# Curriculum Vitae

Cosma Rohilla Shalizi

### Contact


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| ADDRESS | Department of Statistics, Carnegie Mellon University<br>5000 Forbes Avenue, Pittsburgh, PA 15213-3890 |
| E-MAIL | `cshalizi [at] cmu.edu` WWW `http://bactra.org/` |
| SEX | Male NATIONALITY USA |


### Education

**1993–2001**: University of Wisconsin at Madison, Physics Department, Ph.D. *Causal Architecture, Complexity and Self-Organization for Time Series and Cellular Automata*. Advisers: James P. Crutchfield (physics) and David Griffeath (mathematics).
**1990–1993**: University of California at Berkeley, Physics Department, A.B.

## Research

### Positions

**2005–**: Statistics Department, Carnegie Mellon University. (Visiting assistant professor, 2005–6; assistant, 2006–12; associate, 2012–2014; associate with tenure, 2014–) (With joint appointments in the Machine Learning Department; the Center for the Neural Basis of Cognition; and the Heinz School of Public Policy)
**2007–**: External faculty, Santa Fe Institute
**2002–2005**: Postdoctoral Research Fellow, Center for the Study of Complex Systems, University of Michigan
**1998–2002**: Graduate and then Postdoctoral Fellow, Santa Fe Institute
**1997**: Research assistant, Mathematics Department, UW-Madison

### Research Interests

Statistical analysis of complex systems models
Inference for stochastic processes: learning theory, nonparametric prediction
Networks: community discovery, causal inference, exponential families
Simulation-based inference
Inference and prediction with mis-specified models
Large deviations and ergodic theory in statistical learning
Functional connectivity in neural systems
Inference for heavy-tailed distributions
Quantitative measures of self-organization and complexity

Cellular automaton models of pattern formation
Hidden Markov models and hidden Markov random fields
Philosophy of science (causation; induction; reduction and emergence)

### Grant Support

**As PI** "Nonparametric Prediction and Structure Discovery for Spatial Dynamics", NSF (grant DMS1207759), 2012–2015
"Model Complexity and Prediction Error in Macroeconomic Forecasting", Institute for New Economic Thinking (grant IN01100005), 2011–2013
"High-Dimensional Statistics for Macroeconomic Forecasting", INET (grant INO1400020), 2014–2016
"Nonparametric Network Comparison", NSF (grant DMS1418124), 2014–2017

**As co-PI** "New Statistical Methods for fMRI Applied to Visual Reference Frames in Humans", NIH (grant # 2 R01 NS047493), 2009–2013 (PI: Christopher Genovese)
"Six Degrees of Francis Bacon", Google, 2012–2013 (PI: Christopher Warren)

## Publications

### In Peer-Reviewed Journals and Conferences

1. Christopher N. Warren, Daniel Shore, Jessica Otis, Lawrence Wang, Mike Finegold and CRS, "Six Degrees of Francis Bacon: A Statistical Method for Reconstructing Large Historical Social Networks", *Digital Humanities Quarterly* **10:3** (2016)

2. Daniel J. McDonald, CRS and Mark Schervish, "Estimating Beta-Mixing Coefficients via Histograms", *Electronic Journal of Statistics* **9** (2015): 2855–2883, arxiv:1109.5998

3. Leila Wehbe, Aaditya Ramdas, Rebecca C. Steorts and CRS, "Regularized Brain Reading with Shrinkage and Smoothing", *Annals of Applied Statistics* **9** (2015): 1997–2022, arxiv:1401.6595

4. Dena Asta and CRS, "Geometric Network Comparison", pp. 102–110 in Marina Meila and Tom Heskes (eds.), *31st Conference on Uncertainty in Artificial Intelligence* [UAI 2015], arxiv:1411.1350,

5. Xiaoran Yan, CRS, Jacob E. Jensen, Florent Krzakala, Cristopher Moore, Lenka Zdeborova, Pan Zhang and Yaojia Zhu, "Model Selection for Degree-corrected Block Models", *Journal of Statistical Mechanics: Theory and Experiment* (2014): P05007, arxiv:1207.3994

6. CRS and Aryeh (Leonid) Kontorovich, "Predictive PAC Learning and Process Decompositions", pp. 1619–1627 in *Advances in Neural Information Processing Systems 26* [NIPS 2013], arxiv:1309.4859

7. Georg M. Goerg and CRS, "Mixed LICORS: A Nonparametric Algorithm for Predictive State Reconstruction", pp. 289–297 in *Proceedings of the 16th Conference on Artificial Intelligence and Statistics* [AIStats 2013], arxiv:1211.3760

8. CRS and Alessandro Rinaldo, "Consistency under Sampling of Exponential Random Graph Models", *Annals of Statistics* **41** (2013): 508–535, arxiv:1111.3054

9. Andrew Gelman and CRS, "Philosophy and the Practice of Bayesian Statistics", *British Journal of Mathematical and Statistical Psychology* **66** (2013): 8–38, arxiv:1006.3868 (with discussion)

10. Daniel J. McDonald, CRS and Mark Schervish, "Estimating beta-mixing Coefficients", in *Proceedings of the 14th Conference on Artificial Intelligence and Statistics* [AIStats 2011], arxiv:1103.0941

11. CRS and Andrew C. Thomas, "Homophily and Contagion Are Generically Confounded in Observational Social Network Studies", *Sociological Methods and Research* **40** (2011): 211–239, arxiv:1004.4704

12. Shinsuke Koyama, Lucia Castellanos Pérez-Bolde, CRS and Robert E. Kass, "Approximate Methods for State-Space Models", *Journal of the American Statistical Association* **105** (2010): 170–180, arxiv:1004.3476

13. Robert Haslinger, Kristina Lisa Klinkner and CRS, "The Computational Structure of Spike Trains", *Neural Computation* **22** (2010): 121–157, arxiv:1001.0036

14. CRS, "Dynamics of Bayesian Updating with Dependent Data and Misspecified Models", *Electronic Journal of Statistics* **3** (2009): 1039–1074, arxiv:0901.1342

15. Aaron Clauset, CRS and M. E. J. Newman, "Power-law distributions in empirical data", *SIAM Review* **51** (2009): 661–703, arxiv:0706.1062

16. CRS, "Social Media as Windows on the Social Life of the Mind", forthcoming in the proceedings of the AAAI 2008 spring symposium on social information processing, arxiv:0710.4911

17. CRS, Marcelo F. Camperi and Kristina Lisa Klinkner, "Discovering Functional Communities in Dynamical Networks", pp. 140–157 in Anna Goldenberg *et al.* (eds.), *Statistical Network Analysis: Models, Issues, and New Directions* (New York: Springer-Verlag, 2007) [proceedings of a workshop at ICML 2006], arxiv:q-bio.NC/0609008

18. CRS, Robert Haslinger, Jean-Baptiste Rouquier, Kristina Lisa Klinkner and Cristopher Moore, "Automatic Filters for the Detection of Coherent Structure in Spatiotemporal Systems", *Physical Review E* **73** (2006): 036104, arxiv:nlin/0508001

19. Kristina Lisa Klinkner, CRS and Marcelo F. Camperi, "Measuring Shared Information and Coordinated Activity in Neuronal Networks", pp. 667–674 in Yair Weiss, Bernhard Schölkopf and John C. Platt (eds.), *Advances in Neural Information Processing Systems 18* [NIPS 2005] (Cambridge, Massachusetts: MIT Press, 2006), arxiv:q-bio.NC/0506009

20. Michael T. Gaster, CRS and M. E. J. Newman, "Maps and Cartograms of the 2004 US Presidential Election Results", *Advances in Complex Systems* **8** (2005): 117–123

21. Matthew J. Berryman, Scott W. Coussens, CRS, Yvonne Pamula, David Parsons, Kurt Lushington, David Saint, Andrew Allison, A. James Martin, Declan Kennedy and Derek Abbott, "Nonlinear Aspects of EEG Signals from Sleep Patients", pp. 40–48 in Nigel G. Stocks, Derek Abbott and Robert P. Morse (eds.), *Fluctuations and Noise in Biological, Biophysical, and Biomedical Systems III* (Bellingham, Washington: SPIE, 2005), arxiv:q-bio.NC/0506015

22. CRS, Kristina Lisa Klinkner and Robert Haslinger, "Quantifying Self-Organization with Optimal Predictors", *Physical Review Letters* **93** (2004): 118701, arxiv:nlin/0409024

23. CRS and Kristina Lisa Klinkner, "Blind Construction of Optimal Nonlinear Recursive Predictors for Discrete Sequences", pp. 504–511 in Max Chickering and Joseph Halpern (eds.), *Uncertainty in Artificial Intelligence: Proceedings of the Twentieth Conference* [UAI 2004] (Arlington, Virginia: AUAI Press, 2004), arxiv:cs.LG/0406011

24. CRS, "Functionalism, Emergence and Collective Coordinates", *Behavioral and Brain Sciences* **27** (2004): 635–636

25. CRS, "Optimal Nonlinear Prediction of Random Fields on Networks", *Discrete Mathematics and Theoretical Computer Science*, **AB(DMCS)** (2003): 11–30; arxiv:math.PR/0305160 (proceedings of the conference "Discrete Models for Complex Systems 2003")

26. CRS and James P. Crutchfield, "Information Bottlenecks, Causal States, and Statistical Relevance Bases: How to Represent Relevant Information in Memoryless Transduction", *Advances in Complex Systems*, **5** (2002): 91–95, arxiv:nlin/0006025

27. Wim Hordijk, CRS and James P. Crutchfield, "An Upper Bound on the Products of Particle Interactions in Cellular Automata", *Physica D* **154** (2001): 240–258, arxiv:nlin/0008038

28. CRS and James P. Crutchfield, "Computational Mechanics: Pattern and Prediction, Structure and Simplicity", *Journal of Statistical Physics* **104** (2001): 817–879, arxiv:cond-mat/9907176

29. James P. Crutchfield, David P. Feldman and CRS, "Comment on 'Simple Measure for Complexity"', *Physical Review E* **62** (2000): 2996-2997, arxiv:nlin/9907001

30. Cristopher Moore, Mats G. Nordahl, Nelson Minar and CRS, "Vortex Dynamics and Entropic Forces in Antiferromagnets and Antiferromagnetic Potts Models", *Physical Review E* **60** (1999): 5344–5351, arxiv:cond-mat/9902200

31. James P. Crutchfield and CRS, "Thermodynamic Depth of Causal States: Objective Complexity via Minimal Representation", *Physical Review E* **59** (1999): 275–283; arxiv:cond-mat/9808147

## Invited and Contributed Papers

1. Henry Farrell and CRS, "Pursuing Cognitive Democracy", pp. 211–231 in Danielle Allen and Jennifer S. Light (eds.), *From Voice to Influence: Understanding Citizenship in a Digital Age* (Chicago: University of Chicago Press, 2015), `http://bactra.org/weblog/917.html`

2. Justin H. Gross, CRS and Andrew Gelman, "Does the US Media Have a Liberal Bias? A Discussion of Tim Groseclose's *Left Turn: How Liberal Media Bias Distorts the American Mind*", *Perspectives on Politics* **10** (2012): 775–779, `http://www.stat.cmu.edu/~cshalizi/leftturn/`

3. CRS, "Comment on 'Why and When "Flawed" Social Network Analyses Still Yield Valid Tests of No Contagion", *Statistics, Politics, and Policy* **3** (2012): 5

4. Andrew Gelman and CRS, "Philosophy and the practice of Bayesian statistics in the social sciences", in Harold Kincaid (ed.), *Oxford Handbook of the Philosophy of the Social Sciences* (New York: Oxford University Press, 2012)

5. CRS, "Graphs, Trees, Materialism, Fishing: Reflections on Moretti", pp. 115–139 in Jonathan Goodwin and John Holbo (eds.), *Reading* Graphs, Maps, Trees (Anderson, SC: Parlor Press, 2011); `http://www.thevalve.org/go/valve/article/graphs_trees_materialism_fishing/`

6. CRS, "Methods and Techniques in Complex Systems Science: An Overview", pp. 33–114 in Thomas S. Deisboeck and J. Yasha Kresh (eds.), *Complex Systems Science in Biomedicine* (New York: Springer-Verlag, 2006); arxiv:nlin/0307015

7. CRS and Kristina Lisa Klinkner, "Quantifying Self-Organization in Cyclic Cellular Automata", pp. 108–117 in Lutz Schimansky-Geier, Derek Abbott, Alexander Neiman and Christian Van den Broeck (eds.), *Noise in Complex Systems and Stochastic Dynamics* (Bellingham, Washington: SPIE, 2003), arxiv:nlin/0507067

8. Derek Abbott, Paul C. W. Davies and CRS, "Order from Disorder: The Role of Noise in Creative Processes. A Special Issue on Game Theory and Evolutionary Processes — Overview", *Fluctuation and Noise Letters*, vol. 2, no. 4 (December 2002)

### Submitted Papers

- Georg M. Goerg, Elisha P. Merrian, CRS and Christopher Genovese, "Automatic Pattern Discovery Using Local Statistical Complexity", in revision

- Georg M. Goerg and CRS, "LICORS: Light Cone Reconstruction of States for Non-parametric Forecasting of Spatio-Temporal Systems", in revision, arxiv:1206.2398

- Daniel J. McDonald, CRS and Mark J. Schervish, "Time series forecasting: model evaluation and selection using nonparametric risk bounds", under review, arxiv:1212.0463

- George D. Montañez and CRS, "The LICORS Cabinet: Nonparametric Algorithms for Spatio-temporal Prediction", arix:1506.02686
- CRS, "Scaling and Hierarchy in Urban Economies", accepted pending revisions in *PLoS One*, arxiv:1102.4101
- CRS and Edward McFowland III, "Controlling for Latent Homophily in Social Networks through Inferring Latent Locations", arxiv:1607.06565

**Miscellaneous Manuscripts**

- CRS, Abigail Z. Jacobs, Kristina Lisa Klinkner and Aaron Clauset, "Adapting to Non-Stationarity with Growing Expert Ensembles", arxiv:1103.0949 (in revision)
- CRS and Cristopher Moore, "What Is a Macrostate? Subjective Observations and Objective Dynamics", arxiv:cond-mat/0303625 (in revision)
- Daniel J. McDonald, CRS and Mark Schervish, "Stationarity regularizes autoregressive models", arxiv:1103.0942
- Daniel J. McDonald, CRS and Mark Schervish, "Estimating VC Dimension for Risk Bounds", arxiv:1111.3404
- CRS, Kristina Lisa Klinkner and James P. Crutchfield, "An Algorithm for Pattern Discovery in Time Series" Technical Report, Santa Fe Institute, 2002-10-60, arxiv:cs.LG/0210025
- CRS, *Causal Architecture, Complexity and Self-Organization in Time Series and Cellular Automata*, Ph.D. Thesis, UW-Madison (2001), `http://bactra.org/thesis/`
- CRS, "Lecture Notes on Probability, Statistics and Stochastic Processes" (2000), `http://bactra.org/prob-notes/`.
- CRS, "Maximum Likelihood Estimation and Testing for $q$-Exponential Distributions", arxiv:math.ST/0701854
- CRS, "The Backwards Arrow of Time of the Coherently Bayesian Statistical Mechanic", arxiv:cond-mat/0410063
- CRS and David J. Albers, "Symbolic Dynamics for Discrete Adaptive Games", arxiv:cond-mat/0207407
- CRS and James P. Crutchfield, "Pattern Discovery and Computational Mechanics" (2000), cs.LG/0001027.
- CRS and William A. Tozier, "A Simple Model of the Evolution of Simple Models of Evolution" (1999), arxiv:nlin/9910002
- CRS, "Lecture Notes on Computational Mechanics" (1998), `http://bactra.org/comp-mech-lectures/`.

## Manuscripts in Preparation

- Dena Asta and CRS, "Separating Biological and Social Contagions in Social Media: The Case of Regional Flu Trends in Twitter"
- Dena Asta and CRS, "Consistent Maximum Likelihood Embedding of Networks in Continuous Latent Spaces"
- Henry Farrell and CRS, "Selection, Evolution, and Rational Choice Institutionalism"
- Georg M. Goerg, CRS and Larry Wasserman, "Lebesgue Smoothing"
- Daniel J. McDonald, CRS and Mark Schervish, "Risk Bounds for Time Series without Strong Mixing", in revision, arxiv:1106.0730
- CRS, *Advanced Data Analysis from an Elementary Point of View* (Cambridge University Press), `http://www.stat.cmu.edu/~cshalizi/ADAfaEPoV`
- CRS, "Bayesian Learning, Evolutionary Search, and Information Theory"
- CRS, "Do Not Adjust Your Receiver: Ego- and Alter- Centered Designs for Experimenting with Social Influence"
- CRS, "General Factors in Correlational Psychology: Artifacts and Myths"
- CRS, "Large Deviations in Exponential Families of Stochastic Automata"
- CRS, "Predictive Markovian Representations of Stochastic Processes"
- CRS, *Statistical Analysis of Complex Systems* (Cambridge University Press), `http://www.stat.cmu.edu/~cshalizi/stacs`
- CRS, Christopher Genovese and Andrew Thomas, "Network Comparisons"
- CRS with Aryeh (Leonid) Kontorovich, *Almost None of the Theory of Stochastic Processes*, `http://www.stat.cmu.edu/~cshalizi/almost-none`
- CRS, Lawrence Wang and Brian Karrer, "Nonparametric Graph Smoothing"
- Lawrence Wang and CRS, "Network Comparison by Sample Splitting"

### Teaching

**Classes**
**2005–**: Statistics Department, CMU. Courses taught (courses designed in bold): engineering statistics and quality control (36-220); **statistical computing** (36-350); modern regression (36-401); **undergraduate advanced data analysis** (36-402); **data mining** (old 36-350, new 36-462); **chaos, complexity, and inference** (old 36-462); undergraduate research (36-490); (graduate) **statistical network modeling** (36-720); graduate advanced data analysis (36-757); **advanced theory of stochastic processes** (36-754); **advanced network modeling** (36-781); foundations of statistical modeling (36-835); financial time series analysis (46-929); directed reading courses for graduate students and advanced undergraduates.

Adviser to one half ($\approx$ 40) of the undergraduates in the joint Economics-Statistics major (2010–2014)
**2012**: Lecturer, University of Warwick complexity science summer school.
**2000–2, 2005–6, 2010–11, 2013–15**: Lecturer, SFI Complex Systems Summer School
**1996**: Teaching assistant at UW-Madison for Psychology-Anthropology-Zoology-Neuroscience 619, "Biology of Mind", a writing-intensive interdisciplinary course on the biological foundations of behavior, cognition, and consciousness, and their evolution.
**1994–1997**: TA, Physics Department, UW-Madison. Taught discussion and lab sections for a range of introductory physics courses.

**Research Students**
UNDERGRADUATES: Jacob Usinowicz (2002); Jean-Baptiste Rouquier (2004); Akiko Takeda (2006); Shawn Mankad (2006–2008); Francis Keith (2007); Edward McFowland (2008); Abigail Jacobs (2010); Luis Marquina (2013); Jaclyn Wolf; Hannah Worrall; Max Kaplan
GRADUTE STUDENTS: Matthew Berryman (2004); Susan Buchman (Advanced Data Analysis project, 2005–2007); Justin Gross (ADA, 2006–2007); Stacey Ackermann-Alexeeff (2008–2009); Nathaniel Anozie (ADA, 2008); Raja Ahmad (ADA, 2008–2009); Georg Goerg (ADA, 2009–2010); Dena Asta (ADA, 2011–2012); Lawrence Wang (ADA, 2012); Michael Spece (ADA, 2012–2014); Francesca Matano (ADA, 2013–2015); George David Montañez (2012–); Lee Richardson (ADA, 2015–); Jessica Chemali; Alexander Loewi
THESIS COMMITTEES: Peiyi "Judy" Xi; Libo Xie; Sotirios Damouras; Jason Galyardt; Daniel Heinz; Ian McCulloh; Erich Huang; Di Liu; April Galyardt; Zhanwu Liu; Tracy Sweet; Edward McFowland; Zachary Kurtz; Xiaolin Yang; Lubov Zeifman; Rafael Izbicki; David Luke Oates; Brendan O'Connor; Zhen Tang; Leila Wehbe Michael Vespe; Samrachana Adhikari; Beau Dabbs; Seth Flaxman
THESIS SUPERVISOR: Linqiao Zhao (with Mark Schervish; defended, 2010); Justin Gross (with Stephen Fienberg and David Krackhardt; defended, 2009); Daniel McDonald (with Mark Schervish; defended, 2012); Georg Goerg (with Larry Wasserman; defended, 2012); Dena Asta (defended, 2015); Michael Spece; George David Montañez; Lawrence Wang (defended, 2016); Francesca Matano (with Valerie Ventura)

# Professional Activities

**Associate editor**: *Annals of Applied Statistics* (2008–).
**Editorial board**: *Structure and Dynamics: e-Journal of Anthropological and Related Sciences* (2005–).

**Reviewer** for *Advances in Complex Systems*; *American Sociological Review*; *Annals of Applied Statistics*; *Annals of Statistics*; *Artificial Life*; *Behavioral & Brain Sciences*; *Biometrika*; *Biosystems*; *British Journal for the Philosophy of Science*; *British Journal of Mathematical and Statistical Psychology*; Cambridge University Press; *Canadian Journal of Statistics*; *Chaos*; *Complexity*; *The Computer Journal*; CRC Press; *Econometrica*;

*Electronic Journal of Statistics*; *Empirical Economics*; *Entropy*; *European Physical Journal B*; *Europhysics Letters*; *Fluctuations and Noise Letters*; *Foundations of Physics*; *IEEE International Symposium on Information Theory*; *IEEE Transactions on Information Theory*; *IEEE Transactions on Neural Networks*; *IEEE Transactions on Signal Processing*; *IEEE Transactions on Systems, Man, and Cybernetics A*; *Inverse Problems*; International Colloquium on Automata, Languages and Programming; International Conference on Machine Learning (ICML); International Joint Conference on Neural Networks; *International Journal of Theoretical and Applied Finance*; International Parallel and Distributed Processing Symposium; *Journal of the American Statistical Association*; *Journal of the Association for Computing Machinery*; *Journal of Cellular Automata*; *Journal of Computational Neuroscience*; *Journal of Forecasting*; *Journal of Physics A*; *Journal of Statistical Mechanics: Theory and Experiment*; *Journal of Statistical Physics*; *Journal of Statistical Planning and Inference*; *Journal of Theoretical Biology*; *Journal of the Royal Society: Interface*; *Machine Learning*; *Mathematical Reviews*; *Medical Care*; MIT Press; *Nature*; *Network Science*; *Neural Computation*; Neural Information Processing (NIPS); Oxford University Press; Perseus Books, Advanced Books Program; *Philosophy of Science*; *Physica A*; *Physica D*; *Physical Review A*; *Physical Review E*; *Physical Review Letters*; *Physics Letters A*; *PLoS Computational Biology*; *PLoS ONE*; Princeton University Press; *Proceedings of the National Academy of Sciences* (USA); *Proceedings of the Royal Society* (London) *A*; *Psychological Review*; *Scandinavian Journal of Statistics*; *Science*; *Science Advances*; *Social Networks*; *Sociological Methods and Research*; *Statistical Science*; *Statistics and Computing*; *Statistics in Medicine*; *Statistics, Politics, and Policy*; University of Chicago Press; John Wiley and Sons; World Scientific Publishing; Yale University Press.

Outstanding Referee, American Physical Society, 2011

**Conference/workshop program committees**: Noise in Complex Systems and Stochastic Dynamics (2003–2005); Alife X (2006) main conference and workshop on Evolution of Complexity; European Conference on Complex Systems 2006; workshop on Statistical Network Analysis at 23rd International Conference on Machine Learning (ICML 2006); European Conference on Artificial Life (2007, 2011); AAAI Spring Symposium on Social Information Processing (2008); Statistical Methods for the Analysis of Network Data in Practice (2009); AAAI International Conference on Weblogs and Social Media (2010, 2011); AIStats (2011–); European Conference on Artificial Life (2011); WWW (2011–); International Conference on Social Informatics (SocInfo 2011–); AAAI Symposium 2012 on Social Networks and Social Contagion (SNSC 2012); Advances in Neural Information Processing (NIPS 2012–); Uncertainty in Artificial Intelligence (2013)

**Union activities**: Member of the Teaching Assistants Association at UW-Madison, 1994–2001; Natural Sciences area representative, 1995–1996; Physics Department steward, 1996–1997.

**Grant review**: Expert evaluator for the "Future and Emerging Technologies" program of the European Commission's research directorate, 2001–. Referee for the Technology Foundation STW (Dutch national technology research agency), 2003; for the National Environment Research Council (UK), 2004; for the Civilian Research and Development Foundation (US), 2004; for the National Science Foundation (US), 2007–; for the Institute for New Economic Thinking, 2010–.

**University service**: Statistics department senator, Carnegie Mellon University faculty organization, 2011–2013.

**Other professional service**: Science advisory board, Institute for Computational and Experimental Research in Mathematics, Brown University, 2014–.

## Workshops and Journal Special Issues Organized

- *Theory and Applications of Complex Networks*, IMS panel at the 2006 Joint Statistical Meeting. Seattle, 7 August 2006.
- *Order out of disorder: the role of noise in creative processes*, special issue of *Fluctuation and Noise Letters* (vol. 2, no. 4, December 2002), editor with Derek Abbott and P. C. W. Davies.
- *Collective Cognition: Mathematical Foundations of Distributed Intelligence*, co-chair with James P. Crutchfield, Kagan Tumer and David H. Wolpert. Santa Fe, 22–26 January 2002.
  Website: `http://www.santafe.edu/~dynlearn/colcog`.

## Invited Conference Talks

- "Nonparametric Network Smoothing", Workshop on Algorithms for Modern Massive Data Sets (MMDS 2016), Berkeley, 24 June 2016
- "Adaptive Forecasting of Non-Stationary, Heavy-Tailed Distributions", IARPA workshop on Socially-Impactful Rare Events, Tysons Corner, Virginia, 4 April 2016
- "What Do We Learn from ERGMs?", session on "Social Network Data: Challenges and Opportunities", ENAR, Baltimore, 17 March 2014
- "Comparing and Smoothing Networks", workshop on "Mathematics of Social Learning", Institute for Pure and Applied Mathematics, University of California-Los Angeles, 10 January 2014
- "Are Observational Studies of Social Contagion Doomed?", workshop on "Network Theory and Experiment", Simons Institute, University of California-Berkeley, 19 November 2013
- "When Can We Learn Network Models from Samples?", workshop on "Social Network Data: Collection and Analysis", SAMSI, 23 October 2013
- "Sample Sizes in Dependent Data Are Smaller Than They Appear", Atlantic Causal Inference Conference, Cambridge, Massachusetts, 21 May 2013
- "What Can We Learn about Social Influence from Observing Networks?", workshop on "Causality in Political Networks", University of Chicago, 10 May 2013

- "Challenges of Model Selection for Networks", workshop on "Structure, Statistical Inference, and Dynamics in Networks: From Graphs to Rich Data", Santa Fe Institute, 6–9 May 2013
- "Consistency under Sampling of Exponential-Family Random Graph Models", INFORMS Computer Society meeting, Santa Fe, 8 January 2013
- "Just How Hopeless Is Macroeconomic Forecasting?", workshop on machine learning and social science, CMU, 12 October 2012
- "Risk Bounds for Time Series Under Beta-Mixing", at 50th annual Allerton Conference on Communication, Control, and Computing, Monticello, Illinois, 2 October 2012
- "Maintaining Quality in the Face of Rapid Program Expansion" (with Rebecca Nugent), session on "Undergraduate Capstone and Research Courses", Joint Statistical Meeting, San Diego, 2 August 2012
- "Complexity, Prediction, and Inference", at "Foundations of Ockham's Razor" workshop, Carnegie Mellon University, 22 June 2012
- Discussant, "Uncertainty Quantification, Risk and Decision" workshop, Centre for the Analysis of Time Series, London School of Economics, 22–23 May 2012
- "Adapting to Non-Stationarity with Growing Predictor Ensembles", at "Aggregation, Inference and Rare Events in the Natural and Socio-Economic Sciences" workshop, University of Warwick, 17–18 May 2012
- Invited discussant, "Stability and the Generic Economic Model" workshop, Institute for New Economic Thinking, New York, 4 November 2011
- Discussant, "Sifting Fact from Fiction: The Role of Social Media in Conflict" workshop, United States Institute of Peace, Washington, D.C., 16 September 2011
- "Homophily, Contagion, Confounding: Pick Any Three", at "Statistical Inference for Complex Networks" workshop, Santa Fe Institute, 4 December 2008; "Methodology for Empirical Research on Social Interactions, Social Networks and Health II" workshop, Institute for Quantitative Social Science, Harvard University, 13–14 November 2009; "Analyzing Networks and Learning with Graphs", NIPS Workshop, Whistler, British Columbia, 11 December 2009; "Complex Networks" workshop, Statistical and Applied Mathematical Sciences Institute, Research Triangle, North Carolina, 29–30 August 2010; 2011 Atlantic Causal Inference Conference, University of Michigan, Ann Arbor, 19–20 May 2011
- "Bayesian Convergence under Dependence and Mis-Specification", at "Information Theory and Applications" conference, UC San Diego, La Jolla, California, 10 February 2011

- Discussant, "Blogs and Bullets: Social Media and the Struggle for Political Change" workshop, Center on Democracy, Development, and Rule of Law, Stanford University, Stanford, California, 24 February 2011
- "Markovian (and Conceivably Causal) Representations of Stochastic Processes", at Uncertainty in Artificial Intelligence 2010, Catalina Island, California, 9–11 July 2010; "Complexity and Statistics" workshop, Royal Statistical Society, London, 22 October 2010
- "Bayesian Learning, Relative Entropy, and Evolutionary Dynamics", at 48th annual Allerton Conference on Communication, Control, and Computing, Monticello, Illinois, 30 September–1 October 2010
- "When Your Friend Joey Jumps Off a Bridge, Why Do You Jump Too?", SciFoo 2010, Google, Mountainview, California, 30 July–1 August 2010
- Discussant, "Celebration of John Holland", University of Michigan, 30 September 2009
- Discussant, "Estimating Effects and Correlations in Neuroimaging Data" workshop, Columbia University, 15 July 2009
- Discussant, Formal Epistemology Workshop 2009, 18–21 June 2009, Pittsburgh
- "Selecting and Evaluating Stochastic Models", at "Statistical Inference for Complex Networks" workshop, Santa Fe Institute, 5 December 2008
- "Why Oh Why Can't We Have a Better Econophysics?", at "Is There a Physics of Society?" workshop, Santa Fe Institute, 10–12 January 2008
- "Beyond Scaling: Quantitative Complexity Measures", at "Complexity 2007" conference, University of Cambridge, 13–17 August 2007
- "Reconstructing Stochastic State Spaces from Discrete Time Series", at "Statistical Methods for Modeling Dynamical Systems" workshop, Montreal, 9–13 July 2007
- "Emergence and the Complexity of Prediction", at the Philosophy of Science 2006 conference, Vancouver, 2–5 November 2006
- "Optimal Nonlinear Prediction and Self-Organization", at 2nd "Emergent Organization in Complex Biomolecular Systems" (EMBIO) meeting, Vienna, 22 and 23 May 2006
- "Measuring Shared Information and Coordinated Activity in Stochastic Networks", at "New Pathways in Complex Systems", Santa Fe Institute, 26–30 July 2005
- "Emergence, Levels of Description, and the Complexity of Prediction", at CSIRO workshop "Does Anything Emerge?", Melbourne, 12–14 May 2005

- "Detecting Information Sharing and Coordination in Network Dynamics", at SFI workshop on "Robustness in Multiple Overlapping Networks", 19–26 April 2005
- "Symbolic Dynamics, Coarse-Graining, and Levels of Description in Statistical Physics and Cognitive Science", at "Symbol Grounding: Dynamical Systems Approaches to Language", Potsdam, 14–17 March 2005
- "Quantifying Self-Organization and Coherent Structures with Statistical Complexity", at "Nonlinearity, Stochasticity, Scaling, and Self-Organization in Space Plasmas" at the 2004 American Geophysical Union Fall Meeting, San Francisco, 14 December 2004
- "Blind Construction of Optimal Nonlinear Recursive Predictors for Discrete Sequences", at "Twentieth Conference on Uncertainty in Artificial Intelligence" (UAI 2004), Banff, 9–11 July 2004
- "Social Science and Complex Systems: A View from Ann Arbor" at "Exystence Thematic Institute on Complex Systems", École Normale Superiere de Lyon, 30 June 2003
- "Predicting Random Fields on Networks" at "Discrete Models for Complex Systems", ENS-Lyon, 16–19 June 2003
- "Model Averaging, Diversity and Evolutionary Dynamics" at "Science et Gastronomie 2003", ENS-Lyon, 9–13 June 2003
- "Quantifying Self-Organization in Cyclic Cellular Automata" at "Fluctuations and Noise 2003", Santa Fe, 1–4 June 2003
- Discussant, "Interdisciplinary Work in Progress" conference, Stanford Center for the Study of the Novel, Palo Alto, 4 May 2002
- "Computational Mechanics and Pattern Discovery", at the SFI/Max Planck Institute for Mathematics in the Sciences Joint Workshop on "Complexity Science in Eastern Europe/Complexity: Unifying Themes for the Sciences and New Frontiers for Mathematics", Leipzig, 14–18 May 2001

## Seminars and Other Talks

- "Nonparametric Network Comparison and Smoothing", statistics department seminar, University of Washington, 6 May 2016; joint statistics department / Center for the Study of Complex Systems seminar, University of Michigan, 4 December 2015
- "Homophily, Contagion, Confounding: Pick Any Three", Heinz College seminar, CMU, 12 October 2015; Dartmouth College Interdisciplinary Networks Research Group, 12 December 2014; University of North Carolina-Chapel Hill, 24 October 2013; University of Chicago computational social science

seminar, 13 May 2013; Duke University Network Analysis Center, 2 April 2013; Informatics Department/Complex Systems seminar, Indiana University at Bloomington, 27 November 2012; Methodology Center, Pennsylvania State University, 8 December 2011; Center for Complex Networks Research, Northeastern University, 12 May 2011; iLab Network Science Seminar, Carnegie Mellon University, 13 December 2010; Center for the Study of Complex Systems, University of Michigan, Ann Arbor, 7 December 2010; Complex Adaptive Behavior and Dynamics colloquium, Oxford University, 25 October 2010; Yahoo! Research, New York, 18 October 2010; Information Sciences Institute, USC, Marina Del Rey, California, 7 July 2010

- "When Bayesians Can't Handle the Truth", department of statistics, University of Rome "La Sapienza", 23 May 2014; Statistical Laboratory, Cambridge University, 1 February 2013; Statistics Department, Purdue University, 15 April 2011; Statistics Department, Harvard University, 4 April 2011; Statistics Department, Bristol University, Bristol, UK, 29 October 2010; Statistics Department, Columbia University, New York, 20 October 2010; statistics/economics/philosophy joint seminar, Virginia Tech, 18 March 2010;

- "Projective Structure and Parametric Inference in Exponential Families of Networks", Center for Complex Networks Research, Northeastern University, 22 May 2013; Statistics Department seminar, University of Pennsylvania, 5 December 2012; NYU Stern School statistics research seminar, 19 October 2012; Pittsburgh Area Networks Seminar, 11 April 2012; Statistics Seminar, University of Texas-Austin, 11 January 2012; Columbia University Applied Math, 3 November 2011; Probability and Statistics Seminar, Boston University, 22 September 2011

- "Nonparametric Prediction and Automatic Pattern Discovery in Spatiotemporal Data", Indiana University at Bloomington Statistics Department, 26 November 2012; Ohio State University Statistics Department, 1 November 2012; Center for Brain Imaging, New York University, 19 October 2012; Columbia University Applied Math, 18 October 2012

- "Nonparametric Risk Bounds for Time Series Forecasting", econometrics and statistics seminar, University of Chicago Booth School of Business, 17 November 2011

- "Markovian Representations of Stochastic Processes", machine learning seminar, Purdue University, 14 April 2011

- "Praxis and Ideology in Bayesian Statistics", Philosophy Department, Carnegie Mellon University, 20 January 2011

- "Complexity and Prediction in Neural Spike Trains", Applied Dynamics seminar, University of Maryland-College Park, 20 October 2011; Complex Systems Centre, Bristol University, 26 October 2010; Applied Mathematics Department, Columbia University, 19 October 2010

- "So, You Think You Have a Power Law", New York Machine Learning Meetup, 18 October 2010
- "Identifying Coherent Structures from Data", Chalmers University, Göteborg, Sweden, 27 November 2008
- "Statistical Tools for Complex Systems", UC San Diego/ UC Irvine/ UCLA complexity seminar, 16 May 2008
- "Discovering Functional Communities in Dynamical Networks", computer science seminar, University of Maryland - College Park, 17 April 2008; Center for Statistics and the Social Sciences, University of Washington-Seattle, 8 November 2006
- "Reconstructing State Spaces from Discrete Time Series", statistics seminar, Cornell University, 12 March 2008; Applied Mathematics Department, Columbia University, 2 October 2007
- "Quantifying Self-Organization and Coherent Structure", Physics Department, University at Albany, Albany, New York, 5 October 2007; Complexity Colloquium, University of North Carolina-Chapel Hill, 22 February 2006
- "Automatic Filters for the Detection of Coherent Structure in Spatiotemporal Systems", Center for Automated Learning and Discovery, Carnegie Mellon University, 29 November 2005
- "Coarse-graining, Symbolic Dynamics and Collective Coordinates: How Physicists Deal with Large, Complex Systems, and Why Cognitive Scientists Might Care", Institute for Research in Cognitive Science, University of Pennsylvania, Philadelphia, 1 April 2005
- "Automatic Identification of Coherent Structures in Cellular Automata", Max Planck Institute for Mathematics in the Sciences, Leipzig, 18 March 2005
- "Quantifying Self-Organization and Coherent Structures with Statistical Complexity", nonlinear dynamics and complex systems seminar, Physics Department, University of Illinois, Urbana-Champaign, 10 February 2005
- "Reconstructing Predictive Hidden-State Models from Time Series", Statistics Department, Carnegie Mellon University, Pittsburgh, 20 December 2004
- "Predicting Random Fields on Networks", Computer Science Department, University of California-Irvine, 10 December 2004
- "Building Predictive Hidden-State Models from Time Series", Department of Computing Science, University of Alberta, 16 November 2004
- "Shared Information and Coordinated Activity in Distributed Systems", Socio-Technical Infrastructure for Electronic Transactions seminar, School of Information, University of Michigan-Ann Arbor, 25 March 2004

- "Discovering Hidden Markov Models from Time Series", Applied Research Laboratory, Pennsylvania State University, 16 July 2003
- "Building Predictors from Time Series, with an Application to Networks", Center for the Study of Complex Systems, University of Michigan-Ann Arbor, 12 September 2002
- "Optimal Nonlinear Prediction and Filtering: A Thousand Household Uses", SFI Computational Economics Summer School, Santa Fe, July 2002
- "Causal Synchrony", DARPA TASK Program Meeting, Washington, D.C., 9 January 2002
- "Pattern Discovery Techniques for Social Science", SFI Computational Economics Summer School, Santa Fe, 20 July 2001
- "Pattern Discovery in Networks", presentation, 18 July 2001, Air Force Office of Scientific Research workshop "Infospherics: Science for Building Large-scale Global Information Systems", George Mason University, Fairfax, Virgina, 17–19 July 2001
- "Spatiotemporal Emergent Structures from Causal Architecture", Center for the Study of Complex Systems, University of Michigan-Ann Arbor, 22 March 2001
- "$\epsilon$-Transducers: Computational Mechanics of History-Dependent Transduction", SFI/Chinese Academy of Sciences (PRC) Working Group Meeting, Santa Fe, 15 August 2000
- "Computational Mechanics", Center for the Study of Complex Systems, University of Michigan-Ann Arbor, 16 December 1999
- "Unique Optimal Predictors for Stochastic Processes", UW-Madison Probability Seminar, 4 March 1999
- "You Call This Physics?", Graduate Student Mini-Colloquium, Physics Department, UW-Madison, 23 February 1999
- "Two Lectures on Computational Mechanics", in conjunction with the SFI Complex Systems Summer School, 18–19 June 1998
- "Uncovering Structure and Understanding How Nature Computes", University of Wisconsin-Madison Chaos and Complex Systems Seminar, 16 September 1997
- "Digital Boiling, and Other Exciting Things", UW-Madison C&CS Seminar, 29 April 1997
- "Is the Primordial Soup Done Yet? Quantifying Self-Organization, Especially in Cellular Automata", UW-Madison C&CS Seminar, 30 April 1996. Online at `http://bactra.org/Self-organization/soup-done/`

**Magazine Articles**

- "Turning Scientific Perplexity into Ordinary Statistical Uncertainty", *American Scientist* **100** (2012): 260 (review of D. R. Cox and C. A. Donnelly, *Principles of Applied Statistics*)
- (with H. Farrell), "Nudge No More", *New Scientist* **2837** (9 November 2011)
- "Connecting the Dots", *American Scientist* **99** (2011): 335 (review of D. Easley and J. Kleinberg, *Networks, Crowds, and Markets*)
- "Honor Among Thieves", *American Scientist* **99** (2011): 87 (review of K. Sigmund, *The Calculus of Selfishness*)
- "The Bootstrap", *American Scientist* **98** (2010): 186–190
- "Ready or Not", *American Scientist* **98** (2010): 160 (review of S. Hough, *Predicting the Unpredictable: The Tumultuous Science of Earthquake Prediction*)
- "Twilight of the Efficient Markets", *American Scientist* **97** (2009): 504 (review of J. Fox, *The Myth of the Rational Market*)
- "The Domestication of the Savage Mind", *American Scientist* **97** (2009): 244 (review of J. R. Flynn, *What Is Intelligence?*)
- "Obstacles and Tricks", *American Scientist* **97** (2009): 160 (review of T. Tao, *Structure and Randomness*)
- "The Logic of Diversity: The Complexity of a Controversial Concept", *Santa Fe Institute Bulletin*, **20:1** (2005): 34–38
- "The world is our laboratory: Myron Scholes and the history of finance", *Quantitative Finance*, **3:2** (2003): C20–C21.
- "Growth, Form, Function, and Crashes", *SFI Bulletin* **15:2** (2000): 6–11.
- "Modeling Markets", *SFI Bulletin*, **15:1** (2000): 10–15.
- "*Homo reciprocans*: Political Economy and Cultural Evolution", *SFI Bulletin*, **14:2** (1999): 16-20.
- "What Can Emergence Tell Us About Today's Eastern Europe?" *SFI Bulletin*, **14:1** (1999): 8–10.
- "Scientific Models: Claiming and Validating", *SFI Bulletin*, **13:2** (1998): 8–12.

**Book Reviews**

I have written over 160 book reviews, reviewing works on physics, complexity, mathematics, economics, cognition, statistics, philosophy of science, machine learning, evolutionary biology and literary theory. A complete list of my reviews, and their full text, are online at `http://bactra.org/reviews/`. Some of them have appeared in *American Scientist*, the *Bulletin of the London Mathematical Society*, *Physics Today*, and *Quantitative Finance*.

### Weblog

THREE-TOED SLOTH since 2003, `http://bactra.org/weblog/`, ranked one of the top fifty science weblogs by *Nature* (**442** [2006]: 9); and NOTEBOOKS, `http://bactra.org/notebooks/`, since 1994.