THE ISBA BULLETIN

Vol. 23 No. 4 December 2016

The official bulletin of the International Society for Bayesian Analysis

A MESSAGE FROM THE PRESIDENT

- Steve MacEachern -
ISBA President, 2016
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The first good snow of the year has come to Columbus, Ohio, USA (from whence I write). As is generally the case, the mild temperature in the 20s (a few degrees below zero for those familiar with the metric system) produced a soft, light snow. The beauty of the day brought smiles to most, and everywhere on campus the atmosphere is cheery. Oddly enough, there are a few who have a different opinion of the day, as judged by grim faces and grumbles about the weather. This contrast brings me to the topic of this column–heterogeneity.

Heterogeneity of preferences and its cousin, diversity of opinion, have made headlines throughout the world in the past year. Political news ranges from the Brexit vote in Britain, to the presidential election in the United States, to turmoil in Korea, and well beyond. Locally, we have been planning a renovation of the building that houses Statistics, and personal preferences show remarkable variation (e.g., white board or blackboard?). It is very clear that individuals have different and strongly held opinions and preferences.

Classical statisticians handle heterogeneity through random effects, usually part of a mixed model. In essence, the random effects are viewed as a random sample from some distribution, typically a normal distribution. The standard Bayesian model for heterogeneity matches the classical one, with the random effects pulled together to form a hierarchical model. Incidentally, the assumption of a random sample of effects implies exchangeability of the effects. The Bayesian model has the advantage of suggesting, through the principal of full support for the prior distribution, an arbitrary distribution for the random effects rather than restricting it to normality. Nonparametric Bayesian methods, often in the form a mixture models, have exploited this view with great success. The Bayesian community is now quite comfortable writing and fitting these models.

Heterogeneity of preferences has far stronger implications than the mere hierarchical model. Different forms are needed to capture different individuals? choices and actions. I suspect that the standard is for different segments of a population to follow qualitatively different models?in a regression setting, with different sets of "active" predictors (Continued p. 2)

In this issue

and with these active predictors entering the model in different forms. The resulting mixture over models can capture far greater heterogeneity than the standard hierarchical model. Work along these lines appears under various names, such as mixture-of-expert models, mixture-of-regression models, and latent class models. This theme of heterogeneity also arises in data analysis. In my experience, each analyst gravitates toward his or her own toolbox when building models, be they Bayesian or classical. For any given problem, the various toolboxes, coupled with the skills of the craftsman, work a bit better or a bit worse. A full assessment of model uncertainty cuts across many toolboxes (and, when modelling people's behavior, arguably cuts across mixtures of models), the associated modelling strategies, and the decisions made during data analysis.

An open question is how Bayesians can reliably capture or adjust for this type of heterogeneity-driven uncertainty. Two approaches stand out, to which coauthors and I have contributed. One focuses on variation in models. Several analysts tackle a data set, each building a Bayesian model, with the final summary synthesizing the results across analysts. This accounts for heterogeneity in the analysis (Yu et al., 2011, Bayesian Synthesis, Annals of Applied Statistics). The second focuses on data-analytic decisions. Rather than forcing the analyst to "purify" the data and model, an insufficient, robust summary of the data is used in place of the data. Bayesian methods are applied to the summary rather than to the complete data. This strategy accounts for deficiencies in the model, including outliers and some forms of model misspecification (Lewis et al., 2012, Robust Inference via the Blended Paradigm, Proceedings of the Joint Statistical Meetings). The roots of these strategies can be traced in the literature for decades. Modern computation lets us implement them as never before.

Back to Columbus. After a good day's work, I rushed home, eager to share the evening with my family. I arrived to find a snow covered sidewalk and driveway. My son, understanding heterogeneity of preferences, had maximized family utility. Out of kindness, he tells me, he left one of the great pleasures in life to me–shoveling snow. It is a joy indeed, provided the frequency is once or twice a year.

–Steve MacEachern

FROM THE EDITOR

Did you miss the email about the ISBA election results? We have them in this issue. Wonder how ISBA@NIPS went? Also in this issue! A final highlight is the interview with one of the ISBA founders, Thomas Leonard. He was also the first editor of this publication, then called the ISBA Newsletter. This follows on from last issue's interview with another of our former editors, Manuel Mendoza.... I'll start making notes for when I am interviewed in 25 years time! But in all seriousness, these interviews are an important way of preserving the history of our society. This was sadly driven home, as this final issue for 2016 was being put together, by the passing of two ISBA fellows, Hajime Wago and Stephen Fienberg. We have included brief obituaries, and hope to have some longer reflections on the impact of these important Bayesians in the March issue. In the meantime, while we did not have an ISBA interview with Stephen Fienberg, there is a fascinating interview with him from Statistical Science in 2013, which you can find here: https://arxiv.org/pdf/1310.2442.pdf. Both he, and Thomas Leonard in this issue, have thoughts about how our expertise and professionalism as statisticians can make the world a better place–a fitting topic to contemplate as we enter a new year. With my best wishes for the year to come, your Bulletin editor,

Beatrix Jones

UPDATE FROM BA

From the BA Editor

- Bruno Sansó -
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The December issue of the journal is available online at https://projecteuclid.org/euclid.ba. As I had mentioned in the previous issue of the ISBA bulletin, the December BA issue includes the discussion paper "Bayesian Solution Uncertainty Quantification for Differential Equations" by Oksana A. Chkrebtii, David A. Campbell, Ben Calderhead, and Mark A. Girolami. This paper features invited discussions by Sarat Dass, Martin Lysy and Bani Mallick, and four contributed discussions by: Francois-Xavier Briol, Jon Cockayne and Onur Teymur; William Weimin Yoo; Jon Cockayne; Michael Schober and Philipp Hennig. The number of contributed discussions to the Chkrebtii et al. illustrated the interest that such paper has generated within the community.

The invited session on Highlights from Bayesian Analysis, has been approved by the 2017 Joint Statistical Meetings Program Committee. The session will feature the speakers: Oksana Chkrebtii, Ohio State University, presenting the paper "Bayesian Solution Uncertainty Quantification for Differential Equations"; Li Ma, Duke University, presenting the paper "Adaptive Shrinkage in Polya Tree Type Models"; Adam Suárez, Monsanto Corporation, presenting the paper "Bayesian Estimation of Principal Components for Functional Data" and Herbie Lee, University of California Santa Cruz, presenting the paper "Multivariate Stochastic Process Models for Correlated Responses of Mixed Type". Invited sessions at JSM correspond to very competitive slots. The fact that BA keeps having a dedicated invited session year after year is a testament of the great reputation of the journal, and it gives our authors the chance to augment the visibility of their work.

Finally, I would like to mention that Kassandra Fronczyk will step down as Managing Editor of BA at the end of this year. Kassie worked as ME during Marina Vannucci's tenure as EiC and agreed to stay for the transition during the first year of my tenure. Thank you Kassie for all the energy you have dedicated to BA! Kassie will be replaced by Tony Pourmohamad, a young Bayesian who finished his PhD last year under the supervision of Herbie Lee, and is now a data scientist at Genentec. Welcome Tony!

OBITUARIES

This December has seen the passing of two very influential statisticians, Stephen Fienberg and Hajime Wago, both fellows of ISBA. We include below some information about their distinguished careers, but realise this falls far short of representing their impact – both scientific and personal–on ISBA and the discipline of statistics. The March issue will cary some longer and more personal reflections on the contributions of these greats.

Hajime Wago

Kindly contributed by Professor Kazuhiko Kakamu, Kobe University

Hajime Wago, a fellow of ISBA, passed away on December 4th, 2016 after his illness took a sudden turn for the worse. His memorial ceremonies were held on December 10th and 11th, 2016 in Tokyo. Hajime was kind and friendly to everyone, and many friends always gathered around him naturally. He was born in 1943, and he acquired his master degree in economics at Waseda University and Ph.D. in economics at Osaka University in Japan. After he became a research associate at Hitachi and Fuyou Research Institute (1968-1975), he moved to Tsukuba University as an assistant professor (1975-1989). He worked as a professor of economics at Toyama University (1989-1995), Niigata University (1995 - 2000), Nagoya University (2000 - 2007) and Kyoto Sangyo University

(2007 - 2014). Also he was a visiting professor at Saitama University (1993-2000), Institute of Statistical Mathematics (2000-2002), Vienna University of Technology (1989), and a visiting researcher at University of Chicago (1984-1985), Rutgers University (1985-1986), Economic Planning Agency of Japan (1990-1992), Research Center for Advanced Science and Technology at University of Tokyo (1990-1995), and University of Basel (1999). He served on the board of trustees of Japan Statistical Society (1986-1989), the board of directors of Japan Statistical Society (1988-1989, 1994-1998), the board of directors of Japan Economic Association (1999-2001), the Science Council of Japan (2008-2014), and was a founding board member of ISBA (1992-1993).

Hajime Wago published many papers and books on Bayesian econometrics including publications in the Journal of Econometrics. He worked on the economic recovery policy, the analysis of energy prices, the gradual switching multivariate regression models, the unit root of economic time series, GARCH models and spatial econometric models. Moreover, he organized many international conferences to get together with leading researchers and young scholars, including International Symposium on Exploration of Information Aspects of Bayesian Statistics (Fuji, Japan in 1993), Markov Chain Monte Carlo: Recent development and its Applications (Institute of Statistical Mathematics, in 2002), Japanese-European Bayesian Econometrics and Statistics (Austria, Hungary, Italy, Spain, Norway and Japan, in 2006-2009 and 2011-2012), and he was also a chair of the local organizing committee of the 11th World meeting of ISBA Kyoto in 2012. He gave various precious opportunities to young Bayesians and made great contributions to the development of Bayesian econometrics in Japan. He was always enthusiastic to encourage young scholars to promote their research.

Stephen Fienberg

Stephen E. Fienberg, a fellow of ISBA and friend to many members, passed away December 14, 2016, in Pittsburg, Pennsylvania. He was born in Toronto, Ontario, in 1942. After completing a Bachelor's degree at the University of Toronto he went on to obtain a Masters and PhD from Harvard under the supervision of Frederick Mosteller. He worked at the University of Chicago and University of Minnesota before taking a position at Carnegie Mellon University in 1980, where he spent the remainder of his career. By that time he was well know for his work on categorical data, but also for interdisciplinary work in the Social Sciences. As head of the CMU department of statistics (1981-1984) he moved the department into College of Humanities and Social Sciences; he then served as dean of that College from 1987-1991. His contributions in Social Science included methodology for disclosure limitation and use of statistical evidence in the courts. Not content to limit "interdisciplinary" to two fields, he also bridged the statistics and machine learning communities, and had appointments in the Machine Learning Department and CyLab at CMU.

Stephen was the recipient of many of the major awards in the statistics world: the COPSS Presidents' Award, the American Statistical Association's Wilks Award, the National Institute of Statistical Sciences's Jerome Sacks Award for Cross-Disciplinary Research, Society of Canada's Lise Manchester Award, selection as the 2015 Fisher Lecturer, and the 2016 Zellner Medal. He was a fellow of the Royal Society of Canada, the Institute of Mathematical Statistics, the American Statistical Association, the American Academy of Arts and Sciences, the National Academies of Science, and of course ISBA. He served our profession in many capacities: he was a cofounder of *Chance* Magazine and founder of the *Journal of Privacy and Confidentiality*; an editor of *JASA* and the *Annals of Applied Statistics*, and founding editor of the *Annual Review of Statistics and its Application*. With the National Academies, he was co-chair of the Report Review committee for the past eight years, ensuring NAS reports met high standards of integrity and quality. Perhaps Stephen Fienberg's most lasting impact will be as a supervisor and mentor of young statisticians. His 43 PhD students are the tip of the iceberg–many individuals that he taught as undergraduate or Masters students also cite him as a major influence on their career. Stephen is survived by his wife Joyce, their two sons, Anthony and Howard, and six grandchildren.

FROM THE PROGRAM COUNCIL

Chris Hans
Program Council Chair

2018 ISBA World Meeting Planning is underway for the 2018 ISBA World Meeting to be held in Edinburgh, Scotland. Clair Alston-Knox, the incoming chair of the ISBA Program Council, will chair the Scientific Committee for the meeting. Please check the March 2017 issue of the ISBA Bulletin—and your email inbox—for details and updates.

ISBA Section Meetings in 2017 The 11th BNP (Bayesian nonparametrics) meeting https://www.ceremade.dauphine.fr/~salomond/BNP11/index.html will be held in Paris, France from the 26th to the 30th of June 2017 at Ecole Normale Supérieure. The conference is a bi-annual international meeting bringing together leading experts and talented young researchers working on applications and theory of nonparametric Bayesian statistics. It is an official meeting of the Bayesian nonparametrics Section of ISBA and is co-sponsored by the Institute of Mathematical Statistics.

The 12th International Workshop on Objective Bayes Methodology (O-Bayes17) will be held in Austin, TX, USA from the 10th through the 14th of December 2017. The conference facilitates the exchange of recent research developments in objective Bayes theory, methodology and applications, provides opportunities for new researchers, and facilitates the establishment of new collaborations and partnerships. The meeting is an official meeting of the Objective Bayes Section of ISBA. (Contact: Local Organizing Committee Chair Peter Mueller, pmueller@math.utexas.edu)

ISBA@NIPS 2016 We are pleased to report that once again ISBA was very visible at the workshops following the NIPS (Neural Information Processing Systems) https://nips.cc/Conferences/2016 conference. As noted in the last issue of the ISBA Bulletin, three ISBA-endorsed workshops were accepted by NIPS: Advances in Approximate Bayesian Inference, Bayesian Deep Learning, and Practical Bayesian Nonparametrics).

As part of the 2016 ISBA@NIPS initiative, ISBA was pleased to bestow two ISBA@NIPS Travel Awards to early-career researchers presenting research in the ISBA-endorsed workshops. The winners of the awards were:

Maria De Yoreo, Postdoctoral Researcher in Statistics, Duke University, who participated in the Practical Bayesian Nonparametrics workshop.

Jonathan Huggins, Ph.D. student, Computer Science, MIT, who participated in the Advances in Approximate Bayesian Inference workshop.

Congratulations to both winners!

Upcoming ISBA-Endorsed Events We would like to highlight the following upcoming meetings that have been endorsed by ISBA:

- Bayes 2017 Conference on Pharmaceutical Research, http://www.bayes-pharma.org/ , May 23-25, 2017, University of Castilla-La Mancha, Albacete Campus, Spain.
- 5th Symposium on Games and Decisions in Reliability and Risk, June 7-9, 2017, Royal Academy of Sciences, Madrid, Spain. (Contact: Local Organizer David Ríos Insua, david.rios@icmat.es).
- 5th Bayesian Statistics Conference of Latin America (COBAL V) http://cobal2017.eventos.cimat.mx/, June 7-10, 2017, CIMAT, Guanajuato, Mexico.
- International Conference on Recent Developments in Bayesian Theory and Stochastic Processes, June 12, 2017, Milano, Italy. (Contact: Local Organizer Sonia Petrone, sonia.petrone@unibocconi.it).
- International Workshop on Bayesian Inference in Stochastic Processes (BISP-10), June 13-15, 2017, Milano, Italy. (Contact: Local Organier Sonia Petrone, sonia.petrone@unibocconi.it).
- Summer School on Advanced Bayesian Methods, September 11-15, 2017, Leuven, Belgium. (Information will be available soon at http://med.kuleuven.be/biostat/).

2016 ISBA ELECTION RESULTS

Amy Herring
ISBA Executive Secretary

The 2016 ISBA election is complete. Thanks to our nominating committee and our sections who assembled an outstanding group of candidates, we knew all along that we would have a good result! I am happy to congratulate the following candidates on their new positions.

Terms for newly elected officers will start January 1, 2017. Thank you so much to everyone who stood for election ? your willingness to serve ISBA is greatly appreciated! Thanks as well to all our members who voted.

ISBA Officers

- President-Elect: Marina Vannucci
- Treasurer: Robert Gramacy
- ISBA Board: Natalia Bochkina, Catherine Forbes, Feng Liang, and Luca Tardella

Bayesian Computation Section

- Secretary: Tamara Broderick
- Treasurer: Natesh Pillai

Bayesian Nonparametrics Section

- Chair-Elect: Peter Müller
- Secretary: Long Nguyen

Biostatistics and Pharmaceutical Statistics Section

- Secretary: Manuela Zucknick
- Treasurer: Anna Freni Sterrantino
- Program Chair: Gianluca Baio

Economics, Finance and Business Section

- Chair-Elect: Hedibert Lopes
- Secretary: Ivan Jeliazkov
- Program Chair: Carlos Carvalho

Environmental Science Section

- Chair-Elect: Bo Li
- Secretary: Giovanna Jona Lassino
- Treasurer: Elizabeth Mannshardt

Industrial Statistics Section

- Chair-Elect: Simon Wilson
- Secretary: Lizanne Raubenheimer

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- Chair-Elect: Daniele Durante
- Treasurer: Clara Grazian

CONFERENCE REPORT: ISBA@NIPS

Tamara Broderick
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I am thrilled to report that the ISBA@NIPS initiative is in its third year and still going strong. The Neural Information Processing Systems (NIPS) Conference, a premier machine learning conference, has been growing remarkably quickly over the past few years. For the first time this year, registration for the main conference sold out weeks in advance of the NIPS event, which had many thousands of registrants.

This year, there were over 50 workshops after the main NIPS conference in Barcelona. Workshop organizers must submit a proposal during the preceding summer, and the approval process is very selective. I served a co-organizer of two of the Bayesian NIPS Workshops endorsed by ISBA@NIPS this year. We benefited from the endorsement of ISBA@NIPS during the proposal submission phase. And ISBA@NIPS was able to provide Special Travel Awards to two of our speakers, who are also junior researchers and ISBA members: Maria DeYoreo (Duke) in "Practical Bayesian Nonparametrics" and Jonathan Huggins (MIT) in "Advances in Approximate Bayesian

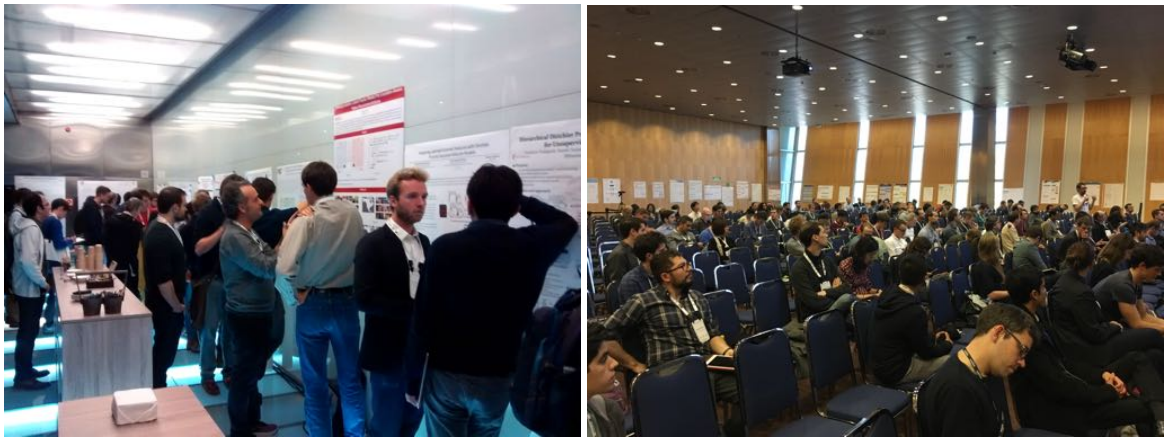

Figure 1: Left: Part of the poster session at Practical Bayesian Nonparametrics. Photo credit: Michael Hughes. Right: A subset of the audience and posters at Advances in Approximate Bayesian Inference. Photo credit: James McInerney.

Inference."

In our "Practical Bayesian Nonparametrics" Workshop, we focused on the practical aspects of Bayesian nonparametric (BNP) modeling. We explored new BNP methods for diverse applied problems, including cutting-edge models and inference algorithms actively being developed by application domain experts. My fantastic co-organizers included Trevor Campbell (MIT), Nicholas Foti (U Washington), Michael Hughes (Harvard), Jeffrey Miller (Harvard), Aaron Schein (U Massachusetts-Amherst), Sinead Williamson (UT Austin), and Yanxun Xu (Johns Hopkins). Our advisory committee consisted of Emily Fox (U Washington), Antonio Lijoi (U Pavia), Fernando Quintana (Pontificia Universidad Catolica de Chile), Erik Sudderth (Brown), and Hanna Wallach (Microsoft Research).

Our schedule was packed with 4 invited talks, a foundations tutorial, 3 contributed talks, a rousing poster session and spotlight talks, a software panel, a research panel, and two lunchtime software tutorials (with lunch generously provided by *Stan*). This workshop followed on the success of our "Bayesian Nonparametrics: The Next Generation" Workshop at NIPS 2015. More information can be found at our website: https://sites.google.com/site/nipsbnp2016/

In our "Advances in Approximate Bayesian Inference" Workshop, we continued the exciting theme of approximate Bayesian inference from our NIPS 2014 and 2015 workshops with additional emphases. In particular, we focused not only on advancing approximate inference but also on (1) unconventional inference techniques, with the aim to bring together diverse communities; (2) software tools for both the applied and methodological researcher; and (3) challenges in applications, both in non-traditional domains and when applying these techniques to advance current domains. My wonderful co-organizers include Stephan Mandt (Disney Research), James McInerney (Columbia), and Dustin Tran (Columbia). Our advisory committee consisted of David Blei (Columbia), Andrew Gelman (Columbia), Michael I. Jordan (UC Berkeley), and Kevin Murphy (Google).

Our schedule was similarly bursting with 5 invited talks, 4 contributed talks, 7 poster spotlights, 2 panels, and 57 accepted posters. Accepted papers, slides, and posters can be found at our website: http://www.approximateinference.org/

We are indebted once again to ISBA for their support this year via the ongoing ISBA@NIPS initiative. We are also deeply grateful to our engaged and thoughtful program committees and to all of our enthusiastic workshop participants.

NEWS FROM THE WORLD

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Please send me your items for NEWS FROM THE WORLD by the 15th of the month prior to the desired issue (March, June, September, or December)!

Conferences and Workshops– First Announcements

BAYESIAN INFERENCE IN STOCHASTIC PROCESSES (BISP10) Bocconi University, Milano, Italy, on June 13-15, 2017.

We are glad to announce the 10th international workshop on BAYESIAN INFERENCE IN STOCHASTIC PROCESSES (BISP10). The preliminary conference web page is www.unibocconi.eu/bisp10.

The scientific program will feature invited and contributed sessions (from June 13, 9am, to June 15, 1pm) and a poster session on June 13, at 5:30pm - with a welcome cocktail gathering. A social dinner is also planned on June 14.

Invited speakers include, so far, Nial Friel, Peter Mueller, Nick Polson, Ananda Sen, Mark Steel, Rebecca Steorts, Matteo Borrotti, Annalisa Cadonna, Daniele Durante, Didem Egenem, David Ginsbourger, Sara Heaps, Julia Palacios, Lorenzo Trippa, Victor Veitch, Frank Wood and Giacomo Zanella. There will be also a special session organised by Richard Wilkinson on paleoclimate problems.

Theoretical and applied contributions on Bayesian inference in stochastic processes are both welcome. A non-exhaustive list of topics includes Markov processes, temporal and spatial processes, empirical processes, birth-death and branching processes, queueing, computations and methods for complex structures, networks and relational data, signal processes, stochastic differential equations.

The 2017 edition of BISP is dedicated to Pietro Muliere, on his 70th birthday, to honour his influential research contributions to the theory and the applications of stochastic processes and Bayesian inference.

BISP10 will be preceded by a one-day conference on "Recent Developments in Bayesian Theory and Stochastic Processes", in honor of Pietro. www.unibocconi.eu/muliereconference.

Important Deadlines:

- 15/2/2017: Abstract submission (for oral or poster presentation)
- 01/3/2017: Decision on acceptance
- 30/3/2017: Early registration at discounted rate

The workshop is organised by Bocconi University, with the endorsement of ISBA - and, very likely, other societies.

Details on past BISP workshops can be found at http://www.maoner.com/bisp9.htm and http://www.mi.imati.cnr.it/conferences/BISP8/

We look forward to welcoming you at BISP10 in Milano in June!

Best regards, Sonia Petrone and Fabrizio Ruggeri Chairs, BISP10 Local and Scientific Committees

ABS17 - 2017 Applied Bayesian Statistics School Villa del Grumello, Como, Italy - 19-23 June 2017

Modeling Spatial and Spatial-Temporal Data with Environmental Applications http://www.mi.imati.cnr.it/conferences/abs17.html.

Lecturer: Bruno Sansó, University of California Santa Cruz

Abstract: This course is intended for students that have a background in statistical methods and modeling. The course is focused on models for data that are spatially referenced and that evolve in time. We will develop models for stochastic processes that are indexed at irregularly scattered, fixed, locations. We will look into the theoretical properties of those models as well as into the computational issues involved in the estimation of their parameters. We will extend the analysis of fields of spatial observations that are collected in time. In particular, we will consider dynamically varying process where space and time interact. Real-data applications of Bayesian methods with MCMC techniques will be illustrated.

Outline:

Day 1 Introduction to Bayesian methods and hierarchical models. Examples of spatially referenced data. Basic properties of Gaussian random fields. Graphical exploration of spatial fields.

Day 2 Variograms. Examples of families of correlation functions. Bayesian approach to estimation and prediction of spatial random fields.

Day 3 The big data problem: reduced rank models and other modern approaches to dimension reduction.

Day 4 Spatio-temporal models. Dynamic linear models: integro-differential equations.

Day 5 Extensions

References:

- Hierarchical Modeling and Analysis for Spatial Data, Second Edition, S. Banerjee, B.P. Carlin and A.E. Gelfand. Chapman and Hall.
- Statistics for Spatial-Temporal Data, N.A.C. Cressie and C.K. Wikle. Wiley.
- Model-based Geostatistics, P.J. Diggle and P.J. Ribeiro. Springer - Handbook of Spatial Statistics, A.E. Gelfand, P.J. Diggle, M. Fuentes and P. Guttorp (eds). CRC Press.
- R PACKAGES: geoR; fields and spBayes.

Other upcoming meetings and conferences

Bayesian statistics applied to archaeology, Nantes University, France. May 24-26, 2017.

This workshop will focus on Bayesian statistics and statistics applied to dating methods in archaeology, palaeoenvironment and geosciences. The sessions will be devoted to the Chronological modelling (methodology, theory and applications to archaeology), treatment of measurements within specific dating techniques (TL/OSL, ESR,...), calibration curve building as reference for dating (geomagnetism, radiocarbon, age-depth curves,...).

There is no registration fee for this conference. All the lunches and the dinner (tentatively May 25th) will be taken in charge by the conference. For full details, including how to register, see http://www.lebesgue.fr/content/sem2016-archeo.

11th Conference on Bayesian Nonparametrics, Paris, France. June 26-30, 2017.

Abstract submission now open; deadline 15 February. The Bayesian nonparametrics (BNP) conference is a bi-annual international meeting bringing together leading experts and talented young researchers working on applications and theory of nonparametric Bayesian statistics. It is an official section meeting of the Bayesian nonparametrics section of the International Society for Bayesian Analysis (ISBA) and is co-sponsored by the Institute of Mathematical Statistics (IMS).

The next BNP conference will be held at in Paris, France from June 26 to 30, 2017. The conference logistics and partial program can be found at the conference website https://www.ceremade.dauphine.fr/~salomond/BNP11/Program.html.

O'Bayes 2017, UT Austin, Texas. Dec. 10-13, 2017.

The next edition of the O'Bayes conference, O'Bayes 2017, will take place at the University of Texas in Austin, with the tentative dates of Dec. 10-13. Somehow making the connection with the previous O'Bayes in Valencia thanks to its Spanish history (even though, technically, Texas was French from 1684 till 1689!). Further details should emerge in the coming months, but keep this objective date in your calendars. (Note that NIPS 2017 will take place in Long Beach, CA, the week before.)

Package Release

SHELF version 3.0, Tony O'Hagan and Jeremy Oakley
http://tonyohagan.co.uk/shelf

SHELF is a package of documents, templates and software to aid with eliciting expert knowledge in the form of a probability distribution. Elicitation is used to develop informative prior distributions for use in Bayesian analysis, but is also widely employed in other situations such as for

characterising uncertainty about inputs to mathematical models.

Although SHELF materials can be used to elicit a distribution from a single expert, judgements are usually sought from multiple experts in order to draw upon a broad base of expertise. SHELF provides guidance on how to set up and manage an elicitation using a group of experts, where the result is a distribution representing the combined knowledge of the experts.

SHELF version 3.0 is a major upgrade to version 2.0 (released 6 years ago!), featuring:

- Additional extensive advice for organising and conducting SHELF elicitation workshops, in the form of several new documents.
- Updated SHELF 1 and SHELF 2 templates, with the six versions of SHELF 2 now consolidated into a single template.
- Two new SHELF 3 templates for eliciting distributions for a group of uncertain quantities. This is the first time that SHELF has included templates for multivariate elicitation.
- Several PowerPoint slide sets to assist with explaining the different kinds of judgements that experts are required to make, and to help them to make those judgements accurately.
- A new R package (https://cran.r-project.org/package=SHELF) for fitting distributions to expert judgements.
- Examples of an evidence dossier and completed SHELF templates.

STUDENTS' CORNER

Shinichiro Shirota
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In this year's last issue, I introduce an assistant professor in the Department of Biostatistics, Johns Hopkins Bloomberg School of Public Health, Abhirup Datta. This year, he completed his PhD in the Division of Biostatistics, University of Minnesota, under the supervision by Prof. Sudipto Banerjee and Prof. Hui Zou. In addition to introducing new researchers, this Students' Corner also features the dissertation abstracts. Issuing abstracts would provide a good opportunity to find collaborators. If you are willing to, don't hesitate to send your dissertation abstract to my email address.

Student Voices

Abhirup Datta
abhidatta@jhu.edu

I thank Shinichiro Shirota for presenting me with this opportunity to write for ISBA Bulletin. I am an Assistant Professor in the Department of Biostatistics at Johns Hopkins Bloomberg School of Public Health but less than six months ago I was a PhD student. My training as a statistician began with my Bachelors and Masters degrees in Statistics at Indian Statistical Institute, Kolkata, India. I then had a brief stint in the finance industry working as a quantitative analyst for Morgan Stanley in New York City. Eventually I realized I wanted to learn more about Statistics and pursue an academic career. I joined the PhD program in the Division of Biostatistics at University of Minnesota from where I graduated in May 2016.

My primary area of research is spatial and spatio-temporal statistics for geo-referenced datasets. Spatial statistics leverages the available geographical information in a dataset to improve statistical inference or prediction. During my PhD, under the supervision of Dr. Sudipto Banerjee, I developed computationally efficient statistical models for massive geostatistical datasets observed at a very large number of locations and possibly multiple time-points. Gaussian Processes (GP) are a very flexible tool for analyzing spatial datasets but are notorious for their lack of scalability. We have proposed a new highly scalable class of Nearest Neighbor Gaussian Process models that delivers fully Bayesian inference for massive spatial and spatio-temporal data. We have used NNGP models to predict US forest biomass based on satellite data and creating fine resolution space-time maps of air pollutants like particulate matter (PM) that will aid in monitoring

and regulating PM levels across regions. An additional perk of being a spatial statistician is that I get to create and present cool maps! Recent years have witnessed explosive growth of statistical methods for high dimensional datasets ubiquitous in genetics, neuroimaging, econometrics etc., where the size of each observation far exceeds the sample size. During my PhD, I worked with my co-advisor Dr. Hui Zou, to develop statistical methods for high-dimensional regression in settings where some common assumptions are violated in the data. We have developed a method for model selection and regression for high dimensional data with measurement error in the covariates. We have established asymptotic and finite sample properties of our estimator and have developed an efficient convex algorithm that leverages existing software. In another project, we have developed a Bayesian high dimensional piece-wise linear regression for analyzing datasets with change points. Our method can be applied to a wide variety of high-dimensional time series data and has been used to identify the changing relationship between house prices and stock prices in Minnesota before and after the recession in 2008.

Besides my methodological and theoretical interests, I have always enjoyed working on collaborative projects. In my last year of PhD, I was awarded the Inter-disciplinary Doctoral Fellowship. I worked with ecologists, biogeochemists and earth system modelers on a project that aims to improve characterization of plant traits like specific leaf area, leaf Nitrogen content etc. We used Bayesian spatial models to deliver full posterior trait distributions which can be subsequently used to improve land component of climate models. Here at Hopkins, I am very privileged to be working with amazing researchers on many interesting collaborative projects. I'm currently working on small area estimation of key population size estimates, that are relevant to infectious diseases, based on survey data. In another project, I'm trying to calibrate verbal autopsy data to improve cause of death determination. These datasets are very small and extraneous information, if available, need to be leveraged. Bayesian hierarchical models provide a unified platform to incorporate all available information that can potentially help finding the answers we seek.

Outside of work, I love to travel and a great perk of my job is that I get to visit new places to attend conferences. I am an avid soccer fan and religiously follow European soccer leagues. I also like to cook and try out different cuisines and restaurants.

INTERVIEW: THOMAS LEONARD

Interview by Diego Andres Perez Ruiz
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Thomas Hoskyns Leonard co-founded ISBA with Arnold Zellner and Gordon Kaufmann in 1992, and he devised the name of the Society while drafting its first constitution. He describes himself as an 'incoherent Bayesian' and as a 'diehard sure loser'. Leonard has made seminal contributions to Bayesian categorical data analysis. Some of his work is on conditional Laplacian approximations for Bayesian marginal inference and prediction, the statistical modelling of log covariance matrices, and to applications of Bayesian methodology. He has several published works on Bayesian function smoothing and prior informative density estimation. He is also known for his work concerning the applications of Bayesian methodology in geophysics, medicine, psychometrics.

He has published *A Personal History of Bayesian Statistics* (Wiley Interdisciplinary Reviews, 2014, Statslife, 2014) and an advanced graduate text *Bayesian Methods: An Analysis for Statisticians and Interdisciplinary Researchers* (Cambridge University Press 1999, with John Hsu). He says that his book *A Course in Categorical Data Analysis* (Chapman and Hall, 1999, with contributions by Orestis Papasouliotis) 'fell stillborn off the press'. He lives in Edinburgh and continues to write on and engage with statistics. This conversation took place on 15th of September, 2016 at the Joseph Pearce's Bar on in Edinburgh and in the Hawes Inn, South Queensferry.

Diego: I understand that Dennis Lindley was your Ph.D. supervisor. Can you remember what happened when you first met?

Thomas: I had this very interesting interview with Dennis Lindley. I didn't let on – I don't know if anyone else did– that I'd flunked in my second year at Imperial College as an undergradu-

ate. Dennis seemed impressed, and the classic thing which he said was that, "Well, we don't do any of that Blackwell rubbish here. If you want to come here you'll have to be a Bayesian." He then said something like, "Look at your PhD problem, and write up all the material while you're taking our advanced Masters, Adrian Smith and I have just completed this work on shrinkage estimators for the linear model using exchangeable prior distributions I want you to do the same for several binomial distributions." That's how I got into Bayesian categorical data analysis. And, then would you believe, I was able to look at the literature, and I solved the problem for shrinkage estimation for several binomial probabilities within three or four weeks, and that's while I was starting off as a Master's student. After that I got a bit obnoxious because I was much too proud of myself for solving my initial PhD problem after three or four weeks.

Diego: Which courses did you take for your advanced Masters degree at UCL?

Thomas: Phil Dawid taught me Bayesian theory. He'd had some sort of kerkuffle while he was a postgraduate student at Imperial. So he'd moved over to UCL as an assistant lecturer. He taught me the most brilliant Bayesian course you could ever think of. I have always empathised with Phil because of the way he was treated as a postgraduate.Phil taught Bayesian theory at a measure theoretic level, and two students from Glasgow (Ben Torsney and Jim McNicol) were initially completely phased out by it. I learned about decision trees, sequential stuff, you name it, it was in it. Phil's brilliantly simple conjugate analysis for the linear model invoked prior and posterior sample sizes, though it was largely ignored by the subsequent all - too - rote literature. It's been interesting how Phil and I have interacted since, when seeing things from very different perspectives. He taught me a lot. I also studied Markov decision processes from the book by Sheldon Ross. Dennis taught me Stochastic Control Theory from the book by Aoki on the same course. It was all mathematics, but it was absolutely brilliant. I remember that we interviewed a potential lecturer at Warwick who specialized in Markov Decision process, and I was unkind enough to say that his research was a special case of what I'd learnt on my Masters. Not very courteous of me I suppose. To my surprise, several things that I learnt while studying for my Masters were subsequently published by other authors.

Diego: Did you study Stochastic Calculus as well?

Thomas: No, my stochastic calculus comes from the function space I had to mug up years later when I was doing my research on prior informative density estimation. I guess I was the first to think of logistic Gaussian prior processes for densities. And what was interesting then to me was that the Radon-Nikodym derivative of the logistic transform depends very much on the choice of dominating measure, and you had to take the Gaussian process to be absolute continuous with respect to some other Gaussian process. It's difficult to get a prior density out of it, which is why I worked with prior and posterior likelihood functionals instead. That came much later, but let me think what other Masters courses I attended. Mervyn Stone taught a very advanced course in multivariate analysis, which was way over my head. All of the ellipsoids looked like spaceships to me. More generally, Mervyn was very much into lateral thinking and didn't feel at all constrained by idealistic Bayesianism. Quite refreshing, really I also took a course from Dennis in educational testing and classical test theory, out of the bizarrely compiled book by Lord and Novick, who'd cut Alan Birnbaum out of his much deserved co-authorship.

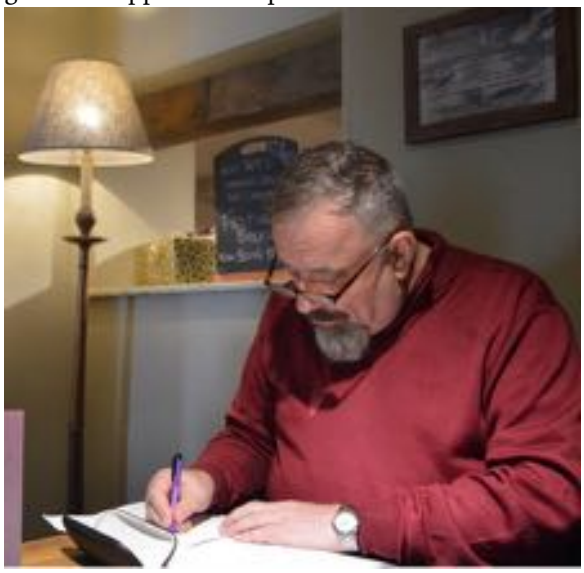
Diego: Please tell me more about the sort of mathematics you were good at, and how you used it in Bayesian Statistics.

Thomas: I guess that my forte was algebraic manipulation, particularly when analysing non-linear models. There's some beautiful algebra to work with, I realized that one of the best ways to perform a Bayesian analysis can be to take a normalizing transformation of the parameters and to consider normalising approximations to the likelihood and/ or to the posterior. I was one of the first to push this concept: rather than using conjugate priors in non-linear situations use Gaussian priors (e.g. at the first stage of a hierarchical prior distribution) for suitably chosen functions of the parameters. I may have been the first to break with the tradition of conjugacy in a big way, in my 1973 Ph.D. thesis and in several published papers

Diego: What was your motivation to break this tradition?

Thomas: My initial motivation was that I wanted to apply the Lindley-Smith ideas, which they were to publish in their 1972 paper, to binomial and multinomial situations. "Oh gee," I thought, "why don't I use logit transformations, and put the Lindley-Smith priors on the logits rather than the normal means?" That left me

with some quite thorny technical problems when completing my prior to posterior analyses. A large gamut of approximate procedures were available.



Diego: So during that time, you don't have the computer, right?

Thomas: Sure we did, but we didn't have a capacity for high-dimensional numerical integrations. We had some computer simulation methods. We had Monte Carlo. People hadn't thought of important sampling in those days. Importance sampling is really one of the most valuable simulation techniques, and it's been neglected since MCMC took over. Dennis was sold on joint posterior modes at the time, particularly in variance commponent models. He had written a somewhat misleading technical report, The Estimation of Many Parameters. So Adrian and I felt that we had to use joint posterior modes, but because there was a collapsing phenomenon they didn't work. Consequently, my first three publications were technically flawed, and I had to qualify the results in two further papers, including my 1977 paper in Biometrics.

Diego: Did Patricia Altham influence your early research?

Thomas: Yes indeed, and she my external examiner. I very much admired that wonderful stuff she had done on 2-way contingency tables which she'd worked on with David Kendall. Patricia deserves every credit for showing the effective equivalence between a Bayesian probability and the tail probability for Fisher's exact test, (It is more precise to use a Jeffrey's prior rather than those which she considered in her 1969 paper in JRSSB) I can remember when I came back from Warwick - it was in December 1973 -for my Ph.D oral, and I remember my train being stuck for a couple of hours outside Euston station. Patricia had come from Cambridge, the lovely lady, and she'd recorded all sorts of the detailed questions in a long list. She was very enthusiastic about my work, and I was very pleased about that. I've got lots of respect for her. At some point Dennis got irritated and said "Mr. Leonard's got to catch the train back to Warwick." So Patricia wasn't able to finish asking her questions.

Diego: How was your relationship with Lindley?

Thomas: Well, I guess that because of my frequentist background at Imperial College, David Cox influenced me, and continues to influence me to this day. My views were much more pragmatic than Dennis's. He thought that everything should be strictly Bayesian, everything should be coherent, and he didn't understand that the De Finetti-style axioms get very, very complicated if you want to try to justify asserting these strange sorts of things. So, he would say, "Well, if you want to be coherent, you have to be a Bayesian," and on the quiet he'd say, "And, anyone who's not is a criminal." So he described people who weren't conventionally Bayesian as criminals! I thought that it would be good to see a compromise between the various approaches, and that was from an early day. I believe that there were fundamental scientific differences between me and Dennis with the way we thought. I thought in much more eclectic and pragmatic ways. When I arrived in Madison, Wisconsin 1979, George Box and Toby Mitchell seemed like Heaven and light to me. The early 1970s were thought of as the golden years in Bayesian Statistics at UCL. There was tremendous international activity there, and the visitors included Jim Press, Jim Dickey, and Jim Zidek. The Bayesians thought of themselves as going forwards, making great advances. But there were huge conceptual flaws in the things they asserted. Dennis once said to me – when I did my 1978 medical data analysis– "It's good, but it's not statistics. That's data analysis." He thought of statistics as being something different from data analysis. Another comment he made was "If someone gives me some data to analyze, and I can't analyze it using a simple application of Bayes Theorem, I send it back." He also thought, like L.J. Savage, that 'a model should be as big as an elephant.'

Diego: Which meetings of the Royal Statistical Society do you best remember from the early 1970s?

Thomas: In 1971 my undergraduate mentor David Cox presented his famous paper on the proportionate hazards model. This was undoubtedly the most brilliant thing that David ever did, and its impact was monumental. V. Godambe presented an invited paper on Fiducial Inference around that time. The whole fiducial approach is of course quite silly. Pivots can't even be sensibly defined when the models are non-linear. Mervyn Stone seconded the vote of thanks, and said, "this paper is like a plum pudding, burnt at the edges and soggy in the middle. Therefore I have great pleasure in seconding the vote of thanks." What a hoot! Godambe was taking a big risk of course. Lindley had already famously indicated in 1958 that Fisher's fiducial approach violated the laws of probability, much to Fisher's wrath of course. My first contribution to the discussion at an RSS meeting was in 1972, following the Lindley-Smith paper, when I said that they could extend their approach in all sorts of ways e.g, to binomial and multinomial models using logistic transformations. I got a pat on the back from Dennis afterwards. He however laid into Chris Chatfield in a bad way, even though I thought that Chris's criticisms were very perceptive. I also attended the meeting where Stone, Dawid, and Zidek presented their paper on marginalization paradoxes. They showed that using improper priors can lead to curiously paradoxical posterior inferences in pathological situations. Tell me something new, I thought. This was a wonderfully presented paper by all three of them. I thought that, well , you should really be doing this in practice by using a sequence of proper priors and seeing whether the posteriors behave in a contradictory way in the limit. Phil asked me afterwards why I hadn't contributed to the discussion. I grunted and gave an evasive reply. Dennis got up afterwards and publicly recanted the general use of improper priors, thereby denouncing the works of Laplace, Augustus de Morgan, Sir Harold Jeffreys, the American School, himself, and so on and so forth. What a rigmarole!.

Diego: Usually which journals do you use as a reference or you send your papers to which journal?

Thomas: Well, in the early stages, I sent them to Biometrika and Series B. In 1992, I published a paper in the Annals of Statistics and they put it on the first page. Arnold Zellner said "Oh, that's a big honour, they published it first." So I boasted about it and demanded a salary rise. And so my departmental chairman actually wrote to the editor of the Annals for clarification! The editor said, "No, no, it's just random," but I didn't believe him. Anyway I spread my papers around in applied journals, and journals like the Japanese Annals and Statistica Sinica. As my career was fractured and curtailed by my personal circumstances, I didn't publish as much as I might have hoped. Some of my research was left sitting in unpublished technical reports, and lots of ideas are still floating around my head.

Diego: What was the data analysis you were most influenced by?

Thomas: Well, I had a sabbatical in 1978 to 79. And the first semester, the first term of it was at Queen's University, Kingston, Ontario. I was invited over to their Statlab there by the Statlab director, Louis Broekhoven, who was a character in himself. He'd studied under Florence David at UCL, churning out asymptotic expansions. The purpose was to analyze a set of data, and this was in conjunction with Kingston General Hospital and Dr. Jim Low. The data used observations for over 2,000 babies. And it was directed towards seeking the best ways of predicting fetal metabolic acidosis in babies. At the time, there was what I termed the term medical folklore and Dr. Low thought that the expression was quite funny. As I remember, the three main predictors were supposed to be meconium-stained fluid, overdue, overweight babies, and extreme prematurity. Well, I looked at the data in all sorts of different ways, looking at scatter plots and it's always good to look at the data first. As Florence Nightingale said you look at the data and try to get messages from the data as to what's happening. And I thought about the medical background and I could see some slight things going on in the data. I was only there for maybe twelve weeks altogether, but the first eight weeks, I didn't get anywhere. And multiple regression always produced an R-squared uncomfortably close to zero. So I split the dependent variable, into three categories, basically: low, medium, and high acidosis.. And then, I looked at scatter plots of the various explanatory variables at the three different levels,–I noticed the shift going on. I did it for different levels of gestational age. I noticed there was a sort of shift of the scatter plots of the birth weights. A small shift. Then I realized the information is pretty probabilistic in a sense, that it's not something that you could capture with multiple regression. Then what I did was– would you believe I thought that I invented the skewed normal distribution? I thought it was

new but Ralph Bradley told me the year after that it was invented by Edgeworth in 1899. Anyway, I fitted the skewed normal distribution to each of these birth weight scatter plots. And then having done that, let's get it right, it was at each level of gestational age, I used Bayes Theorem, basically similar to extended logistic discriminant analysis. And that gave the probability at that level of the dependent variable conditioned on birth weight. I actually thought, "God is speaking to me through the data." And it was almost a divine experience. I hadn't even believed in God for ages. Then something quite remarkable happened. We developed things called crossover points from the curves. When I showed them to Jim Low he pointed out that they were virtually identical to critical values which he'd already tabulated for inter-uterine growth retarded babies. So that validated everything. It's babies who're light in the womb who're at greatest risk.

Diego: And did you discuss any of these ideas with George Box?

Thomas: Yes. See, what happened was, it was very interesting. Louis had a friend, Dave Bacon, the Dean of Engineering at Queen's who was one of Box's students. David was impressed because it was a significant conclusion and he wrote to George about me. And the next thing I knew, George was inviting me to Madison. Maybe he was impressed that one of the crazy mathematical Bayesians in Britain could actually do a decent data analysis. This totally changed my life. At that point I was needing to escape from Warwick for various reasons including salary. It's important how you put food on the table. It was sort of the right timing. So that data analysis changed my life and career. And then I was able to get much more into these things with George at Wisconsin. The Wisconsin school was very vibrant at that time.

Diego: Who else did you meet at Wisconsin?

Thomas: George Tiao was there before he moved to Chicago. He was extremely good in technical terms. He and Box had published a series of papers on applied Bayesian methodology, but they'd been marginalized by the British Bayesian Establishment rather like they marginalized Jack Good. They wrote a scathing review of Box and Tiao's book even though it was far beyond, in statistical terms, anything they'd ever done. George Tiao, Irwin Guttman and Arnold Zellner were three of the most supportive Bayesians I have ever met. Norman Draper was known to his students as 'Mr. Regression'. He and my other colleagues at Wisconsin taught their students in a wonderful way, a perfect blend of theory and practice. This was the Box ideal. Box persuaded me to work half-time with him at the Math Research Center, which was funded by the U.S, Army, much to my dismay because of the stuff they got up to.

Diego: Please tell me more about your relationships with George Box and Toby Mitchell.

In my first year, I taught courses with Toby Mitchell around army bases in the United States. We went to Huntsville Space Station to Huntsville, Alabama, and taught them Experimental Design and Analysis of Variance. In my conversations with Toby, who was visiting from the Oak Ridge National Laboratory, he was a very deep man. He understood all the ramifications of randomization and replication. Also the fact that his experiments are online, he didn't just do one, he did several of them. As Box said, "It's not just the one experiment; it's the sequence of experiments." Toby was keen on the idea that you can only hope to get objective conclusions from well-replicated randomized data, not from observational data. That idea went back to to Charles Peirce, the celebrated American 19th century philosopher. Toby advised me that, "The greater the information, the less you actually know. Because in general terms this means that if you get lots of confusing information, it just confuses you. It's usually best to keep it simple." Toby's ideas on experimental design were superb. Since his untimely death he's been much revered by the Bayesians in ISBA. They named a prize after him. My feeling was that he was one of the highest quality statisticians out of Wisconsin along with the great men who had endeavoured to become great in some way or another.

Diego: How was your relationship with Toby?

Thomas: Extremely good, very friendly. We were great friends and buddies. He was very, very good. He was sympathetic to my ideas too. A wonderfully charming man. Great conscience. It's funny. At the whole school, Toby Mitchell stands out and Box also. But Box had great strengths, huge weaknesses. He was a very boring lecturer. But Box was nonetheless a great person to talk to. He and I had been developing some similar philosophies about Statistics and the scientific method, from independent viewpoints. I first met George at Valencia 1, where we both presented invited papers. We both emphasised that Bayesian inference is only valid when the sampling model is assumed to be correct, but it's also

checking the model that's important or comparing different models, deciding on the model. I argued that while some sort of dubious concept of coherence might be tenable for model-based inference, it certainly isn't when we get to thinking about model checking or wondering what model to fit to the data. Dennis and Adrian didn't like what I said.

Diego: Please tell me more about Statistics at Wisconsin

Thomas: I think students from Wisconsin have created a lot of infrastructure of statistics in the United States because they are so good. It's the way they've trained them. The courses they took. The diverse courses they had to take to get a Master's would be beyond the scope of many mathematical statisticians, The Ph.D qualifier was infinitely hard. All of the faculty would invited to submit their own eccentric questions, each of them tough. They couldn't even do each other's questions, and they sent them to the students.

As the standards where very high, and the quality of the people coming out the Ph.D, program was outstanding, and many former students have since become very successful, for example Jim and Joanne Wendelberger, Doug Nychka, and Finbarr O'Sullivan. Wing Wong and Jun Shao. Sharon Law, and Dennis Lin become distinguished professors and they learned their Bayesian theory from me, Some of my course was based upon what Ann Mitchell and Phil Dawid taught to me at ICL and UCL, and so they were magnificently influential. I remember Dennis Lin coming into my office. He didn't have any money. This was when I was Chairman of Awards. There was only one teaching assistantship left, and so I gave it to him. He didn't realize how close he was, and he's now a distinguished professor. He was a student. He needed money now to survive. It was magnificent. The magnificent flow of graduate students going through that program, and then on to greater things, and a lot of them have far exceeded what I have been able to accomplish myself. The graduate program at Wisconsin influenced the world– some students have gone back to Chile, for example, also, of course a huge number of Taiwanese students. Some of them created the Statistics Academy in Taipei. The department at Wisconsin has taught Statistics as it should be taught, and not in some esoteric way like it's taught on some other American campuses.

Diego: Can you talk a little bit about the history of Statistics at UCL?

Thomas: Yes, as I recall, UCL was firstly the University of London, around the time of the beginning of the 19th century. One of the founders was supposedly Jeremy Bentham. A complex character. His skull and skeleton are still in a glass case there. He used subjective probability in order to assess expected utility. He wasn't the first, Daniel Bernoulli did it beforehand. He did all sorts of interesting things like how to punish people for the betterment of the common good, and he was a bit of so-called social reformer as well. A bit later, Professor Augustus de Morgan was a keen advocate of inverse probability. In other words, he was a Bayesian who used uniform priors. He was well over a century before Dennis Lindley. He was famous for declining to become a Fellow of the Royal Society, on the grounds that it didn't serve useful social purpose because of the high-minded politics. That takes us to the polymath Sir Francis Galton. He was a very great man. He may have been the first person to do the conjugate analysis for the normal distribution with specified variance. He also invented a very strange sort of machine; which tried to calculated posterior probabilities from prior probabilities via a simulation process. That reminds me of modern day MCMC. However, because of recent protests by students, minority students in UCL, I've come to realize that in 1883 that Galton coined the name for the subject of Eugenics, while planning to improve the quality of the human race. Now he may well have had good motives, of course, but what happened because of his work is really quite traumatizing. Florence Nightingale, was instrumental in setting up the Department of Applied Statistics at UCL in 1911. She died in 1910, but she was instrumental in appointing Karl Pearson, to the chair rather than a more theoretical statistician of the Galton school. When I was at UCL, I was taught to revere Karl Pearson and Ronald Fisher. Fisher was professor of Eugenics at UCL and so like Pearson and of course Galton before him, was associated with the Galton Laboratory. A lot of Fisher's work in Genetics concerned Eugenics. A lot of Pearson's work in Statistics which was published in Biometrika concerned Eugenics. In other words, comparisons were made of the attributes of different ethnic groups. I don't know whether their motives were good or not but what came out of the subsequent Eugenics movement around the western world during the 20th century is absolutely terrifying, for example, forced sterilizations, racial discrimination, the CIA mind control program MK Ultra, and genocide. Karl Pearson's son Egon continued the collaboration

with the eugenicists in the Galton Lab after his father's death. When I was at UCL there was still a professor of Eugenics called C.A.B Smith, and there was a mysterious lady who walked between the Lab and the Statistics Department every day. And the University archivist was a statistician who'd published several joint papers in Eugenics! All of those terrible consequences! They originated from Galton's conception and the work of the two Pearsons and Fisher. I find it quite disturbing to think this.

Diego: Do you remember Egon Pearson and Florence David?

Thomas: Egon was a tall, distinguished gentleman with white hair who sat drinking tea in the staff common room with the Bayesians, and Neil Please who always left early. I remember him as being a very fine man who spoke occasional pearls of wisdom. Most of the Bayesians then were a bit arrogant. Egon was sitting apart. A very fine man, if you judged him by his appearance. Florence David, who I met several years later when she visited Warwick, was undoubtedly one the greatest woman statisticians of all time. She smoked a cigar and liked chewing the rag with the other 'fellas'. She was a professor of statistics at UCL until 1967. She published ten books, including Gods, Games and Gambling. She was a leader in her field. Unfortunately when Dennis got the chair, she left. I heard it from Dennis' mouth, during a conversation with George Box in 1981, how she was forced to leave. It's not worth repeating. What is so sad that this woman was marginalized, like a number of statisticians have been marginalized by the British Bayesian establishment. She was marginalized to California. She smoked a cigar. She was a woman who was different. People frowned on her, told bad stories about her without empathizing with people like that. After that there was all the subsequent history, but let's stop there.

Diego: What do you think is your most important research contribution?

Thomas: I don't really know. Maybe my density estimation paper in 1978 led the way for others, it's being used in machine intelligence. Perhaps it was a series of three papers published in - well first of all some of it was in my PhD thesis in '73, then in Technometrics in 1975. Also in the Annals of Statistics in 1992 and then JASA 1996, with my Chinese co-authors. In my Technometrics paper, I took the logs of the variances in the linear model with heterogeneous variances. Take a multivariate normal prior for the log-variances, maybe at the first stage of a hierarchical prior. Take a multivariate normal prior again, maybe at the first stage of a hierarchical prior to the means, and that gives a very general paradigm, with lots of interesting special cases. I tend to receive lots of ridicule whenever I cite my Technometrics 1975 paper, often out of the blue. In fact, Steve Fienberg made a meal of it during his after dinner speech at Valencia 6, just before I played Rev Thomas Bayes returning from Heaven in the comedy skit. As a special case, my probability model reduces to a time series model which represents a sort of stochastic volatility, though at least one worthy Bayesian has laughed his head off at this suggestion, and another firmly denied it when I suggested a touch of déjà vu. Now, the first big application of my 1975 approach came when I taught it on my Bayesian course at Wisconsin, which some of Daniel Gianola's students were attending. As a result of that, Daniel and his students and also my friend Jean-Louis Foulley from Paris used these ideas in animal breeding. I'm very proud of that. John Geweke has more recently published a version which is more accurate in computational terms. I remember talking with my colleague Dennis Cox when I was working at the Math Research Center in Madison during the early 1980s, and saying, "Shame I can't extend this to a general covariance matrix," and he said, "Of course you can. You can take the log of a positive definite matrix." Now, I didn't realize that you could, because what you do is you take the logs of the eigenvalues, leave the eigenvectors unchanged, and then you reconstruct the matrix. Then way back in '81, I remember the people, the Army's people in the Math Research Center who advised me. Ben Noble and an Israeli mathematician told me about an ingenious Taylor series expansion which had been derived by the physicist Richard Bellman and which was based on the theory of Volterra equations. That motivated me to put a multivariate normal prior on some string of the elements of the log of the covariance matrix. The technicalities were very, very difficult to go through, because we had to use the Volterra equation to develop a multivariate normal approximation to the likelihood. About nine years later, John Hsu helped me to complete the algebra, and made the whole thing exact using importance sampling. And, then lo and behold, we published this very lengthy paper in the Annals of Statistics in 1992. I then worked with Tom Chiu and Kam Wah Tsui on developing a log-linear model for covariance matrices. We did a largely non-Bayesian paper

which explored the asymptotic properties of the estimates of the maximum likelihood estimators. After, I returned from my retirement, I discovered that a number of people in Econometrics, including James LeSage, Kelley Pace, and Manabu Asai had applied these ideas both in spatial processes in econometrics and to the multivariate time series modelling of stochastically volatile data. Indeed our approach seems to be regarded as seminal in the Econometrics. So there, those who laugh and pour scorn when I jump out of a corner and cite my Technometrics 1975 paper!

Diego: I have heard a lot of people that are in research that they don't like to teach. Have you learnt from something when teaching which has inspired you?

Thomas: Yes, let me give two examples to this. Firstly, my alternative to the expected utility hypothesis, which I firstly developed in the early '80s. It handles the historical problems with Allais Paradox, by putting a premium on the certain component of the monetary reward. The final version of my epsilon-adjusted utility procedure resulted from an interaction with my Bayesian graduate class, who completed a couple of surveys in order to validate it. Josep Ginebra and Jean Deichtmann made an invaluable suggestion and the approach is fully described in Ch 4 of my 1999 Bayesian book. It seems to refute the classical theory of risk aversion. During 2013, Peter Wakker advised me that a similar approach was by then regarded as the state of the art by theoretical Econometricians, and that they'd developed an axiom system to justify it, which relaxed the very constrictive Savage axioms. I also learnt a great deal while teaching Statistics 431, Applied Categorical Data Analysis at Wisconsin. For their practical projects the multi-disciplinary students were encouraged to analyse data sets from their own area of interest and draw their own practical conclusions. The students came up with a whole plethora of valuable conclusions, for example by investigating the dancing habits of cranes in Wisconsin, estimating the amount of drug rates on campus, and evaluating transition rates between geological layers. I discovered the amazingly broad applicability of Statistics, and how people can cater for their own interests and get some really innovative conclusions e.g. by referring to Goodman's full rank interaction analysis or logistic regression or by fitting a contingency table using a quasi-independence model. By interacting with the students I was able to encourage them to draw their own conclusions in relation to the socio-scientific background of their data.

Diego: Well, there are not too many statistical paradoxes. Which paradox you remember?

Thomas: Three paradoxes for me. I've worked on all three of them. Lindley's Paradox, Simpson's Paradox and Allais Paradox.

Diego: Would you like to let me take those one at a time, two or three minutes on each?

Thomas: Yes, but please pass the cheese first—Thanks! Lindley's Paradox has been much talked about. Lindley first thought of it in 1957 soon after he converted to Bayesianism from confirmed frequentisism and while he was still at Cambridge. In many situations, Bayes factors indicate conclusions about null hypotheses which contradict the results of fixed size significance tests, particularly when the sample size is large. This is the paradox. Lindley thought that his theoretical arguments refuted fixed sized significance testing. I think that many Bayes factors are badly formulated and much too sensitive to the prior assumptions. Zeynup Baskurt and Michael Evans resolved the paradox in their 2013 article in Bayesian Analysis. They suggested rescaling Bayes factors (weights of evidence) in a way which yields more sensible Bayesian conclusions. These moreover concur in approximate terms with the conclusions to be drawn from a classical p-value. I hope that all of our Bayesian friends will catch onto this seminal development before their Bayes factors continue to mislead everybody in sight.

Diego: Wow! And what about Simpson's Paradox?

Thomas: I first learnt about that from Dennis. He gave me all sorts of Bayesian interpretations. Suppose you have a strong positive association in a 2 by 2 contingency table e.g. between treatment and effect, and split the table according to a third variable e.g. relating to the presence or absence of a diagnostic symptom then the association will sometimes be negative in BOTH of the sub-tables. In this case the association in the combined table is said to be spurious and the third variable is referred to as the lurking or confounding variable. This paradox is less likely to occur when your data result from a suitably randomized experiment. It can however occur all too frequently, with some lurking variable or other, when the data are observational. It is therefore never possible to infer causality from a strong association in a 2 by 2 table. This is in tune with David Hume's 18th century philosophy to the effect that correlation can never be used to prove causal-

ity. Simpson's Paradox confirms that we should always qualify our statistical conclusions from observational data by saying that they are subject to modification if somebody can dream up a lurking variable which renders them paradoxical. Quite daunting really.

Diego: Corr!!.

Thomas: Now, onto Allais Paradox. Suppose that you are comparing several different portfolios each of which will yield a random reward which is taken to possess a probability distribution which is specified for that specific portfolio. Then, according to classical utility theory, you should specify a utility function on the space of possible rewards, and choose the portfolio which maximises your expected utility. Savage's highly prescriptive Expected Utility Hypothesis implies that you will always be able to find a utility function which well represents your preferences between the portfolios. The Nobel Laureate Maurice Allais came up with a counterexample involving two simple portfolios during the 1950s. He showed experimentally that any people would prefer portfolio A to portfolio B in situations where maximizing expected utility would imply making the opposite choice whatever the choice of the utility function. Allais paradox pre-empted a plethora of proposed modifications to the Expected Utllity Hypothesis, including my own which I referred to earlier. There are nevertheless still some diehard Savage Bayesians around.

Diego: We are arriving to the last part of this interview. How would you advise young academic statisticians who are just starting their career?

Thomas: The first thing is to feel confident in your own ideas and not to be pushed over by anybody else's preconceptions. When talking to your Ph.D. supervisor or your senior colleagues, you should always be prepared to assert that you think this might be a better way to do it and to discuss it rather than just be told what to do. That's what is very important; you're responsible for your own originality. The other thing, I might sound very traditional on this but it's very important to develop the relevant mathematical expertise to the subject. Dare I emphasise that you need to develop the ability to do the algebra and advanced calculus yourself, rather than using Mathematica to do it, so that you can manipulate and play with it, and that includes using Laplacian approximations or Taylor series expansions, completing the square, and whatever. Certainly, in America it is important to have expertise which I never really possessed, but it is good to be able to prove asymptotic theorems for yourself. It's the American tradition. But please remember that even saddle-point accuracy is an asymptotic criterion; it doesn't imply finite n accuracy. Don't get lost in the asymptotics as many have who have gone before! Asymptopia isn't the Utopia which the Berkeley school make it out to be. Computational skills are also important. You should be prepared to do your own computer programming. I think that it is important to veer away from Bayesian computer packages since you never know what is really going on inside them. You are totally responsible for the numerical results which you publish, and you should develop your own talents while producing them. It's also important to take time out to get acquainted with basic statistical principles. You could start off with the latest edition of the book by Box, Hunter and Hunter, Statistics for Experimenters. It is important to realize that the quality of the data helps determine the quality of the conclusions. It is important to avoid small, unreplicated studies which yield apparently significant conclusions. You should try to replicate your results as many times as possible. Please do not selectively report results or fudge or shuffle your data in order to please your superiors, or to get a paper published. Give due, even slightly overgenerous, credit to others when credit is due even when this affects the apparent originality of your work. You get back what you give out. I believe that there are people in the higher echelons of Society who attempt to control Statistics while trying to control ordinary people everywhere. It is important that you try to assert yourself while attempting to report the most honest conclusions which you can from the data. The same data set can yield entire different conclusions (e.g. about outliers) depending on where it's coming from. Think how the data was collected when you analyze it. You might decide to be interdisciplinary like me or you could decide to focus on one or two areas of application. So it's essential to maintain the honesty and integrity of the statistical paradigm. If done badly, Statistics can be used to confuse the population. Bad statistics can used to control ordinary people with misinformation. I fear that it may already be like that. One thing happening is that there is a huge expansion of Statistics in Big Data analysis. Lots, lots more people from different disciplines are regarding themselves as statisticians. This is in a sense quite tricky because they then have different objectives. Please don't clean the data be-

fore you've scrutinized it in relation to its real-life background. You may be ridding yourself of the key messages in the data. I very much fear the current strangely indecisive situation in the world today. I believe that good Statistics can be used to help change the world for the better. It can for example substantiate suspicion as to what is actually going on. Please be sure to use your expertise in Statistics fairly and wisely.

Diego: Thank you Thomas that's an inspiration for all of us. Many thanks for this interview.

We would like to thank Diane Ruiz and Thomas Tallis for helping us with this interview.