Bernoulli News

Newsletter of the Bernoulli Society For Mathematical Statistics and Probability

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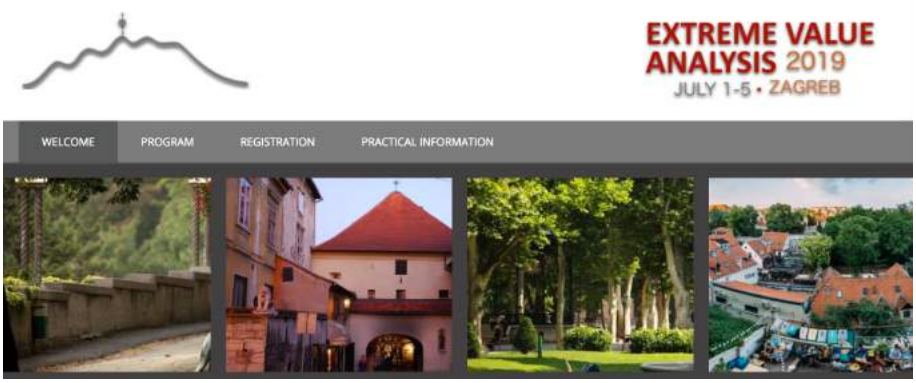
A VIEW FROM THE PRESIDENT



Dear Bernoulli Society Members,

As I write this letter, my colleagues and I are engaged in discussions about the role of p-values as well as hypothesis testing, both topics prompted by recent articles in *Nature*. See in particular the 20 March 2019 thought-proving comment in *Nature* 567, 305–307, "Scientists rise up against statistical significance," by Amrhein, Greenland, and McShane. At the same time, I am also preparing for my lectures in a beginning statistical inference course. This combination of a controversy that concerns methods our field developed as well as teaching an introductory course in statistical inference leads me to these questions: "What roles should mathematical statisticians and probabilists play in the broad scientific controversies of our time? What roles are we obligated to play and what roles might we choose to play?"

We all recognize that statistics is much more than mathematics or a simple application of mathematics. Many of us, including myself, were and are attracted to probability or mathematical statistics by the beauty of the particular proofs or the ability of mathematics to shed light and bring order to apparently complex problems. If you are like me, your preference is to happily solve, bring beauty, bring clarity to complex statistical/probability problems. Given this mindset, what is our duty with regards to these controversies like the p-value controversy? In the *Nature* comment it is apparent (once I read the text multiple times!) that our field develops ideas or tools and then we may or may not assist the broader scientific society in using these tools in a nuanced manner. While nuanced can mean mathematically nuanced such as with issues of measurability or variance/bias tradeoffs in high dimensional settings, here nuanced means striving to ensure that language communicates the mathematics of the idea accurately or recognizing when subtle differences in expression actually point to the need for different mathematical formulations. This brings me back to the p-values controversy; what role or obligation do we have?

Given my preferences for happily working to bring clarity to and solving complex statistical/probability problems, these controversies seem out of my purview. But then I think about our role as educators. In particular, one responsibility we bear is to acknowledge that there can be different ways to mathematize a problem, each leading to subtle [. . .]

... Continued on p. 1

Deadline for the next issue: **30 September, 2019**
Send contributions to: *manuele.leonelli@glasgow.ac.uk*

A View from the President (continued from front cover)

differences in the scientific meaning. As I teach this introductory statistical inference class, I have come to realize that I must, at a minimum, strive to step out of my comfort zone, spend the time and effort to wrestle with the need to be precise not only with mathematics but in terms of how I communicate the utility of these statistical methods. I need to discuss the scientific issues that arise with the use of our statistical methods. What about you?

As in my prior letters, I am very proud to highlight the involvement by Bernoulli members as well as our new initiatives. First we were very successful in attracting a number of rather high quality applications for the 2020 Bernoulli Society New Researcher Award in Probability Theory. Please watch out for an announcement of the winner! Also we will soon announce the winner of the 3rd Ethel Newbold Prize. Recall that Ethel Newbold, an English statistician, was the first woman to be awarded the Guy Medal in Silver by the Royal Statistical Society, in 1928.

I'd like to personally thank our outgoing *Bernoulli News* editor, Miguel de Carvalho (University of Edinburgh) for being a fantastic editor of our Bernoulli News and welcome our new editor Manuele Leonelli (University of Glasgow). Also I thank Eva Vedel Jensen (Aarhus University) for her service in chairing the Ethel Newbold selection committee (and extend a welcome to Jon Wellner of University of Washington as incoming chair). Lastly, although I have already mentioned our Bernoulli–IMS 2020 WC program chair, Siva Athreya (Indian Statistical Institute, Bangalore), in my past letters, I am compelled to again. Siva and the program committee along with the local chair, Hee-Seok Oh (Seoul National University) and local committee have been very hard at work in organizing our 2020 joint conference. We have a website, `http://www.wc2020.org/`! Please see this website for a partial list of our named lectures. It has been an honor to work with all of the above individuals as well as all of you!

Susan A. Murphy
President of the Bernoulli Society
Cambridge, MA

Editorial

This issue ends my journey as Editor of *Bernoulli News*. It is time to say goodbye, but most importantly it is time to say thank you.

I would like to thank everyone at Bernoulli Society for reading these words, for contributing enthusiastically to the outlet, and for helping to broadcast Bernoulli Society through the world.

I am also grateful to you, for walking this journey on my side, and for editing every issue with me; your suggestions and feedback were significant and have greatly helped us offering timely and accurate information.

There is nothing more rewarding than getting the readership knocking on the door asking for more. That means people feel part of the outlet, and that thus we are making a difference.

It is also time to say welcome. Manuele Leonelli is now taking the lead as Editor of *Bernoulli News*; more details on Manuele will be available from p. 6. Contributions to the next issue should be sent to:

manuele.leonelli@glasgow.ac.uk

David John Finney 1917–2018.

I have a very sad announcement to make before I leave. The world mourns Professor David Finney who has passed away in November 2018:

`https://en.wikipedia.org/wiki/D._J._Finney`

We have lost one of our giants.

References

MacNeill, I. (1993), "A Conversation with David J. Finney," *Statistical Science*, 8, 187–201.

The Editor
Edinburgh

News from the Bernoulli Society

Election of BS President-Elect and Ordinary Council Members

The Bernoulli Society has a great pleasure to announce the following final list of candidates for President-Elect and six ordinary members of the Council:

- President-Elect: Adam Jakubowski (Poland).
- Ordinary members of the Council:
  - Ingrid K. Glad (Norway).
  - Johanna G. Neslehova (Canada).
  - Shige Peng (China).
  - Gesine Reinert (UK).
  - Robert Stelzer (Germany).
  - Jianfeng Yao (Hong Kong).

The above list was received from the Nominating Committee chaired by Claudia Klüppelberg. No additional nominations were received from the ordinary members of the current Council.

According to Article 9.8 of the BS Statutes, if the number of candidates for an office does not exceed the number of vacancies, the candidates in question shall be declared elected without vote. Thus, the above candidates shall be declared elected without vote at the General Assembly (GA) in Kuala Lumpur in 2019. The term of office of each elected Officer shall begin immediately after the GA.

Appended below are the articles of the BS Statutes governing all these matters:

- 9.6: The Scientific Secretary shall submit the report of the Nominating Committee to the ordinary members of the Council. The ordinary members of the Council may nominate additional candidates provided that each such nomination is sponsored by at least two ordinary members and sent within a period designated by the Scientific Secretary.
- 9.7: The Scientific Secretary shall submit, not later than eight months before the General Assembly at the ISI World Statistics Congress, the names of all nominated candidates to the Executive Committee including the ISI Director.
- 9.8: At least six months before the General Assembly at the ISI World Statistics Congress, the final list of candidates shall be presented by the ISI Director to the members of the Society. If the number of candidates for an office does not exceed the number of vacancies, the candidates in question shall be declared elected without vote.

Byeong U. Park
Scientific Secretary of Bernoulli Society
& Ada van Krimpen
ISI Director

Call for Hosting the Bernoulli–IMS 11th World Congress in 2024

Preliminary bids / expressions of interest should be emailed to the IMS and Bernoulli society presidents (Xiao-Li Meng meng@stat.harvard.edu and Susan Murphy samurphy@fas.harvard.edu) and cc'ed to the BS president-elect (Claudia Klüppelberg, cklu@ma.tum.de). The due date for bids is June 29, 2019. A preliminary bid should specify names and affiliations of academics who have provisionally agreed to serve on the Local Organizing Committee. It is important that this team contains sufficiently many energetic people to cover fully the oversight of this big event, but in particular the team should also include a couple of senior academics in probability and statistics who have strong research records and international profiles, and who are prepared to commit to ensure the proposed congress will successfully add great distinction to their institution. The Local Organizing Committee should be diverse with all individuals playing significant roles. In many cases the Local Organizing Committee will obtain the assistance from conference organizing professionals.

It is helpful if preliminary bids contain information about the following:

1. The proposed site for the congress. It is especially important to be clear about this if the proposed Local Organizing Committee involves names from across the immediate local region!
2. A range of proposed dates (typically summer in northern hemisphere). The selection of this range should involve explicit consideration of various competing meetings and conferences around the world – to the extent that details are known at this advanced stage of planning.
3. Consideration of likely attendance numbers: for this, and for much other relevant data, the World Congress history page of the Bernoulli Society

will be very helpful; it will become clear that numbers can vary to some extent with congress location.

4. Meeting facilities: there needs to be access to a large auditorium potentially able to accommodate 700 attendees, in addition to an adequate supply of breakout rooms for smaller sessions, and good supply of space for discussions over tea/coffee.
5. Accommodation: there needs to be a good supply of reasonably priced local accommodation. It is particularly helpful if some very cheap and basic accommodation is available for (for example) younger colleagues.
6. It is useful to supply cost estimates on venue rent, catering twice daily coffee breaks, office staff support, for a range of attendance from 500 to 700 participants.
7. Based on the previous item, it is helpful to estimate a range of potential registration fees. As a very rough guide, registration fees should be loosely in line for example with those charged for the 2019 European Meetings of Statisticians and the 2018 IMS meeting.

Overall cost is a particularly sensitive issue to the IMS and Bernoulli Society members, who include both young academics with very limited access to research funds, and distinguished academics from developing world countries who also find it a great challenge to secure sufficient funding to attend meetings. Neither IMS nor Bernoulli Society are in a position to provide substantial financial support, though both organizations organize special invited lectures for the Congress, thus ensuring the presence of very high-visibility speakers for whom the relevant society will pay registration, accommodation and transport.

Susan A. Murphy
President of the Bernoulli Society
Cambridge, MA

2020 Bernoulli–IMS 11th World Congress in Probability and Statistics

BERNOULLI - IMS 10th WORLD CONGRESS IN PROBABILITY & STATISTICS

17–21 August (2020)

Seoul, Korea

http://www.wc2020.org/

Named Bernoulli Lecturers: 2020 Bernoulli–IMS World Congress

Left to right: Persi Diaconis, Alison Etheridge, Massimilliano Gubinelli, Tony Cai, and Sara van de Geer.

The named Bernoulli Lecturers for the 2020 Bernoulli–IMS World Congress in Probability and Statistics have been announced and are listed below:

- **Kolmogorov Lecture**: Persi Diaconis.
- **Bernoulli Lecture**: Alison Etheridge.
- **Lévy Lecture**: Massimilliano Gubinelli.
- **Laplace Lecture**: Tony Cai.
- **Tukey Lecture**: Sara van de Geer.

Details on these and other lectures (IMS Medallion Lectures, Public Lecture, and IMS Presidential Address) are available from:

http://www.wc2020.org/sub03_02.php

Victor Panaretos
Publicity Committee Chair
Lausanne

New Scientific Secretary and New Treasurer

Prof. Byeong Park will be stepping down as Bernoulli Society Scientific Secretary following his election as Vice President of the ISI. We congratulate him and are very grateful to him for his service to the Bernoulli Society in this role. The Council has approved Prof. Song-Xi Chen (Peking University) to replace Prof. Park as Scientific Secretary. The new Scientific Secretary, if approved by the Bernoulli GA at the 2019 WSC in Kuala Lumpur, will begin his term immediately after the WSC, completing Prof. Park's term which runs until the Bernoulli–IMS World Congress (August 2020). At that point he can be reappointed for the regular four-year term.

Lynne Billard will be stepping down at the end of this year from the position of Treasurer. The Bernoulli Society is grateful to her for her service! The Council has approved Prof. Geoffrey Grimmett (University of Cambridge) to succeed Prof. Billard as Treasurer. The new Treasurer will start his four-year term as of January 1, 2020, pending final approval by the Bernoulli Society GA during the 2019 WSC in Kuala Lumpur.

Victor Panaretos
Publicity Committee Chair
Lausanne

Ethel Newbold's Renovated Grave

The Bernoulli Society contributed funds that were used to renovate Ethel Newbold's grave. The grave site and a flyer for a commemoration can be found in the figures above. Ethel May Newbold (1882–1933) was an English statistician and the first woman to be awarded the Guy Medal in Silver by the Royal Statistical Society, in 1928. A detailed biography of Ethel Newbold may be found in her obituary.

References

Greenwood, M. (1933), "Ethel May Newbold," *Journal of the Royal Statistical Society*, 96, 354–357.

The Editor
Edinburgh

Ole E. Barndorff-Nielsen Autobiographical Notes

The former President of the Bernoulli Society, Ole E. Barndorff-Nielsen, has recently published a book "*Stochastics in Science: Some Autobiographical Notes*" (published Forlaget Morgenstjerne) which can be of great interest for our community.

This book gives a kaleidoscopic view of the life of a mathematical scientist. It aims to provide an impression of how multifaceted and fascinating such a life can be, in relation to other scientists. Much of the book can be read without any background knowledge of mathematics, but here and there brief indications of the author's own work are included at stepping stones in the narration. It contains a gallery of remarkable personalities and of historical accounts not available elsewhere. And the author's intense interest in Richard Wagner's operas occasionally shines through.

Mark Podolskij
Co-editor of Bernoulli Journal
Aarhus

Latin American Members (SLAPEM)

Bernoulli Society members baring Latin American nationality or affiliation are also members of the SLAPEM. A partial list of members can be found at

http://bernoulli-society.org/index.php/organization/slapem/members-slapem

Please contact our Membership Secretary at leorolla@dm.uba.ar to have your name included. This is an important step prior to organizing elections for the regional committee.

Carlos Améndola
Editor of e-Briefs
Munich

Awards and Prizes

Susan A. Murphy wins Guy Medal in Silver

Susan A. Murphy, President of Bernoulli Society, was the recipient of the Guy Medal in Silver. From the Royal Statistical Society: "The Guy Medal in Silver is awarded to Susan Murphy for her methodological, computational and applied work on dynamic treatment regimens. Susan's influential *JRSS* B paper in 2003 on Optimal Dynamic Treatment Regimens proposed a methodology for estimating decision regimens that result in a maximal mean response, consistent with an elegantly-defined regret function and for use with experimental or observational data. Substantial follow-up work on multi-stage decision making has built on this paper, including Susan's own work ranging from sample size determination to performance guarantees for individualized treatment rules and applications ranging from addictions to micro-randomized optimization of mobile health interventions for the Fitbit generation."

Congratulations Susan!

The Editor
Edinburgh

Klaus Krickeberg wins "Friend of Vietnam" Medal

The former President of the Bernoulli Society, Klaus Krickeberg, received the the medal "Friend of Vietnam" from the President of Vietnam. The medal is a token of recognition for his work on Public Health in Vietnam. The medal was handed to Klaus by the Minister of Health of Vietnam in a ceremony of the 25th February. Congratulations Klaus!

The Editor
Edinburgh

New Executive Members in the Bernoulli Society

Co-Editors of *Bernoulli*: Mark Podolskij and Markus Reiß

Short Bio: Mark Podolskij is a professor of probability and mathematical statistics at Aarhus University, Denmark. He has obtained his PhD in 2006 from the Ruhr-University of Bochum, Germany. Mark previously hold a professor position in mathematical statistics at Heidelberg University, Germany (2010–2014). His research interests are in the probabilistic and statistical analysis of continuous-time models with a particular focus on high frequency data and potential applications in economics and physics. He is an author of about 50 articles and he is currently a holder of an ERC Consolidator Grant (2019–2024) that focuses on high dimensional diffusion processes. Mark is serving as Editor-in-Chief of *SpringerBriefs in Probability and Mathematical Statistics*, advisory board member of *Lecture Notes in Mathematics*, and associate editor for several international journals. He also served as Membership Secretary of the Bernoulli Society (2012–2017) and he is currently a member of the executive committee.

Short Bio: Markus Reiß is a professor of mathematical statistics at Humboldt-Universität zu Berlin. After studying at Freie Universität Berlin and Somerville College Oxford, he has obtained his PhD in 2002 from Humboldt-Universität. Markus Reiß previously hold a professor position in mathematical statistics at Heidelberg University, Germany (2005–2008). His research focuses on nonparametric and high-dimensional statistics with a particular interest in statistical inverse problems and statistics for stochastic processes. He is speaker of the DFG-research unit *Structural Inference in Statistics: Adaptation and Efficiency* (2012–2019). He has been Editor-in-Chief of *Statistics*, a journal of theoretical and applied statistics (2012–16), and AE for several international journals.

Vision on the EiC Job: Since its foundation in 1995 the *Bernoulli* Journal has been the flagship of our society. It quickly established a great reputation in the statistical and probabilistic communities due to its broad focus on mathematical research in stochastics. In times of the increasing role of stochastic methods in the society, we aim at publishing top quality articles in statistics and probability theory, which are directed towards tackling modern challenges in our science. Nowadays, scientific work becomes ever more specialised and our mission is to make high-level research accessible to the broad stochastics community. The interaction between statistics and probability leads to many new innovative ideas and, at this level, *Bernoulli* has a unique position among the international research journals. The editorial board is set up to represent the broad scientific scope of the *Bernoulli* Journal and to represent the geographical diversity of the Bernoulli Society. On the operational side our goal is to further improve the reviewing procedure and to reduce the backlog of the journal.

Editor of Bernoulli News: Manuele Leonelli

Short Bio: Manuele Leonelli is a Lecturer in the School of Mathematics and Statistics at the University of Glasgow. He obtained a PhD in Statistics from the University of Warwick in 2015 under the supervision of Jim Q. Smith. Before joining the University of Glasgow, he won a CAPES post-doctoral fellowship working at the Federal University of Rio de Janeiro, Brazil, under the direction of Dani Gamerman. Manuele's research focuses on probabilistic graphical models for decision-making under uncertainty and inference over extreme values, with a focus on approximated inferential algorithms within the Bayesian paradigm. His PhD thesis "Bayesian decision support in complex systems: an algebraic and graphical approach," won the John Copas Prize for the best PhD Thesis in Statistics at the University of Warwick in 2015.

Chair of European Regional Committee: Marloes Maathuis

Short Bio: Marloes Maathuis is Professor of Statistics at ETH Zurich, Switzerland. Her research focuses on graphical models, causality, machine learning, and high-dimensional statistics. Marloes has been on the editorial boards of *Biometrika* and the *Scandinavian Journal of Statistics*, and is currently Associate Editor for the *Journal of the American Statistical Association* and the *Annals of Statistics*. Marloes has been a member of the European Regional Committee since 2016, and was elected Fellow of the Institute of Mathematical Statistics in 2017.

Vision on the ERC: It is a great pleasure to take over the role of chair of the European Regional Committee (ERC) from Niels Richard Hansen, and I would like to take this opportunity to thank Niels for his excellent leadership during the past years. It is ERC's mission to foster European cooperation in probability and statistics. In the current era of data science, I believe that this is of particular importance. Our main vehicle for doing so is the organization of meetings. This year we will have the 32nd European Meeting of Statisticians in Palermo (July 22–26) and the 21st European Young Statisticians Meeting in Belgrade (July 29–August 2). The organization of these meetings is already in full swing, and I would like to thank everyone who is contributing, in particular the local organizers and program committees. I am looking forward to an exciting year!

Articles and Letters

Random Planar Geometry

Jason Miller, University of Cambridge
jpmiller@statslab.cam.ac.uk

Communicated by the Editor

This note summarizes key ideas from the 2018 Doeblin prize. Below I will focus on developments in random planar geometry, including the study of Liouville quantum gravity, random planar maps, and the Schramm-Loewner evolution.

§1. Random Surfaces

What is the canonical way to pick a surface homeomorphic to the two-dimensional sphere $\mathbb{S}^2$ at random? There are two approaches to this question which have been proposed and are both natural but in rather different contexts.

The first is rooted in the combinatorics literature from the 1960s stemming from work of Tutte and Mullin on planar map enumeration. Recall that a *planar map* is a graph together with an embedding into the plane so that no two edges cross. Two planar maps are considered to be equivalent if one can be deformed into the other using an orientation preserving homeomorphism. A planar map is called a *quadrangulation* (□) if each face has four adjacent edges. A □ can be thought of as a surface by identifying each of its faces with a copy of the unit square $[0,1]^2$ where the squares are glued together according to the adjacency structure of the map using boundary length. For each $n \in \mathbb{N}$, there are only finitely many □'s $\mathcal{Q}_n$ with n faces and therefore one can pick one uniformly at random. This is an example of a *random planar map* (RPM). A uniformly random □ serves to discretize the problem of picking a surface homeomorphic to $\mathbb{S}^2$ at random in the same way that simple random walk discretizes the problem of picking a continuous curve uniformly at random.

Although it is natural to consider RPMs with faces which are triangles, pentagons, etc . . . , □'s are especially amenable to study due to the Cori–Vauquelin–Schaeffer (CVS) bijection which gives an encoding of a □ in terms of what is known as a well-labelled plane tree. Using the CVS bijection, it was shown by Chassaing and Schaeffer (2004) that the typical graph distance diameter of a random element in $\mathcal{Q}_n$ is of order $n^{1/4}$ and they described the scaling limit of the profile of distances from a uniformly random vertex in terms of Le Gall's Brownian snake. Le Gall subsequently showed that if M_n is chosen uniformly at random in $\mathcal{Q}_n$ and d_n denotes its graph distance then the sequence $(M_n, n^{-1/4} d_n)$ is tight with respect to the Gromov-Hausdorff topology. The subsequential convergence of the law of $(M_n, n^{-1/4} d_n)$ was promoted to true convergence in independent works of Le Gall (2013) and Miermont (2013) and the limiting metric space is called the *Brownian map*. Their work has since been extended to □'s of the disk, the whole-plane, and the half-plane and the limiting objects are respectively referred to as the Brownian disk (Bettinelli and Miermont, 2017), plane (Curien and Le Galle, 2014), and half-plane (Baur et al., 2016; Gwynne and Miller, 2017).

The theory of *Liouville quantum gravity* (LQG) gives another way of describing a random surface. LQG was first considered by Polyakov in the 1980s in the context of string theory. The starting point for its definition is the classical uniformization theorem, which we recall states that every two-dimensional Riemannian manifold which is homeomorphic to $\mathbb{S}^2$ can be conformally mapped to $\mathbb{S}^2$. Using the conformal map as a chart, the Riemannian metric takes the form

$$e^{\rho(z)}(dx^2 + dy^2), \quad z = x + iy \tag{1}$$

where ρ is a smooth function and $dx^2 + dy^2$ denotes the Euclidean metric. This implies that one can parameterize the space of $\mathbb{S}^2$-homeomorphic Riemannian manifolds using the space of smooth functions on $\mathbb{S}^2$. To use this to develop a theory of random surfaces, one therefore needs to put a probability measure on choices of ρ.

In LQG, one makes the particular choice of $\rho = \gamma h$ where $\gamma \in (0, 2]$ and h is an instance of the *Gaussian free field* (GFF). The GFF is the two-time dimensional analog of Brownian motion. Just like Brownian motion arises as the scaling limit of many different types of random curves, the GFF arises as the scaling limit of many different types of random surfaces. Recall that the *Dirichlet inner product* is defined by

$$(f, g)_\nabla = \frac{1}{2\pi} \int \nabla f(x) \cdot \nabla g(x)\, dx, \quad f, g \in C_0^\infty$$

where C_0^∞ denotes the space of compactly supported smooth functions in $\mathbb{C}$. For a domain $D \subseteq \mathbb{C}$, the space $H_0^1(D)$ is defined to be the closure of $C_0^\infty(D)$ with respect to $(\cdot,\cdot)_\nabla$. The GFF h on D is defined by taking $h = \sum_n \alpha_n f_n$ where (α_n) is a sequence of i.i.d. $N(0,1)$ random variables and (f_n) is an orthonormal basis of $H_0^1(D)$. This series expansion does not converge in $H_0^1(D)$ and in fact does not converge in a space of functions; rather the GFF is a distribution in the sense of Schwartz. This complicates the definition of LQG since the GFF cannot be exponentiated.

The mathematical study of LQG was popularized by Duplantier and Sheffield (2011). Their work is focused on constructing the volume form associated with (1) using a regularization procedure and also on proving a form of the *Knizhnik–Polyakov–Zamolodchikov* (KPZ) relation, which relates fractal dimensions computed using the random metric (1) and the Euclidean metric. Work of Rhodes and Vargas and others (David et al., 2016; Guillarmou et al., 2016; Kupiainen et al., 2017) has sought to give a rigorous treatment of LQG which is faithful to the approach developed in the physics literature.

Rough conjectures made in the physics literature in the 1980s asserted that LQG should describe the continuum limit of RPMs, where the value of γ determines the type of RPM. In particular, $\gamma = \sqrt{8/3}$ corresponds to uniform RPMs as described above and $\gamma \neq \sqrt{8/3}$ corresponds to RPMs with extra structure. For example, the case $\gamma = \sqrt{2}$ corresponds to a RPM decorated with a uniform spanning tree. These conjectures were based on (non-rigorous) computations of exponents associated with critical models on both RPMs and planar lattices and noticing that they transformed according to the KPZ relation.

§2. Schramm–Loewner Evolution

A key tool in the analysis of LQG and its connection with RPM is the *Schramm–Loewner evolution* (SLE). SLE was invented by Schramm (2000) as a candidate for the scaling limit of Lawler's loop-erased random walk (LERW), the random process which is defined by starting with a random walk and then chronologically erasing its loops. Since then, SLE has been shown to arise as the scaling limit of several planar lattice models, including LERW (Lawler et al., 2004), critical percolation on the triangular lattice (Smirnov, 2001), and the Ising model (Smirnov, 2010). It is also conjectured to describe the scaling limits of a number of other planar lattice models.

The starting point for the definition of SLE is the so-called chordal Loewner equation, which encodes a non-crossing curve η in the upper half-plane $\mathbb{H}$ connecting 0 to ∞ in terms of a continuous, real-valued function W. In particular, if for each $t \geq 0$, one lets g_t be the unique conformal transformation from the unbounded component of $\mathbb{H} \setminus \eta([0,t])$ to $\mathbb{H}$ with $g_t(z) - z \to 0$ as $z \to \infty$, then the family of maps are given by the solution of the ODE

$$\partial_t g_t(z) = \frac{2}{g_t(z) - W_t}, \quad g_0(z) = z. \tag{2}$$

The function W which drives this ODE is related to η in that $W_t = g_t(\eta(t))$ for each $t \geq 0$. Conversely, it is easy to see that η can be recovered from the family (g_t). The Loewner equation was invented by Loewner in the 1920s in the deterministic context of trying to prove the Bieberbach conjecture concerning univalent functions (and de Branges' eventual proof (de Branges, 1985) makes use of them).

Schramm realized that if one encodes an interface from a planar lattice model using the Loewner evolution, then the ansatz that the scaling limit is conformally invariant implies that the driving function W has stationary independent increments and satisfies Brownian scaling. In particular, it must be that $W = \sqrt{\kappa}B$ where B is a standard Brownian motion and $\kappa \geq 0$. This led him to consider the solution to (2) with W of this form and this object is now known as SLE_κ. The behavior of SLE_κ strongly depends on κ: it is a simple curve for $\kappa \leq 4$, self-intersecting but not space-filling for $\kappa \in (4,8)$, and space-filling for $\kappa \geq 8$.

The first connection between SLE_κ and LQG was discovered by Sheffield (2016a), who showed that SLE_κ for $\kappa \in (0,4)$ arises as the seams obtained when one glues together independent γ-LQG surfaces, $\gamma = \sqrt{\kappa}$, along their boundary. The $\gamma = \sqrt{\kappa}$ relation is one way of arriving at the conjecture of the relationship between $\sqrt{8/3}$-LQG and uniform RPMs. Indeed, as we will explain in more detail below, the seams which arise when one glues together independent uniformly random $\square$'s are self-avoiding walks (SAWs) and it was conjectured by Lawler et al. (2003) that the scaling limit of the SAW on a planar lattice is $\mathrm{SLE}_{8/3}$.

§3. Imaginary Geometry

Another random geometry that one can build from the GFF is the so-called *imaginary geometry*. It corresponds to the formal vector field

$$e^{ih/\chi}, \quad \chi > 0$$

where h is an instance of the GFF. As in the case of LQG, this expression does not make literal sense since the GFF does not take values at points. It was discovered by Sheffield (2016a), building on work of Schramm and Sheffield (2013), that one can make sense of the flow lines of this vector field, i.e., solutions to

$$\eta'(t) = e^{ih(\eta(t))/\chi}, \quad \eta(0) = z. \tag{3}$$

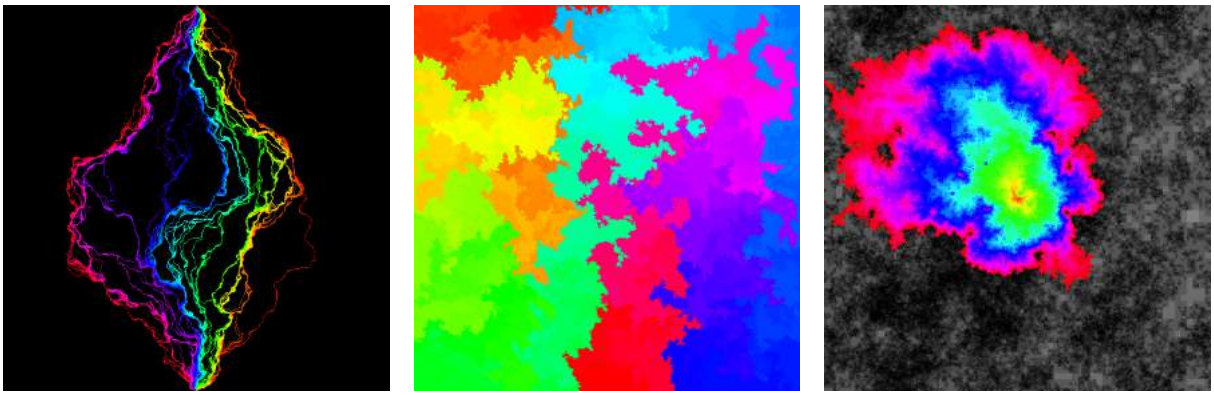


Figure 1: **Left:** Flow lines of a GFF on $[0,1]^2$ started from a common point with different angles. **Middle:** A space-filling form of SLE_6 constructed from GFF flow lines. **Right:** A discrete approximation to $\mathrm{QLE}(8/3,0)$.

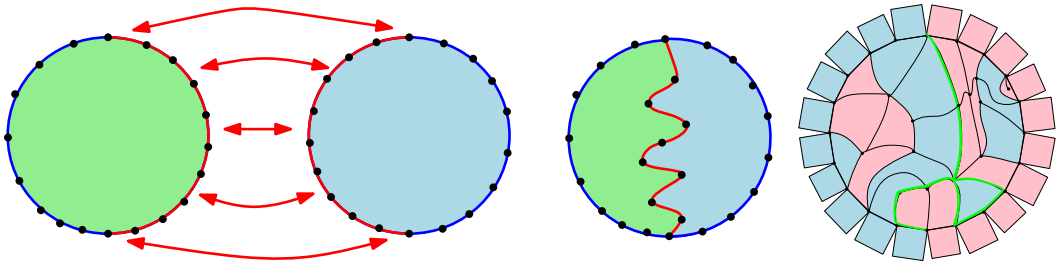


Figure 2: **Left and middle:** A gluing of independent uniform $\square$'s of $\mathbb{D}$ to produce a $\square$ decorated by a SAW. **Right:** Face percolation on a random $\square$ where red (resp. blue) quadrilaterals are closed (resp. open) with closed (resp. open) boundary conditions on the counterclockwise (resp. clockwise) arcs. The interface between the open/closed clusters attached to these boundary arcs is shown in green.

Moreover, if $\chi = 2/\sqrt{\kappa} - \sqrt{\kappa}/2$ with $\kappa \in (0,4)$, then they are SLE_κ-type curves. The most natural approach to constructing solutions to (3) is to regularize h to obtain a continuous function, solve the corresponding ODE, and then take a limit. It is not known yet how to show that the limit converges. The construction of solutions to (3) is thus indirect and is based on 'reverse-engineering' using the following two principles. First, if h were a continuous function then changing the values of h off a flow line η does not affect η. In other words, η is 'local' for h. Second, the values of h along η are determined by the winding of η. This leads to the fact that one can construct a flow line η of a GFF h by first sampling η, sampling a GFF h in the complement of η with boundary conditions given by what they would be if h were a continuous function (with a certain correction to reflect that h is a distribution), and then showing that the marginal law of h (after integrating out η) is that of a GFF on the entire domain. It is not obvious from this construction that η is a deterministic function of h (since the definition of h depends on η); this fact was established using an indirect argument by Dubédat (2009).

The articles by Miller and Sheffield (2016a,b,c, 2017) are focused on understanding the manner in which GFF flow lines interact with each other. Namely, one can consider flow lines started at different points or with different angles (i.e., using the vector field $e^{ih/\chi+\theta}$ in place of $e^{ih/\chi}$). Just as in the case of continuous h, the flow lines respect monotonicity in their angle but in contrast they can intersect and bounce off each other and, if their angle is the same, merge. These constructions have important consequences for SLE, such as the time-reversal symmetry of SLE_κ for $\kappa \in (4,8)$ and the fact that the loops of a CLE_κ (the loop version of SLE_κ) for $\kappa \in (4,8)$ are continuous curves and are locally finite. The tools based on the interaction of GFF flow lines also play an important role in more general welding constructions in LQG, described just below.

§4. LQG as a Mating of Trees

There are a number of models for RPMs which can be encoded in terms of a gluing of a pair of random trees. The first example of this comes from the Mullin bijection, which gives that a RPM decorated by an instance of the uniform spanning tree (UST) can be encoded in terms of a walk on $\mathbb{Z}^2$ where the coordinates represent the contour functions of a distinguished spanning tree and its dual tree. The continuum limit

of the lattice walk is a standard planar Brownian motion where the coordinates each represent an instance of the continuum random tree (CRT). The Mullin bijection was extended by Sheffield (2016b) to describe a RPM decorated by an instance of the random cluster model for $q \in (0,4)$ in terms of a pair of trees and the limit of their contour functions is a correlated planar Brownian motion. In view of the conjectured connections between RPM and LQG, this led to the question as to whether one can represent LQG decorated by SLE as a mating of CRTs. Representations of LQG of this type were developed in Duplantier et al. (2014), where the Peano curve between the two trees is given by a space-filling form of SLE constructed using GFF flow lines.

§5. Growth Models on LQG Surfaces

The Eden model (Eden, 1961) is one of the classical growth models in probability. Given a graph $G = (V,E)$ and $x \in V$, it describes a growing cluster C_n where $C_0 = \{x\}$ and $C_n = C_{n-1} \cup \{y_n\}$ where y_n is the vertex $y \in V \setminus C_{n-1}$ of a uniformly random edge $\{z,y\}$ chosen among those with $z \in C_{n-1}$ and $y \in V \setminus C_{n-1}$. In the case that $G = \mathbb{Z}^2$, Cox and Durrett (1981) established a law of large numbers for the macroscopic shape of C_n towards a deterministic convex set. Computer simulations show that the macroscopic shape is not a Euclidean ball, the reason being that $\mathbb{Z}^2$ is not sufficiently isotropic. However, it has been shown that if one considers the Eden model associated with a Poisson-Voronoi tessellation of $\mathbb{C}$ then the macroscopic shape *is* a Euclidean ball (Vahidi-Asl and Wierman, 1992). The reason for this is that the law of the Poisson point process is rotationally invariant and the randomness prevents the formation of preferential directions.

Another setting in which it is natural to consider the Eden model is on a RPM. Due to the randomness, one would expect that as in the case of the Poisson-Voronoi tessellation, there are no preferential directions, hence at large scales an Eden cluster should behave like a metric ball. It is also natural to believe that there should be universality in the macroscopic shape in the sense that it does not depend on the microscopic chunks that one chooses to add at each stage. These are the discrete ideas which motivate the construction of the growth process $\mathrm{QLE}(8/3,0)$ (Miller and Sheffield, 2016e) (*quantum Loewner evolution* with parameters $\gamma^2 = 8/3$ and $\eta = 0$). It was later verified by Curien and Le Gall (2015) that the Eden growth on the dual of uniformly random triangulations at large scales is indeed described by a metric ball.

The process $\mathrm{QLE}(8/3,0)$ is constructed by considering a version of the Eden model defined in the continuum on top of $\sqrt{8/3}$-LQG where the chunks which are added at each stage are given by segments of SLE_6 curves (rather than individual vertices or faces) and the measure that one uses to choose the starting point of each segment is the $\sqrt{8/3}$-LQG boundary length measure (in place of counting measure). The tree-mating constructions from Duplantier et al. (2014) make it possible to describe this growth process in terms of the same type of $3/2$-stable Lévy processes one sees in the Brownian map of Le Gall (2013) and Miermont (2013). It is shown in Miller and Sheffield (2015, 2016d) that this construction in fact defines the metric balls in a metric space and if one chooses the probability measure on GFF-like distributions h appropriately, then it is isometric to the Brownian map, disk, half-plane, or plane.

Performing the same procedure with other types of SLEs, one obtains a growth process which is the conjectural scaling limit of the η-dielectric breakdown model, a family of growth models which interpolate between the Eden model ($\eta = 0$) and diffusion limited aggregation ($\eta = 1$), on γ-LQG (so-called $\mathrm{QLE}(\gamma^2,\eta)$) for (γ,η) pairs which satisfy

$$\eta = \frac{3\gamma^2}{16} - \frac{1}{2} \quad \text{or} \quad \eta = \frac{3}{\gamma^2} - \frac{1}{2}.$$

§6. Scaling Limits

The construction of the metric for $\sqrt{8/3}$-LQG paves the way to show that statistical mechanics models on RPMs converge to SLE_κ curves with respect to the Gromov–Hausdorff–Prokhorov–uniform (GHPU) topology, the natural generalization of the Gromov–Hausdorff topology to curve-decorated metric measure spaces. We will now discuss two such models: the SAW and critical percolation.

The SAW on a RPM has a particularly nice representation that makes it more amenable to analysis than on a deterministic planar lattice. Namely, if one takes two independent uniform $\square$'s of the disk and glues them together along their boundary, then one obtains a RPM decorated by a SAW (corresponding to the gluing interface). In the infinite volume and boundary length limit, the two uniform $\square$'s of the disk converge to $\square$'s of $\mathbb{H}$. Baur et al. (2016) and Gwynne and Miller (2017) show that the two $\square$'s of $\mathbb{H}$ converge in the limit to independent instances of the Brownian half-plane and Gwynne and Miller (2016) show that the scaling limit operation commutes with the gluing operation. That is, the GHPU limit of the gluing of two independent $\square$'s of $\mathbb{H}$ is the metric gluing of two independent Brownian half-planes along their boundary. The work of Gwynne and Miller (2016), which builds on the existence of the $\sqrt{8/3}$-LQG metric, establishes that the metric gluing of two independent Brownian half-planes is equivalent to a certain type of $\sqrt{8/3}$-LQG surface decorated by an $\mathrm{SLE}_{8/3}$ (the gluing interface). Combining, this gives that the SAW on

RPMs converges to $\mathrm{SLE}_{8/3}$ on $\sqrt{8/3}$-LQG in the GHPU topology. Historically, the SAW on RPMs was important because it served as the first test case of the KPZ relation by Duplantier and Kostov (1988).

Gwynne and Miller (2017) considers face percolation on random $\square$'s, the variant of percolation in which faces are either open or closed independently with some probability p. It was shown by Angel and Curien (2015) that the critical probability in this setting is $p_c = 3/4$. If one considers critical face percolation on a $\square$ of the disk with boundary conditions which are open on one boundary arc and closed on the other, then there is a unique interface which separates the clusters of open and closed faces which are connected to the respective arcs. The main result of Gwynne and Miller (2017) is that the percolation interface together with the underlying planar map converge jointly with respect to the GHPU topology to SLE_6 on the Brownian disk.

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Obituary: Richard Boys

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Richard Boys: 1960–2019.

Richard James Boys was born on the 6th of April 1960, in Leeds, England. He grew up in Leeds and Doncaster, and retained a trace of his Yorkshire accent, in addition to his straight-talking no-nonsense attitude, throughout his life. He first moved to the North East of England for his undergraduate degree, where he studied Mathematics at Newcastle University, graduating with a B.Sc. in 1981, before returning to Yorkshire for his graduate studies, undertaking an MSc in Statistics and PhD at the University of Sheffield, with his PhD awarded in 1985. Following a short temporary lectureship at Sheffield, he was appointed to a Lectureship in Statistics at Newcastle University in the summer of 1985. He was promoted to Senior Lecturer in 1996 and to Professor of Applied Statistics in 2005, the post he held until his untimely death.

Richard began his research career by taking an interest in methodology for screening designs. His PhD thesis, "Predictive screening methods," resulted in several joint papers with his supervisor, Ian Dunsmore, including a 1986 paper in *JRSS* B and a 1987 paper in *Biometrika*. During his PhD, Richard came to fully appreciate the power and practical utility of a Bayesian approach to inferential problems, and remained a committed Bayesian statistician throughout his career.

Shortly after Richard settled in Newcastle, he began a productive collaboration with Kevin Glazebrook, the resident expert in applied probability, which continued Richard's work on Bayesian approaches to screening and also expanded to include more general stochastic scheduling problems. The work arising from this collaboration was significant, again leading to several publications in journals such as *JRSS* B and *Biometrika*.

In parallel with his methodological work, Richard also developed close collaborations with clinicians at Newcastle, especially Stephen Robson, carrying out the statistical analysis for medical studies and trials. Richard's most highly cited paper is with Robson and others, published in the *American Journal of Physiology-Heart and Circulatory Physiology* (Robson et al., 1989). It has almost 800 Google Scholar citations at the time of writing. Richard thrived on collaborations, both with applied scientists and with fellow methodological researchers. He published over 100 refereed journal articles in his career, and almost all of these were jointly authored. He especially enjoyed supervising PhD students and acting as mentor to junior academics. Many statisticians at Newcastle, and elsewhere, have benefited from supervision and mentoring by Richard at the early stages of their career, and he supervised a total of 13 PhD students. Towards the end of the 1990s, Richard developed a new interest in statistical bioinformatics, and particularly hidden-Markov models for DNA sequence segmentation, with PhD student Daniel Henderson. They published several papers on this topic, culminating in a *Biometrics* discussion paper (Boys and Henderson, 2004), which has over 100 citations at the time of writing. With the arrival in Newcastle of Thomas Kirkwood, a noted theoretical biologist, Richard's interests in this line of work gradually morphed into an interest in statistical issues in computational and stochastic systems biology, and inference for partially observed stochastic processes more generally. Most of Richard's significant contributions in recent years were in this general area. An initial collaboration between Richard, Kirkwood and Darren Wilkinson investigated Bayesian inference strategies for stochastic models of gene expression. At the time, people were just beginning to appreciate the potential importance of stochasticity in gene expression, and starting to develop forward stochastic process models to describe observed heterogeneities. However, no-one had seriously consid-

ered the problem of reverse-engineering model parameters from time-course data. This work led to Richard's most highly cited statistics paper, "Bayesian inference for a stochastic kinetic model," which, having circulated on-line for several years, was eventually published in 2008 in *Statistics and Computing* (Boys et al., 2008). Although the paper used a discrete stochastic Lotka–Volterra model to illustrate the concepts, it was clear that the techniques used were quite general. So the paper demonstrated that it was likely to be possible to do exact Bayesian inference for the parameters of a broad class of biochemical network models, and this helped to spawn a new area of research in computational systems biology. The paper has over 250 citations. Richard continued to make regular contributions to this field right up to his death. Following on from initial success in this area, two large grants followed on the development of generic techniques for modelling and Bayesian inference for arbitrary stochastic biochemical reaction network models, with Wilkinson and Kirkwood. This work then formed the underpinning technology for Newcastle's externally funded Centre for Integrated Systems Biology of Ageing and Nutrition, led by Kirkwood, in which Richard played a significant role. A large number of publications, both methodological and applied, resulted from this series of grants. A 2009 paper published in *JASA* (Henderson et al., 2009), with former PhD student Henderson was a particular highlight, and was one of the first papers to use Gaussian process emulators for stochastic computer models. Over the years, Richard developed many interests and collaborations, too numerous to enumerate exhaustively here. One notable funded collaboration with applied mathematicians and archaeologists, and fellow statistician Andrew Golightly, concerned inference for population dynamics in the neolithic period, which resulted in publications in the statistics, physics and archaeology literature. When noted evolutionary biologist Martin Embley moved (back) to Newcastle in 2004, he soon developed a collaboration with Richard and fellow statistician Tom Nye, in the area of statistical phylogenetics. This collaboration formed an important part of a large European grant to Embley's group, and together with Sarah Heaps, a former PhD student that Richard had supervised with Malcolm Farrow, they published a number of papers on the difficult problem of rooting deep phylogenetic trees. At the time of his death, Richard had many ongoing projects, involving around a dozen different collaborators at Newcastle. It is likely that several of these projects will be published posthumously.

Richard particularly enjoyed statistics talks and seminars, both locally at Newcastle, and at conferences and workshops around the world. He was involved in organising several conferences and workshops over the years. In particular, he instigated and led a biennial workshop in Statistical bioinformatics and stochastic systems biology at Newcastle, which ran several times. He was a diligent attendee of Newcastle's internal and external statistics seminar programmes over the years, and was infamous locally for asking at least one pertinent question at the end of every talk. Over a period of many years, Richard developed a great appreciation for Australia. He first visited in 2003, for a bioinformatics conference in Brisbane, a trip which included a short stopover in Sydney. He liked most things about Australia, including the sunshine, despite an aversion to extreme heat. This would be the first of many trips down under, and most years he would try and factor a trip to Australia's east coast into his conference travel plans. When a Newcastle colleague, Andrew Metcalfe, emigrated to Australia, Richard arranged a research visit to Adelaide to see him. His collaboration with Metcalfe continued until his death. He developed several new contacts through his regular visits to Australia, and had been an Adjunct Professor in Statistics at Queensland University of Technology in Brisbane since 2017, where he had several ongoing collaborations. He was also an Associate Investigator for the Australian Research Council Centre of Excellence for Mathematical and Statistical Frontiers. Richard lived for his work, and relished almost all aspects of academic life, including teaching and administration. He was passionate about the development of a coherent statistical curriculum within the mathematics degrees at Newcastle. He introduced the first course on Bayesian statistics (at Stage 3), and then later helped develop additional Bayesian courses at Stage 4, and eventually Stage 2. He also pioneered, within Newcastle, the use of computers for Monte Carlo simulation within introductory statistics courses (illustrating, inter alia, sampling distributions of frequentist estimators), and the use of write-on printed lecture notes including gaps for proofs and worked examples. He was actively involved in administration within the School of Mathematics and Statistics, at all levels, and over the years he held many of the key administrative posts within the School. Senior posts held included Director of Business Development, Head of Statistics and Deputy Head of School. He also served a term on the Senate of the University. At the time of his death he was Head of Statistics and Pure Mathematics within the recently expanded School of Mathematics, Statistics and Physics.

Due to his interest in the teaching of statistics, Richard enjoyed serving as external examiner for both undergraduate and masters degree programmes elsewhere. His term as external examiner at the University of Mauritius between 2008 and 2012 was one of his more exotic duties. Within the UK, he served as external for programmes at Oxford, Edinburgh, Lancaster, St. Andrews, Southampton and Queen Mary University of London. He also acted as internal and external examiner for a large number of PhD students. Richard

was an active Fellow of the Royal Statistical Society, which he first joined in 1984. He was particularly active in the North Eastern local group of the society, and served on its committee as a regular member, secretary and treasurer, and chair. At national level, he served on the National Programme Committee, as Senior Examiner, on Council, General Applications Section, Research Section, Graduate Training Programme Committee and President Nominating Committee. At the time of his death, he was Joint Editor of Applied Statistics (*JRSS* C), one of the Society's leading journals, having previously served two separate terms as an Associate Editor.

Richard Boys died on 5th March 2019, from a heart attack, while recovering in hospital from recent heart surgery. His sudden and untimely loss will be felt by friends and colleagues across the community.

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Past Conferences, Meetings and Workshops

Sponsored and Co-Sponsored by Bernoulli Society for Mathematical Statistics and Probability

ECMTB 2018: July 23–27, 2018; Lisbon, Portugal



To celebrate the growing importance of mathematical Biology field, the Year of Mathematical Biology 2018 (YMB) was declared by the European Mathematical Society (EMS) and the European Society for Mathematical and Theoretical Biology (ESMTB) Comprising many scientific meetings, its main event was the 11th European Conference on Mathematical and Theoretical Biology (ECMTB 2018).

Traditionally organized by the ESMTB, the ECMTB 2018 was for the first time also organized by the EMS. The Portuguese Mathematical Society (SPM) co-organized it. The conference venue was the Faculty of Sciences of the University of Lisbon (FCUL), hosted by its research centre CMAFcIO (Centre for Mathematics, Fundamental Applications and Operational Research). The ECMTB 2018 had the patronage of His Excellency the President of the Republic of Portugal and the UNESCO seal granted by the National UNESCO Committee. Besides the three organizing societies, it was sponsored by several Portuguese research centres (CMAFcIO, CMA, CIMA, CEAUL) and the FCT (Portuguese Foundation for Science and Technology), Instituto Gulbenkian de Ciência, publishers (Springer, MDPI, PLOS One, Elsevier, EMS-PH, IOP Publishing, Oxford University Press, Wiley), the Bernoulli Society, the Centro Internacional de Matemática, the Portuguese Statistical Society, and other organizations and companies.

From July 23 (July 22 for early registration and cocktail party) to July 27, the city of Lisbon (Portugal) welcomed over 700 participants (a record number only beaten by joint ESMTB-SMB Conferences) from 80 countries. After the opening ceremony, there was a Tribute to Karl Peter Hadeler by Odo Diekmann, immediately followed by the opening plenary conference, a Bernoulli Society-European Mathematical Society Joint Lecture, by Samuel Kou (Harvard University, USA), on the exciting topic of "Big data, Google and disease detection: A statistical adventure". The other plenary conferences were on equally exciting

topics and were given by the eminent scientists Helen Byrne (Oxford Univ., UK), Antonio DeSimone (SISSA, Italy), Eva Kisdi (Univ. of Helsinlki, Finland), Mirjam Kretzschmar (Univ. Medical Centre Utrecht, The Netherlands), Eva Löcherbach (Cergy-Pontoise Univ., France), Andrea Pugliese (Univ. of Trento, Italy), Eörs Szathmáry (Eötvös Loránd Univ., Hungary) and Kees Weijer (Univ. of Dundee, UK). One of the recent winners of the Reinhart Heinrich Best Ph. D. Thesis Award, Jochen Kursawe gave his winner's talk.

ECMTB 2018 had also a very rich programme of 36 cutting-edge Mini-symposia, 60 Contributed Talk parallel sessions and 2 Poster sessions (in a nice get together coffee +cocktail break), totalling 455 oral communications and 119 posters covering all areas of Mathematical and Theoretical Biology. There were 4 poster prizes given by a jury and sponsored by publishers (Elsevier, MDPI, Springer). Moreover, the ECMTB Mentorship Programme was set up to facilitate research and career interactions between junior and more senior scientists attending the meeting. The General Assembly of the ESMTB took place on July 26, opened also to non-members and followed by further discussions over a wine tasting event. The reader can take a look at the Programme (or the short version) and at the Book of Abstracts.

The social programme provided ample opportunities for scientific exchange and personal contacts. Besides the already mentioned social activities and the coffee and the lunch breaks, there were excursions and a conference dinner that started with a Tuna (which is a not a fish, but a typical Portuguese University playing and singing student group) and was followed by dancing.

The ESMTB, to celebrate the Year of Mathematical Biology 2018 and wishing to extend its membership to other researchers in the area, invited every participant registered for the ECMTB 2018, that was not yet an ESMTB member, to become a member. The Society welcomes those accepting such invitation by exempting them of the first year membership fee. Note that the invitation is still standing (detailed information on `http://dev.ecmtb2018.org/RegRules`).

On behalf of the Organizing Committee, we thank the organizing societies for their trust, the Scientific Committee, the sponsors, the plenary speakers, the organizers of the Mini-symposia, the session chairs, the mentors and mentees, the jury of the poster prizes, the student helpers and the hard-working and skilful members of the Secretariat (Ana Rita Ferrer, Ana Isabel Figueiredo, Joana Guia). We are especially grateful to all the participants, for whom this Conference was organized, for having made it a memorable event and a landmark in the growing path of Mathematical and Theoretical Biology.

Maíra Aguiar, Carlos Braumann & Nico Stollenwerk
Conference Chairs
Lisbon & Évora

Forthcoming Conferences, Meetings and Workshops, and Calendar of Events

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SPA 2019: July 8–12, 2019; Evanston, Illinois, USA

Statistics Conference: June 17–21, 2019; Leiden, The Netherlands

Copyright Lucien Birge

"The conference will bring together collaborators and leading researchers in theoretical and applied statistics. Topics include nonparametric Bayes, high-dimensional/nonparametric statistics and applications of statistics in the life sciences."

Statistics Conference: In Honor of Aad van der Vaart's 60th Birthday

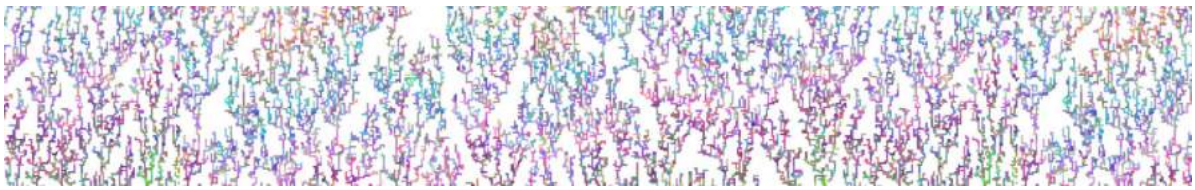
"Aad van der Vaart has shaped mathematical statistics through his wide range of contributions including seminal work on empirical processes, likelihood based methods and semiparametric statistics. He is well known for the Ghosal-Ghosh-van der Vaart theory for nonparametric Bayes. In addition, Aad has been contributing to many fields in applied statistics, in particular statistical genetics and genomics. He is author of several excellent books that are standard references and basis of statistics courses worldwide. For his work, Aad received numerous awards and honors."

17–21 June (2019)

Leiden, The Netherlands

goo.gl/2QqmVt

Brazilian School of Probability: July 22–27, 2019; São Carlos, Brazil



The XXIII Brazilian School of Probability (XXIII *Escola Brasileira de Probabilidade*) will be held at the São Carlos campus of the University of São Paulo, during the week July 22–27, 2019. EBP is a traditional international event which has been running since 1997 by initiative of the Brazilian probability community. It represents a good opportunity for researchers and students from Brazil and abroad to interact in a very high scientific level and including the participation of some of the best world leaderships. The School aims at emphasizing and diffusing the new and more promising research lines in Probability and Stochastic Processes, as well as on promoting new collaborations between the participants and on opening new horizons to the young researchers.

As in the previous sessions, in 2019, the scientific program will include mini-courses, invited conferences, short talks and poster sessions. The XXIII EBP is a Bernoulli Society sponsored meeting. Bernoulli members are entitled to a discount in the registration

fee. Confirmed invited speakers:

- **Courses**
  - Alison Etheridge (Oxford, England).
  - David Nualart (University of Kansas, US).
- **Plenary talks**
  - Aernout van Enter (Univ. of Groningen, Netherlands).
  - Alexandre Gaudillière (Univ. Aix-Marseille, France).
  - Firas Rassoul-Agha (Univ. of Utah, US).
  - Leonardo Rolla (UBA, Argentina and NYU-Shanghai, China).
  - Alexandre Stauffer (Univ. of Bath, UK).
  - Marie Théret (Univ. Paris Nanterre, France).
  - Benedek Valkó (Univ. of Wisconsin Madison, US).
  - Frederi Viens (Michigan State Univ. , US).
  - Anita Winter (Universität Duisburg-Essen, Germany).
  - Tianyi Zheng (Univ. of California San Diego, US).

Registration is already open. For more information, please visit:

http://ebp23.icmc.usp.br/

Maria Eulália Vares
Rio de Janeiro

EMS 2019: 22–26 July; Palermo, Italy

European Meeting of Statisticians 2019

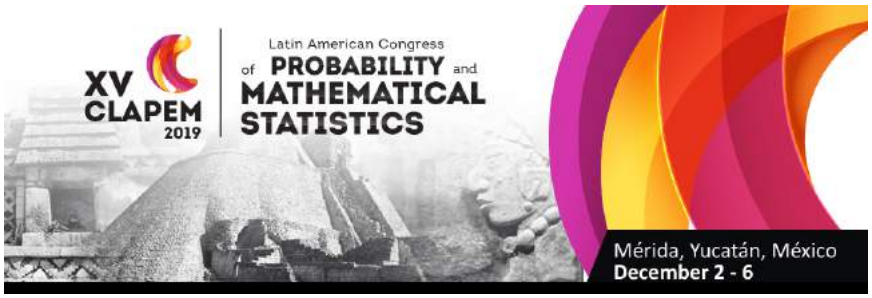
22–26 July (2019)

Palermo, Italy

http://www.ems2019.palermo.it/

CLAPEM 2019: 2–6 December; Mérida, Mexico

Latin American Congress of Probability and Mathematical Statistics



2–6 December (2019)

Mérida, Mexico

http://clapem2019.eventos.cimat.mx/

Other Events

IWFOS 2020: 24–26 June, 2020; Brno, Czech Republic

Following the success of the previous four meetings held in Toulouse (France, 2008), Santander (Spain, 2011), Stresa (Italy, 2014) and A Coruña (Spain, 2017), it is our pleasure to announce that the 5th International Workshop on Functional and Operatorial Statistics IWFOS 2020 will be held in Brno (Czech Republic), from 24th to 26th June 2020. The workshop will cover all topics in the broad area of infinite-dimensional statistics, such as: statistical modelling for functional variables; functional data analysis; operator-based statistics. Contributions in high-dimensional statistics are also welcomed. The list of confirmed invited speakers is below:

- Gérard Biau (Sorbonne Université, France).
- Eduardo García-Portugués (Universidad Carlos III de Madrid, Spain).
- Lajos Horváth (University of Utah, USA).
- Roberto Imbuzeiro Oliveira (IMPA, Brazil).
- Dominik Liebl (Universität Bonn, Germany).
- Regina Y. Liu (Rutgers, USA).
- Stanislav Nagy (Charles University, Czech Republic).
- Piercesare Secchi (Politecnico di Milano, Italy).
- Yoav Zemel (Georg-August-Universität Göttingen, Germany).

The preliminary schedule is as follows. During 3 days (6 half days), the workshop will offer about 10 invited talks, 30 contributed talks and poster sessions. There will be no parallel sessions. Short communications will be published in a peer-reviewed proceedings volume. Full papers may be published in a special issue of an international journal (to be specified). Further details on the meeting are available from:

https://iwfos2020.sci.muni.cz

Hoping to see you in Brno.

M. Hušková, P. Vieu, I. Horová & G. Aneiros
On behalf of the Scientific and Organizing Committees
Czech Republic

DSSV 2019: 13–15 August, 2019; Kyoto, Japan

Data Science & Visualization

13–15 August (2019)

Kyoto, Japan

https://iasc-isi.org/dssv2019/

ERCIM 2019: 14–16 December, 2019; London, UK

CMStatistics 2019 (ERCIM 2019)

14–16 December (2019)

London, UK

http://cmstatistics.org/CMStatistics2019/

ANZSC2020: 6–10 July, 2020; Gold Coast, Australia

Australian Statistical Society and New Zealand Statistical Association Conference

6–10 July (2020)

Gold Coast, Australia

Gold Coast Convention and Exhibition Centre

https://anzsc2020.com.au/

Expected attendance: 400–500pax.

10th IWSS: 2–6 September, 2019; Salzburg, Austria

10th International Workshop on Simulation and Statistics 2019

2–6 September (2019)

Salzburg, Austria

goo.gl/gLRVQR

Calendar of Events

This calendar lists all meetings that have been announced in this and previous issues of *Bernoulli News* together with forthcoming meetings organized under the auspices of the Bernoulli Society or one of its Regional Committees (marked by).

A more comprehensive calendar of events is available on the ISI Websites

- www.bernoulli-society.org/index.php/meetings
- www.isi-web.org/index.php/activities/calend

May 2019

May 27–29 (2019), *SASI (Singapore-Abu Dhabi-Shanghai-India Probability Meeting)*; Singapore.

June 2019

- June 4–7 (2019), *SYSORM 2019*; El Escorial, Spain.
- June 17–21 (2019), *Aad van der Vaart 60th Birthday Conference*, Leiden, The Netherlands.
- June 24–28 (2019), *BNP12—12th International Conference on Bayesian Nonparametrics*; Oxford, UK.

July 2019

- July 1–5 (2019), *11th International Conference on Extreme Value Analysis (EVA2019)*; Zagreb, Croatia.
- July 8–12 (2019), *41st Conference on Stochastic Processes and their Applications*; Evanston, Chicago, USA.
- July 22–26 (2019), *32nd European Meeting of Statisticians*, Palermo, Italy.
- July 22–27 (2019), *XXIII Brazilian School of Probability*; São Carlos, Brazil.
- July 27–August 1 (2019), *JSM 2019*; Denver, Colorado, USA.
- July 29–August 2 (2019), *21st European Young Statisticians Meeting*, Belgrade, Serbia.

August 2019

- August 13–15 (2019), *DSSV2019: Data Science, Statistics & Visualization*; Kyoto, Japan.
- August 18–23 (2019), *62nd ISI World Statistics Congress*; Kuala Lumpur, Malaysia.

September 2019

- September 2–5 (2019), *RSS 2019 Annual Conference*; Belfast, Northern Ireland.
- September (2019), *10th International Workshop on Simulation and Statistics*; Salzburg, Austria.
- September 22–26 (2019), *ESREL 2019*; Hannover, Germany.

December 2019

- July 9–11 (2018), *ERCIM 2019* (CMStatistics 2019); London, UK.
- December 2–6 (2019), *Latin American Congress of Probability and Mathematical Statistics (CLAPEM)*; Merida, Yucatán, Mexico.

June 2020

- June 24–26 (2020), *IWFOS 2020* (International Workshop on Functional and Operatorial Statistics); Brno, Czech Republic.

July 2020

- July 6–10 (2020), *ANZSC2020: Australian Statistical Society and New Zealand Statistical Association Conference*; Gold Coast, Australia.

August 2020

- August 17–21 (2020), *World Congress in Probability and Statistics*; Seoul, South Korea.

Quote of the Issue:

"*As I teach this introductory statistical inference class, I have come to realize that I must, at a minimum, strive to step out of my comfort zone, spend the time and effort to wrestle with the need to be precise not only with mathematics but in terms of how I communicate the utility of these statistical methods. I need to discuss the scientific issues that arise with the use of our statistical methods. What about you?*"

Susan A. Murphy

Recent Issues of Official Publications

Bernoulli

Vol. 25, No. 2: May 2019

Editors-in-Chief: M. Podolskij & M. Reiß

http://projecteuclid.org/current/euclid.bj

"Expansion for Moments of Regression Quantiles with Applications to Nonparametric Testing, " E. Mammen, I. Van Keilegom, K. Yu, 793–827.
"On Squared Bessel Particle Systems," P. Graczyk, J. Małecki, 828–847.
"Smooth, Identifiable Supermodels of Discrete DAG Models with Latent Variables," R. J. Evans, T. S. Richardson, 848–876.
"Bayesian Consistency for a Nonparametric Stationary Markov Model," M. Chae, S. G. Walker, 877–901.
"Low-Frequency Estimation of Continuous-time Moving Average Lévy Processes," D. Belomestny, V. Panov, J. H.C. Woerner, 902–931.
"Fréchet Means and Procrustes Analysis in Wasserstein Space," Y. Zemel, V. M. Panaretos, 932–976.
"Are there Needles in a Moving Haystack? Adaptive Sensing for Detection of Dynamically Evolving Signals," R. M. Castro, E. Tánczos, 977–1012.
"Towards a General Theory for Nonlinear Locally Stationary Processes," R. Dahlhaus, S. Richter, W. B. Wu, 1013–1044.
"Properties of Switching Jump Diffusions: Maximum Principles and Harnack Inequalities," X. Chen, Z.-Q. Chen, K. Tran, G. Yin, 1045–1075.
"Error Bounds in Local Limit Theorems using Stein's Method," A.D. Barbour, A. Röllin, N. Ross, 1076–1104.
"Stability for Gains from Large Investors' Strategies in M1/J1 Topologies," D. Becherer, T. Bilarev, P. Frentrup, 1105–1140.
"Convergence Rates for a Class of Estimators Based on Stein's Method," C. J. Oates, J. Cockayne, F.-X. Briol, M. Girolami, 1141–1159.
"Mallows and Generalized Mallows Model for Matchings," E. Irurozki, B. Calvo, J. A. Lozano, 1160–1188.
"Stable Limit Theorems for Empirical Processes under Conditional Neighborhood Dependence," J. H. Lee, K. Song, 1189–1224.
"Oracle Inequalities for High-dimensional Prediction," J. Lederer, L. Yu, I. Gaynanova, 1225–1255.
"Truncated Random Measures," T. Campbell, J. H. Huggins, J. P. How, T. Broderick, 1256–1288.
"Minimax Optimal Estimation in Partially Linear Additive Models under High Dimension," Z. Yu, M. Levine, G. Cheng, 1289–1325.
"Strong Gaussian Approximation of the Mixture Rasch Model," F. Liese, A. Meister, J. Kappus, 1326–1354.
"Time-Frequency Analysis of Locally Stationary Hawkes Processes," F. Roueff, R. von Sachs, 1355–1385.
"Quenched Central Limit Theorem Rates of Convergence for One-dimensional Random Walks in [...]," S. W. Ahn, J. Peterson, 1386–1411.
"From Random Partitions to Fractional Brownian Sheets," O. Durieu, Y. Wang, 1412–1450.
"A Bernstein-Type Inequality for Functions of Bounded Interaction," A. Maurer, 1451–1471.
"An Extreme-Value Approach for Testing the Equality of Large U-Statistic Based Correlation Matrices," C. Zhou, F. Han, X.-S. Zhang, H. Liu, 1472–1503.
"Numerically Stable Online Estimation of Variance in Particle Filters," J. Olsson, R. Douc, 1504–1535.
"New Tests of Uniformity on the Compact Classical Groups as Diagnostics for Weak-$*$ Mixing of Markov Chains," A. Sepehri, 1536–1567.
"Macroscopic Analysis of Determinantal Random Balls," J.-C. Breton, A. Clarenne, R. Gobard, 1568–1601.

Stochastic Processes and their Applications

Vol. 129, No. 4: April 2019

Editor-in-Chief: S. Méléard

http://www.sciencedirect.com/science/journal/03044149

"Stochastic and Partial Differential Equations on Non-smooth Time-dependent Domains," N. L. P. Lundström, T. Önskog, 1097–1131.
"Persistence of Sums of Correlated Increments and Clustering in Cellular Automata," H. Lyu, D. Sivakoff, 1132–1152.
"Reflected BSDEs with Regulated Trajectories," T. Klimsiak, M. Rzymowski, L. Słomiński 1153–1184.
"Affine Representations of Fractional Processes with Applications in Mathematical Finance," P. Harms, D. Stefanovits 1185–1228.
"Integral Representations of Martingales for Progressive Enlargements of Filtrations," A. Aksamit, M. Jeanblanc, M. Rutkowski, 1229–1258.
"Systems of Quasi–variational Inequalities Related to the Switching Problem," T. Klimsiak, 1259–1286.
"Robust Mean–variance Hedging Via G-expectation," F. Biagini, J. Mancin, T. M. Brandis, 1287–1325.
"Discrete-time Trawl Processes," P. Doukhan, A. Jakubowski, S. R.C. Lopes, D. Surgailis, 1326–1348.
"Asymptotic Normality of High Level-large Time Crossings of a Gaussian Process," F. Dalmao, J. R. León, E. Mordecki, S. Mourareau, 1349–1370.
"A Rigidity Property of Superpositions Involving Determinantal Processes," Y. Qiu, 1371–1378.
"Berry–Esseen Estimates for Regenerative Processes under Weak Moment Assumptions," X. Guo, J. Peterson, 1379–1412.
"Non-equilibrium and Stationary Fluctuations of a Slowed Boundary Symmetric Exclusion," T. Franco, P. Gonçalves, A. Neumann, 1413–1442.
"Ergodic Aspects of Some Ornstein–Uhlenbeck Type Processes Related to Lévy Processes," J. Bertoin, 1443–1454.
"Derivation of Mean-field Equations for Stochastic Particle Systems," S. Grosskinsky, W. Jatuviriyapornchai, 1455–1475.

Bernoulli Society Bulletin e-Briefs

Vol. 32: February 2019

Editor-in-Chief: C. Améndola

http://goo.gl/G9AOgl

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Bernoulli Society for Mathematical Statistics and Probability

Have a look at http://goo.gl/7EP2cZ for the latest articles in *Electronic Communications in Probability*, *Electronic Journal of Probability*, *Electronic Journal of Statistics*, *Probability Surveys* and *Statistics Surveys*, as well as *International Statistical Review*.

Who is Who in the Bernoulli Society

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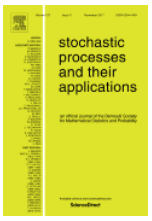
for Mathematical Statistics
and Probability

"If you are alredy a member, encourage your colleagues, postdocs and PhD Students to join the Bernoulli Society."



Publications and Meetings

The Bernoulli Society official journals are *Bernoulli* and *Stochastic Processes and their Applications*. In addition, the BS co-sponsors the following open-access online publications: *Electronic Communications in Probability*, *Electronic Journal of Probability*, *Electronic Journal of Statistics*, *Latin American Journal of Probability and Mathematical Statistics*, *Probability Surveys* and *Statistics Surveys*. Published twice a year, *Bernoulli News* provides detailed information about activities of the Society, while *Bernoulli* e-*Briefs* is a bimonthly electronic information bulletin that summarizes and draws the attention of relevant information to the membership.

The Bernoulli Society organizes or sponsors several international meetings which have a prominent relevance in the fields of mathematical statistics, probability, stochastic processes and their applications. These meetings are often held in conjunction with the ISI and other ISI Associations, the IMS or by the BS Regional and Standing Committees. Some of the meetings with a proud tradition are the *Bernoulli–IMS World Congress in Probability and Statistics* every four years, the *Conference on Stochastic Processes and their Applications* (SPA) organized every year, the *ISI World Statistics Congress* (formerly ISI Session), the *Latin American Congress in Probability and Mathematical Statistics* (CLAPEM) organized every two or three years, the *European Meeting of Statisticians* (EMS) organized every two years and the *European Young Statisticians Meeting* (EYSM) organized every two years.

Benefits of Joining the Bernoulli Society

- Reduced registration fees for meetings organized or sponsored by the Bernoulli Society.
- Free online access to *Bernoulli* (back to the first issue in 1995) and to *Stochastic Processes and their Applications* (back to the first issue in 1973). Receive the print version of *Bernoulli News* and the electronic information bulletin *Bernoulli* E-*Briefs*.
- Reduced subscription rates are available for print copies of *Bernoulli* and *Stochastic Processes and their Applications*, and to online version of the ISI *International Statistical Review*.
- Printed version of the *International Statistical Review* (ISR) is also available at a reduced price.
- Special subscription rates on several journals in probability and statistics.
- Springer offers a 20% discount on their books, if ordered directly. Members with a BS-IMS joint membership have free on line access to the IMS journals: *Annals of Statistics*, *Annals of Probability*, *Annals of Applied Probability*, *Annals of Applied Statistics* and *Statistical Science*. They also have reduced subscription rates to print IMS publications.

Membership Application and Fees

Online Applications for Membership

- Bernoulli Society membership
  `http://isi.cbs.nl/bern-form.asp`
- Joint BS–IMS membership
  `https://secure.imstat.org/secure/orders/IndMember.asp`
- Joint BS–IMS–ISI membership
  `http://isi.cbs.nl/bern_ims_isi-form.asp`

Membership Fees for 2018

- Full members: €80.
- First year of membership for members from developed countries: €40.
- Members from developing countries, first two years of postdoc, retired members: €24.
- Joint BS–IMS memberhip: $150.
- Joint BS–IMS–ISI membership (only for elected ISI Members): €180.
- PhD Students: Free!!!