ibisuva.nl/ESIAS` for more information.

Bayesian mortality models in Mexico (*by Manuel Mendoza-Ramírez, CNSF*). As in many other countries, in Mexico the local insurance industry uses of a number of mortality tables to calculate the premiums and reserves associated to life insurance policies. In particular, the most widely used tables, EMI82-89 and EMG73-83 (produced nine and fifteen years ago respectively), use data provided by the insurance companies. The basic procedure to obtain a table like these includes an artificial, most of the times arbitrary, increase of the observed death rates – as a protective measure – and a deterministic fit of a curve – the graduated table – describing the relationship between death probability and age.
Even though the insurance industry (as well as the government agency in charge of its supervision, the CNSF – Comisión Nacional de Seguros y Fianzas) is well aware of the importance of having updated tables at hand, these tools are replaced only after very long periods of time. Even worse, there is no systematic revision of the possible changes in the mortality patterns.
Under these circumstances, the CNSF has initiated a research project whose main objective is to develop a system by means of which the mortality patterns will be reviewed every year and, on this basis, adjustments to the mortality tables will be carried out.
This project also includes research on statistical models for mortality, aiming to obtain properly overestimated graduated tables. In this respect, the CNSF has announced the future adoption of the Bayesian methodology to produce the next generation of mortality tables for the Mexican insurance industry. This statistical approach is based on the analysis of the joint predictive distribution of the death rates to be observed in the future, and makes use of some other notions such as the "value at risk". A paper describing these ideas in full detail is now in preparation.

Mailing address: *ISBA NEWSLETTER - CNR IAMI - Via Ampère 56 - 20131 Milano (Italy)*
E-mail: *isba@iami.mi.cnr.it* **Phone:** *+39 0270643206* **Fax:** *+39 0270643212*

ISBA 2000

The Sixth World Meeting of the International Society for Bayesian Analysis

Bayesian Statistics in Public Policy and Government

Hersonissos, Crete, May 28 - June 2, 2000
http://www.ntua.gr/ISBA2000

The Sixth World Meeting of the International Society for Bayesian Analysis is jointly sponsored by ISBA, EUROSTAT, and the Association of Balkan Statisticians (ABS).
You can use the form at the above ISBA 2000 web site to register on-line (the site is secure for credit card payments), or you can use the enclosed form and mail it, together with payment in U.S. dollars, to:


```
Prof. Valen Johnson, ISBA Treasurer              Phone: +1-919-684-8753
Institute of Statistics and Decision Sciences    Fax:   +1-919-684-8594
Duke University                                  E-mail: valen@isds.duke.edu
Durham, NC 27708-0251, USA                       http://www.isds.duke.edu/~valen
```


Conference Venue:

ISBA 2000 will take place in the conference center of the Knossos Royal Village Hotel, located approximately 25 kms east of Heraklion, on the northern coast of Crete. The conference will be residential; a block of 260 rooms has been reserved in the Knossos Royal Village Hotel and in the adjacent Royal Mare Village Hotel. Address, phone, and fax information for the hotels will be provided to conference participants together with confirmation of their reservations.

Note: The hotels will NOT take reservations directly from ISBA 2000 attendees. If you wish to reserve a room, you must do so through the conference organizers.

Travel:

Conference participants arrive in Heraklion, the capital of the island of Crete. Crete can be reached by air or sea from Athens, or by air from most major European cities. Direct flights from Frankfurt, Paris, London, and several other European cities are scheduled for the summer months by Lufthansa, British Airways, KLM, and various other airlines. More information about flight schedules, visa requirements, expected climate, will be provided to those who register to attend the conference, and will also be posted on the conference's web site.
Conference participants will be transported from/to the airport (or port) to the conference hotels as part of registration. It will be the responsibility of travelers to inform conference organizers of their arrival/departure times and flight (or boat) numbers.

Conference Outline:

Delegates arrive on Sunday, May 28. An opening session and a welcoming cocktail are planned for Sunday evening. Sessions will take place all day Monday, all day Tuesday, half day Wednesday, and all day Thursday. Contributed poster sessions are planned for Monday, Tuesday, and Wednesday evenings. A conference half-day trip is scheduled for Wednesday afternoon, and a conference dinner and talent show for Thursday night. Delegates depart on Friday, June 2.

Conference Fees and Deadlines:

Prices in the registration form below are quoted in U.S. dollars. Registration fees cover hotel room for five nights, half board (breakfast and dinner) from Sunday evening to Friday morning, conference banquet, excursions, transportation to/from Heraklion airport (or port), coffee breaks and all conference materials. For spouses, fees will include all of the above, except coffee breaks and conference materials.

Hotel prices are for single-occupancy rooms. Those who wish to share a room can subtract $75 from the total cost of registration. A line is provided in the registration form to list roommates, when applicable. Delegates who wish to share a room but list no one on the form will be assigned a roommate by the conference organizers.

Delegates can opt for a full board complement for an additional $15 per day. Additional hotel nights are $90/day for single rooms and $75/day for double occupancy rooms.

Non-ISBA members are charged $25 more for registration than ISBA members. The $25 surcharge will cover one year of ISBA membership to non-member conference delegates.

Students requesting reduced registration fees must show proof of student status. Students must have their major professors or department chair sign the registration form on the appropriate line, to establish that the individual is a student in good standing.

Note: Deadline for registration at the prices below is January 31, 2000. After January 31, 2000, conference fees increase by $100 (student registration up by $50).

A confirmation of registration and hotel reservation will be mailed out to conference registrants no later than February 15, 2000.

Cancellation Policy:

It is possible to cancel registration and receive a (partial) refund of fees. Please refer to the time-table below for refund conditions.

If refund is requested:

Before April 20, 2000	Full refund minus $150 service fees
From April 20 to May 15	Full refund minus $230 service fees
After May 15	No refunds

Registration / Payment:

Payment will be received by Prof. Valen Johnson, ISBA Treasurer, exclusively. We regret that we cannot guarantee registration to those who do not submit their completed form, together with payment, to Prof. Johnson.

The ISBA 2000 web site is secure, and payment can be done, on line, using Visa, Master Card, or American Express. Alternatively, individuals can use the enclosed registration form and fax, with a credit card number, to Prof. Johnson. Personal checks (only in U.S. dollars!), money orders, and credit card payments can also be remitted via regular surface mail to Prof. Johnson. Please refer to the previous page of this document for address, phone, fax, e-mail and internet address of Prof. Johnson.

Travel Support:

Partial travel support is likely to be available for some conference participants. Funding preference will be given to young investigators presenting invited or contributed papers. A young investigator is anyone whose PhD was completed no earlier than December, 1993, or who is currently working on his/her doctoral dissertation. Young investigators from all over the world will be eligible for travel support.

The terms of the competition for travel funds will be announced later in 1999. Details will be posted on the conference's web site. A competition is anticipated for February-March of 2000.

Questions? Concerns?

Please feel free to contact any of the conference organizers, or any ISBA officer. In particular:

For questions regarding the conference program and organization, please contact the Chair of the Scientific Committee, Prof. Mike West, via e-mail at mw@isds.duke.edu.

For questions regarding fees, payment schedule, travel support, or any other financial matters, please contact the Chairs of the Finance Committee, Prof. Stephen Fienberg or Prof. Alicia Carriquiry, at fienberg@stat.cmu.edu or alicia@iastate.edu, respectively.

For questions regarding travel to Greece and Crete, local arrangements, hotels, and transportation, please contact the Chair of the Local Organizing Committee, Prof. George Kokolakis, at kokolakis@math.ntua.gr.

LAST MINUTE ANNOUNCEMENT

by Steve Fienberg
and Alicia Carriquiry
Chairs, ISBA 2000 Finance Committee
fienberg@stat.cmu.edu alicia@iastate.edu

Travel grants: We are pleased to announce that we have been able to raise funds for travel grants. The Savage Foundation, the Section on Bayesian Statistical Science of the American Statistical Association, and the European Union, through Eurostat, have generously contributed monies that will be used to partially cover travel expenses of a sizeable proportion of participants to ISBA 2000. In addition, financial help has also been requested from NSF. An announcement of the competition for travel grants will be forthcoming before the end of the year. Please note that only those who have submitted a paper to ISBA 2000 are eligible for support. Funds will be available to eligible participants from any country. Details about the competition will be given in the announcement.

REGISTRATION FORM FOR ISBA 2000

Please complete the form below, and send via fax or surface mail, to Prof. Valen Johnson, ISBA Treasurer, Institute of Statistics and Decision Sciences, Duke University, Durham, NC 27708-0251, USA, phone: +1-919-684-8753, fax: +1-919-684-8594, e-mail: valen@isds.duke.edu, http://www.isds.duke.edu/~valen/.

Name: ______________________________(Mr., Ms., Prof., Dr.)

Affiliation and Title: ______________________________

Address: ______________________________

____

____

Work phone: ______________________________Fax: ______________________________

E-mail: ______________________________

Please complete the form below, indicating which item you are submitting payment for, and in what quantities. Prices quoted are in U.S. dollars. After January 31, 2000, add $100 to all registration fees (students add $50).

ITEM		COST / UNIT	QUANTITY	TOTAL
Single occupancy, ISBA member		$795	________	________
Single occupancy, non-ISBA member		$820	________	________
Single occupancy, student ISBA member		$695	________	________
Single occupancy, student non-ISBA member		$720	________	________
Double occupancy, ISBA member		$720	________	________
Double occupancy, non-ISBA member		$745	________	________
Spouse		$650	________	________
Double occupancy, student member		$625	________	________
Double occupancy, student non-ISBA member		$650	________	________
One child under 12, same room as parents		free	________	________
Additional children under 12, different room		$325 each	________	________
Additional hotel nights	Single	$90/day	________	________
	Double	$75/day	________	________
Full-board complement		$15 /day	________	________
Total submitted				________

If you are registering for a double occupancy room and wish to choose your roommate, please specify roommate's name:

____

Payment form:

Personal check (in US$ only) ________ Money order (in US$ only) ________ Credit Card ________

Visa Master Card American Express (please circle one)

Name as it appears on card: ________________________________

Card number: ____________________ Expiration date (MM/YY): ____________________

Signature authorizing payment: ________________________________

Students: Please have your major professor or the Chair of your department sign below, to confirm that you are a student in good standing in the institution you listed above. If registering on-line, please give name, address, phone number and e-mail address of your major professor or Department Chair.

I certify that ____________________ is a student in good standing at ____________________

Name: ________________ Position: ________________ Signature: ________________

Speakers and poster presenters:

If you are presenting an invited or a contributed talk, please complete items below.

NOTE: if you will be applying for travel support, you MUST present your work at the conference.

I am an : Invited Speaker ____________ Poster presenter: ____________

Invited speakers only:

The organizer of my session is: ________________________________

The title of my talk is: ________________________________

My co-authors are: ________________________________

____

Poster presenters only:

The title of my poster is: ________________________________

My co-authors are: ________________________________

____