Josiah Willard Gibbs Lecture

Wednesday, January 4, 2012
8:30 PM

Ballrooms A-B
3rd Floor
Hynes Convention Center
Boston, MA

A 250-year argument: Belief, behavior, and the bootstrap

Bradley Efron
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To commemorate the name of Professor Gibbs, the American Mathematical Society established an honorary lectureship in 1923 to be known as the Josiah Willard Gibbs Lectureship. The lectures are of a semipopular nature and are given by invitation. They are usually devoted to mathematics or its applications. It is hoped that these lectures will enable the public and the academic community to become aware of the contribution that mathematics is making to present-day thinking and to modern civilization.
The year 2013 marks the 250th anniversary of Bayes rule, one of the two fundamental inferential principles of mathematical statistics. The rule has been influential over the entire period, and controversial over most of it. Its reliance on prior beliefs has been challenged by frequentism, which focuses instead on the behavior of specific estimates and tests under repeated use. Twentieth Century statistics was overwhelmingly behavioristic, especially in applications, but the Twenty-First Century has seen a resurgence of Bayesianism. I will use some simple examples to show what’s at stake in the argument. The bootstrap, a computer-intensive inference machine, helps connect Bayesian and frequentist practice. No advanced statistical background is required.
Bradley Efron

Bradley Efron is the Max H. Stein Professor of Statistics and Biostatistics at Stanford University's School of Humanities and Sciences and the Department of Health Research and Policy with the School of Medicine. He completed his undergraduate work in mathematics at the California Institute of Technology, and earned his doctorate in statistics from Stanford in 1964, joining the Stanford faculty that same year. He was Associate Dean for the School of Humanities and Sciences from 1987 to 1990, served a term as Chair of the Faculty Senate as well as three terms as Chair of the Department of Statistics, and continues as Chairman of the Mathematical and Computational Sciences Program. He has served as president of the American Statistical Association and of the Institute of Mathematical Statistics. He is a past editor of the *Journal of the American Statistical Association* and is presently the founding editor of the *Annals of Applied Statistics*.

Among the numerous honors that Efron has received are Fellowships of the American Academy of Arts and Sciences, the American Statistical Association, the Institute of Mathematical Statistics, the Royal Statistical Society, the International Statistical Institute and the MacArthur Fellows Program of the John D. and Catherine T. MacArthur Foundation. He is a member of the U.S. National Academy of Sciences, a recipient of the Ford Prize of the Mathematical Association of America and of both the Wilks Medal and the Noether Prize of the American Statistical Association. Efron was awarded the 1998 Parzen Prize for Statistical Innovation by Texas A&M University, and the first-ever Rao Prize for outstanding research in statistics by Pennsylvania State University in 2003. He received the 2005 National Medal of Science “for his contributions to theoretical and applied statistics, especially the bootstrap sampling technique; for his extraordinary geometric insight into nonlinear statistical problems; and for applications in medicine, physics and astronomy.”
1. February 1924, New York City; Professor Michael I. Pupin, Columbia University; *Coordination*, Scribner’s Magazine, v. 76, no. 1, pp. 3–10 (1925).


18. November 1944, Chicago, Illinois; Professor John von Neumann, Institute for Advanced Study; *The ergodic theorem and statistical mechanics.*


22. December 1948, Columbus, Ohio; Professor Hermann Weyl, Institute for Advanced Study; *Ramification, old and new, of the eigenvalue problem*, Bulletin of the American Mathematical Society, v. 56, no. 2, pp. 115–139 (1950).


24. December 1950, Gainesville, Florida; Professor G. E. Uhlenbeck, University of Michigan; *Some basic problems of statistical mechanics*.


26. December 1952, St. Louis, Missouri; Professor Marston Morse, Institute for Advanced Study; *Topology and geometrical analysis*.


33. January 1960, Chicago, Illinois; Professor Julian Schwinger, Harvard University; *Quantum feld theory*.


35. January 1962, Cincinnati, Ohio; Professor C. N. Yang, Institute for Advanced Study; *Symmetry principles in modern physics*.

36. January 1963, Berkeley, California; Professor Claude E. Shannon, Massachusetts Institute of Technology; *Information theory*.

37. January 1964, Miami, Florida; Professor Lars Onsager, Yale University; *Mathematical problems of cooperative phenomena*. 
40. January 1967, Houston, Texas; Professor Mark Kac, Rockefeller University; Some mathematical problems in the theory of phase transitions.
46. January 1973, Dallas, Texas; Professor Jürgen Moser, Courant Institute of Mathematical Sciences, New York University; The stability concept in dynamical systems.
47. January 1974, San Francisco, California; Professor Paul A. Samuelson, Massachusetts Institute of Technology; Economics and mathematical analysis.
49. January 1976, San Antonio, Texas; Professor Arthur S. Wightman, Princeton University; Nonlinear functional analysis and some of its applications in quantum field theory.
52. January 1979, Biloxi, Mississippi; Professor Martin Kruskal, Princeton University; “What are solitons and inverse scattering anyway, and why should I care?”
53. January 1980, San Antonio, Texas; Professor Kenneth Wilson, Cornell University; The statistical continuum limit.

58. January 1985, Anaheim, California; Professor Michael O. Rabin, Harvard University, Cambridge, Massachusetts and Hebrew University, Jerusalem, Israel; *Randomization in mathematics and computer science*.

59. January 1986, New Orleans, Louisiana; Professor L. E. Scriven, University of Minnesota; *The third leg: Mathematics and computation in applicable science and high technology*.

60. January 1987, San Antonio, Texas; Professor Thomas C. Spencer, Courant Institute of Mathematical Sciences, New York University; *Schrödinger operators and dynamical systems*.


63. January 1990, Louisville, Kentucky; Professor George B. Dantzig, Stanford University, Stanford, California; *The wide wide world of pure mathematics that goes by other names*.

64. January 1991, San Francisco, California; Sir Michael Atiyah, FRS, Trinity College, Cambridge, England; *Physics and the mysteries of space; Selected Lectures, AMS videotape*.

65. January 1992, Baltimore, Maryland; Professor Michael E. Fisher, Institute for Physical Sciences and Technology, University of Maryland, College Park, Maryland; *Approaching the limit: Mathematics and myth in statistical physics*.

66. January 1993, San Antonio, Texas; Professor Charles S. Peskin, Courant Institute of Mathematical Sciences, New York University; *Fluid dynamics and fibre architecture of the heart and its valves*.


68. January 1995, San Francisco, California; Professor Andrew J. Majda, Princeton University; *Turbulence, turbulent diffusion, and modern applied mathematics*.

69. January 1996, Orlando, Florida; Professor Steven Weinberg, University of Texas, Austin; *Is field theory the answer? Is string theory the answer? What was the question?*


73. January 2000, Washington, DC; Professor Roger Penrose, Mathematical Institute, Oxford University; *Physics, computability, and mentality*.

74. January 2001, New Orleans, Louisiana; Professor Ronald L. Graham, University of California, San Diego; *The Steiner problem*.

76. January 2003, Baltimore, Maryland; Professor David B. Mumford, Division of Applied Mathematics, Brown University, Providence, RI; *The shape of objects in two and three dimensions: Mathematics meets computer vision.*

77. January 2004, Phoenix, Arizona; Professor Eric S. Lander, Professor of Biology, Massachusetts Institute of Technology, Cambridge, Massachusetts; *Biology as information.*

78. January 2005, Atlanta, Georgia; Professor Ingrid Daubechies, Department of Mathematics and Program in Applied and Computational Mathematics, Princeton University, Princeton, New Jersey; *The interplay between analysis and algorithms.*

79. January 2006, San Antonio, Texas; Professor Michael A. Savageau, Department of Biomedical Engineering and Microbiology Graduate Group, University of California, Davis, California; *Function, design, and evolution of gene circuitry.*

80. January 2007, New Orleans, Louisiana; Professor Peter D. Lax, Courant Institute of Mathematical Sciences, New York University, New York, New York; *Mathematics and physics.*

81. January 2008, San Diego, California; Professor Avi Wigderson, Institute for Advanced Study, Princeton, New Jersey; *Randomness—A computational complexity view.*


83. January 2010, San Francisco, CA; Professor Peter Shor, Massachusetts Institute of Technology; *Quantum channels and their capacities.*

84. January 2011, New Orleans, LA; Professor George Papanicolaou, Stanford University; *Mathematical problems in systemic risk.*

85. January 2012, Boston, MA; Professor Bradley Efron, Stanford University; *A 250-year argument: Belief, behavior, and the bootstrap.*