

APPLIED COMPLEXITY STUDIO OVERVIEW

Santa Fe Institute | Santa Fe, New Mexico

The **Santa Fe Institute Studio Workshop** offers firms, governments, and other ACtioN Members an opportunity to deeply explore the implications of complex systems theory on their work. The theories discussed, and the instructors involved, are selected to maximize their impact on challenges faced by the member. Studio participants are typically executive decision makers or senior scientists working on a particular problem or set of problems. The Santa Fe-based program is structured to enable participants to both:

- i. Develop a deep understanding of the selected complex systems tools and theories, and
- ii. Practice applying those tools and theories to the issues facing their organization.

The core content portion of the program lasts three days. The program is highly customizable, and the following sample agenda can be adjusted.

	Day One	Day Two	Day Three
Early Morning	Introduction to Complexity	Hike & Mountaintop Discussion (Miller Campus)	Content Area Three
Midmorning & Afternoon	Content Area One	Content Area Two	Wrap-up
Evening	Welcome Reception (Cowan Campus)	Canyon Road Art Tour & Dinner with Faculty	Depart Santa Fe

Each morning, two faculty present aspects of their research which are most relevant to the challenges facing the participants. These faculty presentations flow into a discussion focusing largely on the theory and ideas themselves. Mid-day, participants meet without the faculty to begin sketching how that morning's science applies to the challenges facing their organization. SFI staff with a background in complexity theory facilitate this initial portion of the discussion. Later in the afternoon, the faculty rejoin the group to continue the discussion on the application of the theories to the firm's challenges. On the first two nights, participants enjoy social activities and dinner with the faculty. The final afternoon will focus on solidifying the application of insights gleaned from earlier sessions.



Thaw House, Miller Campus



View from the Miller Campus in Tesuque, New Mexico

APPLIED COMPLEXITY STUDIO OVERVIEW

Santa Fe Institute | Santa Fe, New Mexico

CONTENT AREA COMPONENTS

Examples of past studio content areas include:

CONSTRAINTS ON INNOVATION

Understanding scientific progress and radical innovation helps leaders determine how their organization should adjust their innovation processes. However, it is often difficult to implement such changes. This session seeks to address ways in which human behavior influences an organization's innovation or research processes—as well as challenges an organizations faces during the transition from invention to patent. Particular attention will be paid to the role of groups and group dynamics in the innovation domain.

EVOLUTION OF SCIENCE IN SOCIETY

This session begins with a discussion of the tools used to analyze scientific progress in society. This leads to an introduction to techniques used to analyze ideas and their reception within society—false facts, first movers, open data. Particular emphasis will be made on situations in which scientific facts are rejected by large swaths of the population. The session concludes with a discussion of the future research landscape and the space of political and public opinion.

IMPLEMENTING ORGANIZATIONAL CHANGE

This session seeks to address ways in which human behavior influences an organization's innovation or research processes. Particular attention will be paid to: (i) the role of groups and group dynamics in the innovation domain, and (ii) insights from collective intelligence and organizational information processing.

NETWORKS & INDUSTRY

Innovation is increasingly distributed across a network of interconnected firms. This session focuses insights on the application of network theory to industrial innovation.

RADICAL INNOVATION

Non-trivial improvements can be obtained by exploring slight variations of current technologies or processes. However, the most significant improvements are often realized by experimenting with radically different technologies. This session examines the insights complex systems theory offers into both the processes by which radical innovation occurs, and the relationship between these innovations and the broader social-market system.

Other content areas have included:

COLLECTIVE PROBLEM SOLVING

ENVIRONMENTAL SYSTEMS & ECONOMIC SYSTEMS

PHYSICAL SYSTEMS & MENTAL MODELS

SOCIAL SYSTEMS

NATURAL & ARTIFICIAL INTELLIGENCE

REGULATION & THE LAW



Thaw library

APPLIED COMPLEXITY STUDIO OVERVIEW

Santa Fe Institute | Santa Fe, New Mexico

CULTURAL PROGRAM COMPONENTS

WELCOME RECEPTION

Weather permitting, participants join select SFI faculty, postdoctoral fellows, and staff for an outdoor reception on our stunning Cowan Campus portal. Following cocktails and dinner, participants have the option of enjoying a Bocce ball tournament with fellow attendees and SFI community members. In the event of inclement weather, dinner and cocktails will be moved inside to the Noyce Hall.

TESUQUE HIKE & MOUNTAINTOP DISCUSSION

Participants enjoy a mild 30 minute hike at SFI's beautiful Miller Campus in Tesuque. The hike includes a brief mountaintop discussion where participants regroup to hash-out ideas, discuss insights gleaned from earlier content days, and to build an action plan for what they hope to get out of the remaining sessions.

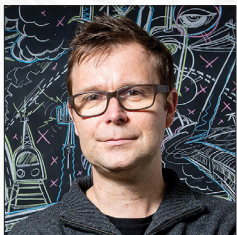
CANYON ROAD ART TOUR & DINNER WITH FACULTY

Participants enjoy a private after-hours Canyon Road art tour, which features three fabulous galleries, each of which highlights a different style of artwork. On the tour, participants have the opportunity to speak with the gallerists as they delve into the work on view. The tour concludes with a visit to a wind sculpture garden, followed by dinner with SFI faculty.

PAST FACULTY



Dr. W. Brian Arthur is an SFI External Professor. He is best known for his pioneering work on positive feedbacks or increasing returns in the economy—what happens when products that gain market share find it easier to gain further market share—and their role in locking markets into the domination of a single player. He holds degrees in operations research, economics, mathematics, and electrical engineering, and was awarded the inaugural Lagrange Prize in Complexity Science in 2008. Dr. Arthur was recently profiled in the magazine *Fast Company*, in which his article, “Increasing Returns and the New World of Business,” was referred to as *Harvard Business Review*’s “most influential article.”



Dr. Luís M. A. Bettencourt is the Pritzker Director of the Mansueto Institute for Urban Innovation at the University of Chicago. He is also a Professor of Ecology and Evolution at the University of Chicago and an SFI External Professor. He was trained as a theoretical physicist and obtained his Licenciatura from Instituto Superior Técnico (Lisbon, Portugal), and his Ph.D. from University of London, Imperial College, for research in statistical and high-energy physics models of the early Universe. He has held postdoctoral positions at the University of Heidelberg, Los Alamos National Laboratory, and MIT’s Center for Theoretical Physics.



Dr. Elizabeth Bruch is an Associate Professor of Sociology and Complex Systems at the University of Michigan. Prior to joining the faculty at Michigan in 2008, she was a postdoctoral scholar in the Robert Wood Johnson Health Policy Program. She earned a Ph.D. in Sociology and M.S. in Statistics from the University of California at Los Angeles. Bruch’s longstanding interest is in the quantitative study of human behavior and what it implies for larger scale social patterns and dynamics. Her research combines substantive knowledge of human behavior from cognitive science, marketing, and decision theory with statistical techniques and richly textured online activity data in an effort to understand the dynamic interplay between human behavior and the social environment.

APPLIED COMPLEXITY STUDIO OVERVIEW

Santa Fe Institute | Santa Fe, New Mexico



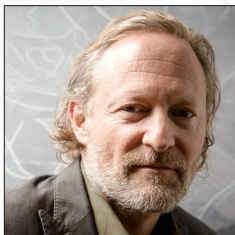
Dr. Simon DeDeo is an Assistant Professor at Carnegie Mellon University in the Department of Social and Decision Sciences, and an SFI External Professor. He is also affiliated with the Cognitive Science program at Indiana University, where he runs the Laboratory for Social Minds. For three years, from 2010 to 2013, he was an Omidyar Postdoctoral Fellow at SFI. He and his collaborators study how people use words and signals, and the ideas they represent, to create a world. They combine data from the contemporary world, archives from the deep past, statistical tools from cosmology, and models of human cognition from Bayesian reasoning and information theory to understand how cultures grow, flourish, innovate, and evolve. Dr. DeDeo holds an A.B. in astrophysics from Harvard, a M.S. in applied mathematics and theoretical physics from Cambridge University, and a Ph.D. in astrophysics from Princeton University.



Dr. Jessica Flack is a Resident Professor at SFI and the director of its Collective Computation Group, which draws on evolutionary theory, cognitive science, statistical mechanics, information theory, and theoretical computer science to study how adaptive systems use collective intelligence to find novel solutions to challenges. Dr. Flack was previously the founding director of the University of Wisconsin-Madison's Center for Complexity and Collective Computation in the Wisconsin Institutes for Discovery. Dr. Flack's research at SFI focuses on coarse-graining and collective computation in nature and their role in the evolution and development of social organization, new function, and new kinds of collectives. The approach is both theoretical and empirical, beginning with rich, fine-grained behavioral data, including network time series data gain from model systems in neuroscience, animal behavior, and human social systems.



Dr. Mirta Galesic is an SFI Resident Professor and holds the Cowan Chair in Human Social Dynamics at SFI. She is an Adjunct Researcher at the Center for Adaptive Behavior and Cognition at the Max Planck Institute for Human Development in Berlin. In one line of research, she investigates how apparent cognitive biases in social judgments emerge as a product of the interplay of well-adapted minds and the statistical structure of social environments. In another, she studies how different combinations of search, stop, and decision rules for social learning perform in different social network structures. A third line of research examines the origins of humans' uniquely profound cooperation. Dr. Galesic also studies risk and uncertainty in complex systems, in particular in financial, medical, and environmental domains. Related projects include developing a sampling framework for understanding uncertainty in environmental decisions, studying simple rules for financial decisions, and communicating medical risks to the general public by means of different information formats. She received the 2013 Jane Beattie Award for Innovation in Decision Research.



Dr. David Krakauer is the President of SFI and is the William H. Miller Professor of Complex Systems. His research focuses on the evolution of intelligence, from the Big Bang to brains. Dr. Krakauer is convinced that increasing our tolerance for experiment and failure, the sophistication of quantitative theory, and the careful analysis of data, all combined with a willingness to abandon our existing beliefs and practices when challenged by analysis, will transform society and culture for the better. A graduate of the University of London and Oxford University, he has authored more than 150 scientific publications, serves on several journal editorial boards, and works to bridge the gap between academia and business. Dr. Krakauer's vision drives SFI's non-disciplinary, information-rich environment aimed at addressing some of the world's most pressing problems. Dr. Krakauer has worked collaboratively with several business partners including Google, Boeing, Fidelity, and Intel. In 2012, he was included in *Wired* UK's "Smart List" as one of "50 people who will change the world."

APPLIED COMPLEXITY STUDIO OVERVIEW

Santa Fe Institute | Santa Fe, New Mexico



Dr. Dan Levinthal is the Reginald H. Jones Professor of Corporate Strategy at the Wharton School, University of Pennsylvania. He has published extensively on questions of organizational adaptation and industry evolution, particularly in the context of technological change. He is a past winner of the Strategic Management Society's Best Paper prize and, in addition to being a Fellow of the Strategic Management Society, he is a Fellow of the Academy of Management and has received the Distinguished Scholar Award from the Organization and Management Theory Division of the Academy. Dr. Levinthal previously served as Editor-in-Chief of *Organization Science* and as editor for

Business Strategy at *Management Science*. He has received an honorary doctorate from the University of Southern Denmark and has held visiting professorships at the Harvard Business School and the Santa Anna School of Advanced Studies.



Dr. José Lobo is an Associate Research Professor at Arizona State University (ASU). He is interested in determinants of metropolitan economic performance and location-specific economic growth; the application of machine learning, data mining and spatial statistics methods to the study of socioeconomic data; causes and consequences of urban size and scale; and how the characteristics of individuals, organizations, institutions and social networks interact to create "regions of innovation." Dr. Lobo has acted as a visiting researcher at SFI and Italy's Università di Modena e Reggio Emilia. Currently, he is on the faculty steering committee for ASU's Center for Social Dynamics and Complexity. Dr.

Lobo holds a Ph.D. from Cornell University.



Dr. Walter W. Powell is Professor of Education and (by courtesy) Sociology, Organizational Behavior, Management Science and Engineering, and Communication, and Co-Director of the Center on Philanthropy and Civil Society at Stanford University. He has been a member of the board of directors of the Social Science Research Council since 2000, and has been an SFI External Professor since 1999. Powell works in the areas of organization theory, economic sociology, and the sociology of science. He is interested in the processes through which knowledge is transferred across organizations, and the role of networks in facilitating or hindering innovation, and institutions in codifying ideas. His current work

focuses on the emergence of novel organizational forms. His latest book, *The Emergence of Organizations and Markets*, co-authored with John Padgett, was published by Princeton University Press in 2012. He received his Ph.D. in sociology from SUNY – Stony Brook in 1978, and previously taught at Yale, MIT, and the University of Arizona. He has received honorary degrees from Uppsala University, Copenhagen Business School, and the Helsinki School of Economics, and is a foreign member of the Swedish Royal Academy of Science.



Dr. Jessika Trancik is an Associate Professor of Energy Studies at the Massachusetts Institute of Technology. She is also an SFI External Professor. She received her B.S. in materials science and engineering from Cornell University and her Ph.D. in materials science from the University of Oxford as a Rhodes Scholar. Before MIT, she spent several years at SFI as an Omidyar Fellow, and at Columbia University as an Earth Institute Fellow, where her research focused on energy systems modeling. Her research group studies the dynamic costs and environmental impacts of energy technologies to inform technology design and policy. Dr. Trancik's research centers on evaluating the environmental impacts and costs

of energy technologies, and setting design targets to help accelerate the development of these technologies in the laboratory. This work involves assembling and analyzing expansive datasets and developing new quantitative models and theory. Projects focus on electricity and transportation, with an emphasis on solar energy conversion and storage technologies.

APPLIED COMPLEXITY STUDIO OVERVIEW

Santa Fe Institute | Santa Fe, New Mexico



Dr. Geoffrey West is a Distinguished Professor and former President of SFI. He received his BA from Cambridge University in 1961 and his doctorate from Stanford University in 1966, where he later returned to join the faculty. Dr. West is a theoretical physicist whose primary interests have been in fundamental questions ranging from elementary particles and their cosmological implications to universal scaling laws in biology and developing a quantitative science of cities, companies, and global sustainability. His work is motivated by the search for “simplicity underlying complexity.” His research includes metabolism, growth, aging and death, sleep, cancer and ecosystems, cities and companies, rates of growth and innovation, and the accelerating pace of life. He has been featured widely across the media including *The New York Times*, *The Economist*, *Financial Times*, *Wired*, *Scientific American*, *Nova*, *National Geographic*, and the BBC, and has given many lectures at high profile events such as Davos and TED. His public service includes serving on the Council of the World Economic Forum. His work was selected as a breakthrough idea by *Harvard Business Review* (2007) and he was named by *Time Magazine* as one of the “100 Most Influential People in the World” (2006).



Dr. Hyejin Youn Hyejin Youn is an Assistant Professor of Management & Organization Department at the Kellogg School of Management, and a core faculty at NICO, the Northwestern Institute on Complex Systems. She is also a Royal Society of Arts fellow, and an external fellow at London Mathematical Laboratory, London, UK. Prior to joining Kellogg, she worked at University of Oxford, Harvard University, and MIT Media Lab, and Santa Fe Institute, as a research fellow. Hyejin received her PhD in Physics in 2011 from Korea Advanced Institute of Science and Technology (KAIST). She was a Principal Investigator of the project a National Science Foundation grant (USA) to study Technological Change from the Map of Capabilities. Her research focuses on the intersection of scale, innovation, and network theories. She holds a Ph.D. in Statistical Physics from KAIST, and recently joined the faculty of Northwestern University’s Kellogg School of Management.

STUDIO ORGANIZER



Dr. Will Tracy is the Vice President for Applied Complexity at the Santa Fe Institute. His academic work lies at the intersection of complex systems and strategic management, with a focus on how boundedly-rational actors approach novel problems. Dr. Tracy came to SFI from Rensselaer Polytechnic Institute, where he was the undergraduate program director for the Lally School of Management and a faculty member. He was formerly the Associate Director of CSSS-Beijing, which was jointly administered by the Santa Fe Institute and the Institute of Theoretical Physics at the Chinese Academy of Sciences. Before entering academia, he was a Junior Professional Associate at the World Bank, where he focused on Eastern Europe and Central Asia. Dr. Tracy also has private sector and entrepreneurial experience in the US, China, and India. He holds a Ph.D. in management with a certificate in human complex systems from UCLA.

PRICING

To minimize the impact of the Studios on our faculty’s scientific research, we are currently running only four Studios per year. The standard fee for a Studio is \$175,000. If a firm desires a Studio with a structure significantly different from the above, pricing will be determined on a case-by-case basis.



SANTA FE INSTITUTE

1399 Hyde Park Road | Santa Fe, New Mexico 87501 | 505.984.8800