

# Parallax

Winter 2017

THE NEWSLETTER OF THE SANTA FE INSTITUTE



## SFI, JSMF fellows jam in first joint conference

SFI's hand-picked, tightly knit cohort of quantitatively trained postdoctoral fellows representing many disciplines might be a singular phenomenon in science. Equally as elite, multidisciplinary, and mathematically inclined, but currently less connected, are the James S. McDonnell Foundation (JSMF) Fellows, who are dispersed at academic institutions over the globe.

For five days in January, the two groups gather at SFI to seed collaborations on questions relating to complex systems. The first Postdocs in Complexity Conference is designed to grow participants' academic and professional networks, consolidate professional development, and introduce them to career opportunities, says Hilary Skolnik, program manager for SFI's postdoctoral fellows program.

As part of the mashup, participants will discuss overcoming obstacles in academia, collaborating across disciplines, and serving as science policy advisors. They will hear from top researchers in a number of fields, and rub elbows with members of SFI's Applied Complexity Network (ACtioN) to get a taste of how some companies and government agencies draw from complexity science to solve problems.

Getting the two elite groups together as a meta-community has long been a wish of SFI President David Krakauer and JSMF President Susan Fitzpatrick. The January meeting is the first activity under a new two-year JSMF grant provisioned to do just that. A follow-up conference will be held in July; by then, some of the budding collaborations may be ready to grow into more formal research projects.

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## 2017 'sherpas' lead 2018 intelligence research

If you are scaling a Himalayan peak, you're going to need sherpas. Renowned for their hardiness, expertise, and experience at high altitudes, sherpas forge ahead of the climbing party, scouting routes and dangers and emplacing essential equipment and rations.

This month at SFI, a small team of intellectual sherpas will meet over two days to scout the path ahead for future Institute research. They'll meet several more times this year, inviting in the experts needed to lay the groundwork for a robust research expedition starting in 2018.

The 2017 sherpa series is the first of a planned annual ritual intended to prepare for each successive year's SFI-wide research theme. For 2018, that theme is the complexity of intelligence, both natural and artificial.

"From the sensing capabilities of single cells to the perceptual and decision-making abilities of large populations of neurons, a defining feature of complex systems is their ability to encode, store, process, and employ functional information,"

says SFI President David Krakauer. "Intelligence is a property of the complex world, and in this small working group we are exploring the fascinating connections between natural and artificial intelligences."

In both manifestations of intelligence, representation, storage, and inference are shared across organically and culturally evolved intelligent systems, from spider webs to the world wide web, he says.

The theme raises a number of interesting questions:

- What are the species-specific and species-spanning forms of intelligence?
- How should we think about natural perceptual, motor, and analytical intelligence?
- Is there a general intelligence that supports all of these functions, or is intelligence modular in a fundamental sense?
- Which features of organic intelligence and its modules lend themselves to object- and

tool-based amplification and replacement?

- What novel forms of artificial intelligence can be derived from consideration of the full diversity of natural intelligences?

The sherpa meetings are designed to establish the research waypoints for later SFI working groups, pinpoint key challenges in the research space, and most important, identify experts with novel, intriguing, or radical ideas.

Krakauer and SFI Trustee Jim Rutt are coordinating the 2017 meetings with support from SFI Board Chair Emeritus Bill Miller's Miller Omega Program and Rutt's Proteus Foundation.

Each sherpa meeting is small (around 10-15 participants each), informal (prepared talks are passionately discouraged), and lively (strong opinions are appreciated), Krakauer says.

"Rather than being stunned to mental death by collisions with PowerPoint, this meeting is all about old-fashioned debating and its genuinely open-ended possibilities," he says. 🗨️

## What makes a terrorist, at every scale?

The scourge of political violence is as ancient as politics, but modern terrorism features a notable mark: citizens of one country supporting terrorism on behalf of another. How this violent radicalization occurs perplexes researchers from many disciplines.

At one level, the micro level, psychologists have analyzed historical, national, and socioeconomic factors among radicalized individuals to better understand what makes a terrorist. At a broader level, the meso scale, researchers have studied social networks and other structures to better

understand recruitment and organization.

Zooming out even further, to a macro scale, physicists and computer scientists have sought patterns in data about the severity and frequency of terrorist acts to determine if they follow statistical laws that would suggest a degree of predictability.

Yet researchers at these three levels—the micro, the meso, the macro—often work in silos, says SFI Professor Mirta Galesic. Her own research explores how people's beliefs influence—and are influenced by—their environments, giving rise

to complex social behavior.

She has helped organized an early March meeting at SFI to bring together scientists who have approached violent radicalization from radically different approaches. Her co-organizers include SFI External Professor Aaron Clauset (CU Boulder), SFI Omidyar Fellow Marion Dumas, and SFI Co-founder In Residence David Pines. Invitees to the working group will bring a range of expertise in fields ranging from forensic psychology to complexity theory.

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A case could be made that the fundamental challenge facing all societies is to solve problems arising from the mechanics of large scales. As SFI science has taught us, the nonlinear nature of scaling introduces many surprising features into our modern lives—from near-instantaneous global news to life-threatening pandemics.

The sociologist Emile Durkheim argued this way when he wrote that “The roles of art, morality, religion, political faith, science itself are not to repair organic exhaustion nor to provide sound functioning of the organs. All this supraphysical life is built and expanded not because of the demands of the cosmic environment but because of the demands of the social environment.”

The demands of the social environment arise through the need to coordinate large populations of self-interested individuals in possession of partial and often incompatible knowledge seeking fulfillment through exclusionary behaviors built upon weakly or defectively aligned incentives.

Another way to say all of this is that societies are complex largely as a result of their scale. Problems that might be resolved among friends and small communities become insuperable when they involve thousands, millions, or billions of independent actors. The population explosion is not only a resource challenge, it is a coordination problem.

The historical answer to the challenge of social cohesion has been the cultural evolution of institutions: monarchies, laws, currencies, movements, schools, governments, and technological platforms, all of which provide some means of coordination, consensus building, and efficient information diffusion.

Over the last several months we have been involved in a number of meetings that all orbit around the fundamental challenges of decentralized governance at scale. These conversations range from the efficient design of online education (MOOCs), the theory of institutional niche construction, the analysis of legal systems as operating systems for societies (LawOS), and the emergence of powerful technological platforms from Facebook and Uber to Blockchain. All of these institutions seek to short-circuit hierarchies and devolve powers away from consolidated centers towards dispersed organizations and individuals, and ideally to do so fairly, efficiently, and equitably.

It is evident that an important future role for complexity science in these social arenas is to provide key ideas, methods, and technologies for understanding and surviving the new world order of large-scale autonomous networks.

If the democratic phase of small human societies has been satisfied hitherto by the principles of central and national government, recent experience suggests that it is time to pursue, in parallel, humanistic and egalitarian principles that can work equally well in a distributed world at scale.

It would be a significant and noble ambition for SFI science to contribute to rethinking society along lines faithful to the increasingly complex organization of the modern world, and several of our recent meetings and discussions, portend a move in this direction.

— David Krakauer  
President, Santa Fe Institute

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## SFI IN THE NEWS

FastCompany on December 6 memorializes a 1996 *Harvard Business Review* article by SFI External Professor W. Brian Arthur (edited by SFI Trustee Cormac McCarthy) that popularized the theory of increasing returns in tech markets.

In our *CS Monitor* essay series, SFI Science Board member Molly Jahn asks whether a complex systems approach can help improve the agricultural practices and soil health on which our food systems depend.

In a November 14 *Bloomberg* article headlined “Why science couldn’t predict a Trump presidency,”

SFI External Professor Simon DeDeo explains how transparency and peer-review are necessary for good prediction models.

In a podcast interview on *The Technoskeptic*, SFI President David Krakauer parses complementary vs. competitive cognitive artifacts and shows how technologies and institutions can hijack human cognition.

A *Nature News & Views* piece on November 3 explores the implications of a paper by recent SFI researchers Sam Scarpino and Laurent Hébert-Dufresne suggesting that replacing sick workers

with healthy ones isn’t necessarily the best way to slow an epidemic.

A November 28 *CS Monitor* article about BMW’s new i3 model cites SFI External Professor Jessika Trancik’s study contradicting widespread consumer fears that electric vehicles’ single-charge ranges are insufficient.

In a November 22 *CS Monitor* article, Cormac McCarthy’s conversations with the scientists at SFI offer an example of some novelists’ disregard for intellectual borders. 📖

## Urban sprawl: If hunter-gatherers planned a city

Cities and towns since the dawn of agriculture sprawl with a common dependence on only a few key, and related, factors: population size versus space, and the costs of movement *vis a vis* the benefits of socioeconomic interactions.

These interrelationships result in familiar patterns of land use and densification that are apparent in cities today. On the other hand, even though some rival the population of a medium-sized modern village, large seasonal encampments of hunter-gatherers look vastly different.

Why?

Participants in an SFI working group in February will attempt to make sense of these two distinct patterns of settlement.

“We’re trying to understand how we went from hunter-gatherers to what we have today,” says anthropologist and SFI External Professor Scott Ortman (CU Boulder). He is co-organizing the meeting with José Lobo (Arizona State University), SFI Professor Luís Bettencourt, and Michael Smith (ASU).

“We are asking whether these observable changes in settlement patterns are the sign of a fundamental change in human sociality, the cusp between a foraging lifestyle and modern urbanism,” says Bettencourt.

The organizers’ “social reactor” hypothesis

proffers that the costs that escalate as people crowd together—such as conflict, transportation delays, and high prices—must be offset by the increased frequency of positive socioeconomic interactions. But this calculus seems not to apply to prehistoric or contemporary hunter-gatherers.

“Whether your neighbors live in lean-tos, teepees, or igloos,” Ortman says, “you will be looking at them across a distance that grows larger the

more people assemble together.”

Ortman says participants are going to hear from people who have experienced hunter-gatherers camps first-hand. The goal is to find new ways to identify possible societal transitions between a stable but basic foraging way of life to settlement systems.

“Where better to look than where people choose to ‘pitch their tents?’” Bettencourt says. 📖



Dallas, Texas

(Image: Andreas Praefcke)

## What is invention, and when does novelty persist?

Necessity might be the mother of invention, but not all of necessity’s offspring bear obvious likenesses. Superficially, the newfangled gadget for your smart phone seems pretty far removed from a bird species’ unique beak.

But underlying commonalities do exist across inventions in technology and biology—and in culture and economics too. That’s the hypothesis of a series of science meetings held at SFI over the last couple of years, all on the topic of invention.

SFI External Professor Manfred Laubichler and his Arizona State University colleague José Lobo want to take the next step in understanding the appearance and persistence of novelty in an April workshop, during which they hope to begin formalizing a general theory of invention.

This theory, they expect, would offer an overarching framework that encompasses evolutionary steps in biology and chemistry, technological breakthroughs, and cultural revolutions, Laubichler says. “At SFI, we are always looking to take qualitative insights and make quantifiable, predictive models,” he says.

To lay the groundwork for a model of invention, Laubichler and Lobo are inviting to their workshop a dozen researchers from biology, chemistry, physics, anthropology, engineering, and economics. Rather than featuring formal presentations, the three-day schedule will favor more freestyle discussion groups.

One primary goal is to provide a clearer understanding of genuinely new inventions. Research has shown that, across domains, truly

new ideas are rare. Most inventions are recombinations of past inventions. A smart phone, for example, is the merger of a telephone, a camera, and a data processor, among other core technologies.

A comprehensive theory of invention might isolate the conditions that spawn genuine novelty. And it might pinpoint the factors that determine which inventions survive and which get left by the wayside.

“The history of human development teaches us that it is certainly possible to engage in transformative change without an adequate theory guiding decisions,” Lobo says. “But having a good theory is necessary for adequately managing natural and social processes. So perhaps a theory of invention could help to facilitate and promote the many inventions needed to tackle the pressing problems our species faces.” 📖

## FROM THE EDITOR

It’s a privilege to do what I do—share the most creative, expansive, and promising science in the world *with* the world. Helping build an SFI science communications program these past 10 years has been a singular honor. This month I am moving on, to Arizona State University, but you are in good hands: longtime SFI communications pro Jenna Marshall shall take it from here. Thank you for being the planet’s greatest science enthusiasts.

— John German  
Director of Communications



## From offense to defense in ecology and politics

As online social networks grow, it gets easier to turn our own social circles into echo chambers of the like-minded or heated debates across ideological divides, as we please.

SFI researchers are asking not just what the consequences of this modularity are for political discourse, but also how political parties might use that knowledge strategically to alter the debate.

In typical SFI style, the research started with a conversation about something entirely different: the ecology of algae. The pursuit grew from a discussion between Laurent Hébert-Dufresne, a James S. McDonnell Fellow then at SFI, and SFI Omidyar Fellow Eric Libby about how species compete with each other for resources.

“It’s this very simple tradeoff between offense and defense: do you go after different resources or protect your own?” Hébert-Dufresne says. But it reminded him of voter

models: simple, physics-inspired formulations aimed at understanding competition between political parties.

In a typical voter model, people influence each others’ political preferences, but the social network connecting them never changes: not the most realistic assumption about how the real world works, Hébert-Dufresne says. Over the last year, he, Libby, and their collaborators have looked at what happens when they extend voter models to allow for adaptive networks.

Already they’ve had some surprising results. For example, in their models, in order for two parties to coexist, it turns out each party must aggressively try to convert the other party’s followers—that is, focus more on persuasion and less on consolidating support in echo chambers.

In a recent working group, Strategies in Adaptive Systems: From Life Cycles to Political

Campaigns, the team sought to expand their model even further to see what happens when parties can adjust their approaches on the fly, shifting back and forth from rallying the troops to converting others in response to changes in individuals’ views or the social network ties that bind them.

Doing so, Hébert-Dufresne hopes, could lead to some exciting new questions. For example: How do you start as a third party? Do you need more resources, or can you be smart and get by with less? And how would an upstart party’s strategy change with time?

“At the very least we want to mathematize the ideas,” he says, but the group also hopes to test the new models they develop and see how they fare in comparison with real-world data, such as those describing interactions among Twitter users. 📊

The meeting will feature lively “research jam sessions” in which small groups of postdocs convene for 90 minutes to informally discuss single but broad topics, such as the scaling of local governments in metropolitan areas and how human attitudes affect the spread of infectious diseases.

Participants will also have an opportunity to hear author and SFI Miller Scholar Neal Stephenson explore the intersection of science fiction and science fact and the limits of the imagination.

“Susan and I are optimistic about this meeting, where we get to jointly generate a critical mass of incredible talent in the field of complexity science, something that no university is currently equipped to accomplish, and which might in the long run have a significant impact on the research landscape,” says Krakauer. 📊

## How friends shape our thinking

If all your friends jumped off a bridge, would you? It’s a parental standby, but like most clichés, it rests on a basic truth: our social circles significantly influence our thoughts and behaviors.

For social scientists, unraveling friends’ true influence on us has been challenging: do we really know what our friends think, and how much sway do our friends hold relative to other factors?

Through a new online social circle research panel dubbed “SciFriends,” SFI Professor Mirta Galesic and her team are working to shed new light on these questions.

“Our behaviors are often influenced by what we think other people around us think,” Galesic says. “And even if we know that something else might be better for us, a lot of people will just do whatever their friends are doing. This panel is an attempt to measure that.”

Funded by an NSF grant, the research aims to attract participants with a diversity of socio-demographic characteristics, along with members of their personal networks.

By asking panelists about their own behaviors (like their health habits) and their beliefs about

how their friends behave, the team can study how subjective judgments participants make about their friends stack up against objective data collected from their social circles.

Planned studies include an exploration of the spread of new beliefs in social circles. For example, if people are given scientifically accurate information about the benefits of vaccination, will their willingness to accept this information depend on the heterogeneity of their social circles?

Data collected in the SciFriends pilot phase will help researchers from psychology, sociology, computational social science, and other fields build more coherent models of the cognitive processes underlying social judgments, but it’s only the start, Galesic says. The logical progression is to use SciFriends to learn more about the social mechanisms that perpetuate inequality in our society, she says.

“This work can illuminate how people’s social circles affect their aspirations, their inferences about what is normal, and their support for policies aimed at reducing societal inequality, in turn fostering behaviors that either fight or further reinforce inequality,” she says. 📊

## What drives social inequality?

No matter when or where they emerge, or how complex they are, human institutions tend to breed inequality. Somehow, some members of a social system manage to collect more for themselves while leaving others poorer.

A new project under SFI’s Dynamics of Wealth Inequality series aims to discover how a society’s networks influence its resource distribution.

“We still have difficulty understanding how institutions have produced such high levels of inequality and left poorer folks without support,” says Paul Hooper, a professor of biological anthropology at Emory University and a former SFI Omidyar Fellow.

He and five other SFI researchers have organized a longitudinal study to test predictions about how structures of social relationships affect the degree of wealth inequality. But their subjects are atypical.

“Much research has looked at historical cases or at modern societies like Sweden and the U.S.,” Hooper says. “We’re going outside of industrial market systems to work with hunter-gatherers, herders, and farmers to ask if some of the same principles might be playing similar roles” in these very different societies.

Two mechanisms stand out as possible drivers for inequality. The first is the bottleneck, where one person has exclusive access to important goods and can set their costs. The second is the collective bargaining model, similar to labor unions, in which people’s coordinated actions can help secure a deal for groups of people.



Herders tending their wealth in Mongolia (Image: Paul Hooper)

Some 30 scientists will gather in early February for the first of four workshops to design field methods for studies of small-scale societies around the world. These selected communities of up to 300 people each—cattle herders in Namibia, farmers in Guyana, and foragers in Siberia, for example—rely mostly on subsistence food production.

Through interviews with participants, researchers will identify and weight each social link—who’s connected to whom and how, by sharing food or helping, for example—as well as inventory household wealth in a way that renders this metric statistically comparable across countries and cultures. 📊

### RESEARCH NEWS BRIEFS



Section of the West Antarctic Ice Sheet ice core sample with a dark ash layer.

(Image Heidi Roop)

#### INFORMATION THEORY FOR INTERPRETING ICE CORES

Ice cores are tangible records of our planet’s climate history, but figuring out whether blips in the chemical data are evidence of human activity, weather events, or equipment malfunctions challenges scientists trying to interpret them. A research team led by SFI Omidyar Fellow Joshua Garland has proposed new, more sophisticated techniques that promise to improve these interpretations. Drawing from information theory and permutation entropy (essentially a measure of predictability), they examined anomalies in the sampling data from two ice cores, with several early, surprising results. Their paper appeared in *Advances in Intelligent Data Analysis XV*.

#### YOU MIGHT ALSO LIKE...BETTER ONLINE MATCHES

The internet is rife with recommendation systems suggesting movies you should watch or people you should date. But existing methods are often simplistic, matching people to a single type of item (e.g. science fiction movies) or groups of items to people, says physicist and computer scientist SFI Professor Christopher Moore. In *PNAS*, Moore and collaborators introduce a new method that allows individuals and items to belong to mixtures of multiple overlapping groups. It also predicts probability distributions of ratings based on the groups to which the person or item belongs. The researchers tested their improved model on real recommendation data for songs, movies, and romantic partners. In each case, their new model’s predicted ratings proved more accurate than those from existing systems.

#### A FRIEND OF A FRIEND MAKES FOR A DENSE NETWORK

It’s a familiar request in the digital age: one of your friends on social media has a friend who wants to be your friend. Frequent linking among friends of friends results in greater social network connectivity. A new theoretical model shows that networks evolve very differently depending on how often these “second neighbor” connections occur. The work could offer a better understanding of how dense networks form, says co-author Sid Redner, an SFI Professor. It might also offer a way to study the role of triangles and other “cliques” as information or diseases spread in a population. The work appeared recently in *Physical Review Letters*.

#### HOW ANIMALS MAKE DECISIONS

We know animals make many decisions related to improved evolutionary fitness—choices about finding shelter, food, and mates, for example—but we don’t know much about how they make those decisions. A recent paper in the journal *Trends in Ecology and Evolution* co-authored by SFI Omidyar Fellow Caitlin Stern suggests that a common tool used to study human psychology, the judgment and decision-making framework, can also be used to understand the components, or “cognitive phenotypes,” of animal decisions.

#### IN THE LONG RUN, GREEN VEHICLES ARE A VALUE

What’s keeping consumers from buying electric cars? SFI External Professor Jessika Trancik and her MIT colleagues are busting some pervasive myths about electric vehicles, such as “the battery will run out of juice” or “the technology is still too expensive.” In two recent studies in *Environmental Science and Technology* and *Nature Energy*, respectively, the Trancik team produced hard data showing that in the long run, electric vehicles are no more expensive than conventional cars and trucks, and that nearly all U.S. consumers’ driving behaviors can be accommodated on single battery charges.

## UPCOMING COMMUNITY EVENTS

**SFI Community Lecture, Christof Koch, Consciousness in Biological and Artificial Brains, Tuesday, January 24, 7:30 p.m., The Lencic Performing Arts Center (211 W. San Francisco Street).** When we feel cold or angry or see colors, that's consciousness. Humans have conscious experiences, and so do other animals. But can artificial brains like computers also be, or become, truly conscious? Christof Koch says digital brains will never be able to have experiences like humans, no matter how closely their software mimics the human brain. He will describe one leading theory—Integrated Information Theory—that offers an explanation about which physical systems can experience consciousness and which cannot, and why.

Koch is a physicist-turned-neurobiologist who is president and chief scientific officer of the Allen Institute for Brain Science in Seattle. His most recent book, *Consciousness: Confessions of a Romantic Reductionist*, summarizes the modern science of consciousness.

**SFI Community Lecture, Michael Kearns, Machine Learning and Social Norms, Tuesday, April 4, 7:30 p.m., The Lencic Performing Arts Center (211 W. San Francisco Street).** Algorithms, including those that can learn to predict from historical data, are making increasingly consequential decisions about the lives of individual citizens in domains as diverse as advertising, credit, employment, education, and criminal sentencing. This trend has been accompanied by increasing concern and alarm over potential erosions of privacy, fairness, transparency, and accountability. Recent research in machine learning seeks to quantify the extent to which such social norms can be embedded in these algorithms, and the tradeoffs presented with predictive accuracy and other measures of utility. Michael Kearns will describe some of these developments, with a focus on what it means for machine learning to be "fair."

Kearns is a professor in the Computer and Information Science Department at the University of Pennsylvania, where he holds the National Center Chair. He has secondary appointments in the Department of Economics, and in the departments of Statistics and Operations, Information, and Decisions in the Wharton School. He is the founding director of the Warren Center for Network and Data Sciences and the founding co-director of Penn Engineering's Networked and Social Systems Engineering Program. He is chief scientist of MANA Partners, a trading, technology, and asset management firm.

SFI's 2017 Community Lectures are made possible through the generous underwriting of Thornburg Investment Management, with additional support from The Lencic Performing Arts Center. Tickets are free, but reservations are required; to reserve tickets, visit <http://tickets.ticketssantafe.org>. Watch lectures live on SFI's YouTube page.

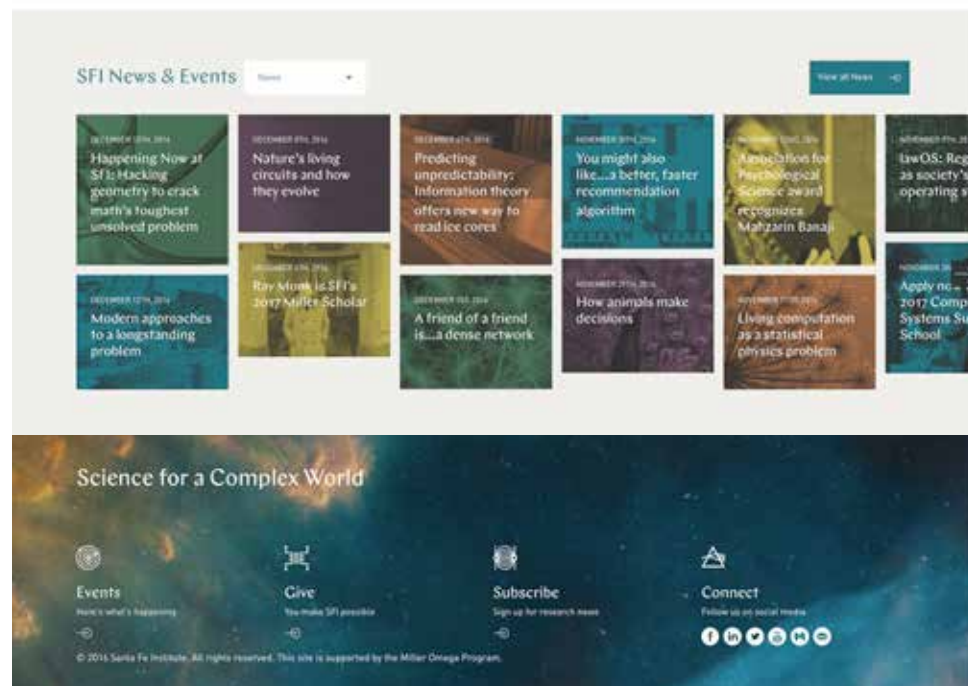
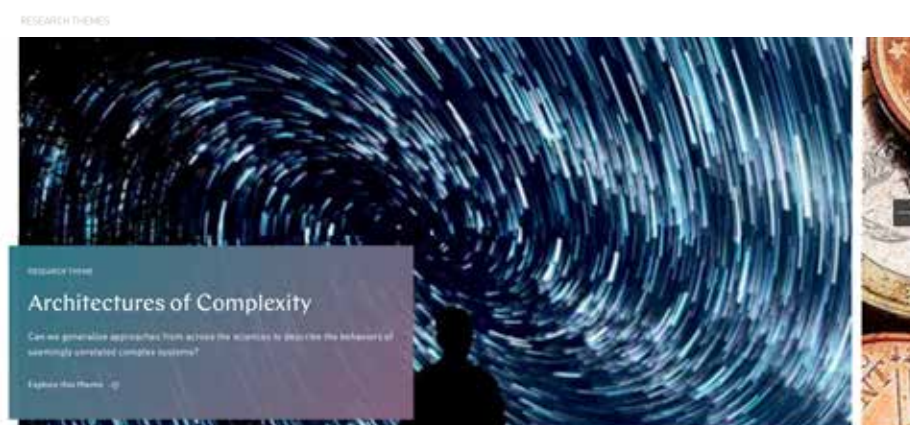
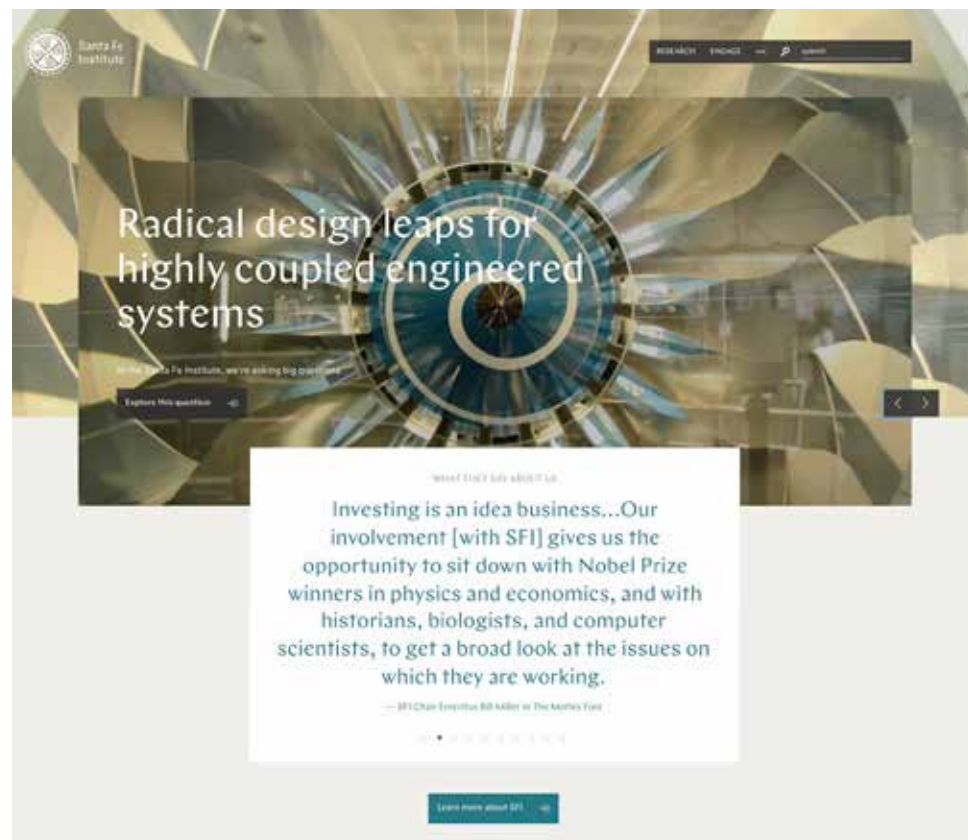
## SFI, JSMF fellows (cont. from page 1)

"It is really an unusual effort to bring together scientists who work in terrorism, who tackle different levels of this phenomena, and who rarely speak to each other," Galesic says. She anticipates some friction among the participants, but says that's a good thing. "I think we will all change how we think about the problem."

The meeting represents a first step toward a comprehensive framework of violent radicalization.

Ultimately, she says, the conversation will angle toward an underlying question: What are the implications for designing interventions to reduce the extent of radical violence? 🗨️

## SFI unveils redesigned website



The Institute recently launched its new website. Laura Egley Taylor, SFI's design coordinator, oversaw the project, working with SFI President David Krakauer, Institute faculty and staff, and Los Angeles-based design firm HAUS. The new site strives for a visually spare and elegant—and somewhat "runic"—design, with a content focus on big ideas in complexity science. "It is important that the style of the web conveys some essence of our mission and the inviting grandeur of the complex universe," says Krakauer. The Institute thanks SFI Board Chair Emeritus Bill Miller and the Miller Omega Program for its generous funding of this project. (Image: SFI's new homepage at [www.santafe.edu](http://www.santafe.edu))

## Ray Monk: SFI's 2017 Miller Scholar



Philosopher and biographer Ray Monk is SFI's Miller Scholar for 2017. He plans to reside at the Institute for four months from February-May.

The Miller Distinguished Scholarship is the most prestigious visiting appointment at SFI, awarded to highly accomplished, creative thinkers who make profound contributions to science, society, and culture. During their stays at SFI, Miller Scholars are encouraged to collaborate with researchers and may devote their time to scholarship on any topic.

In his award-winning biography *Ludwig Wittgenstein: The Duty of Genius*, Monk

chronicles Wittgenstein's life and relentless self-examination. Monk's other biographies include *Bertrand Russell: The Spirit of Solitude* and *Inside the Centre: The Life of J. Robert Oppenheimer*.

He will be the eighth Miller Scholar since SFI Board Chair Emeritus Bill Miller conceived and underwrote the scholarship in 2010. Monk follows author Laurence Gonzales (2016-2017), author Neal Stephenson (2016-2017), author Hampton Sides (2015), actor-author-playwright Sam Shepard (2012-2013), philosopher Rebecca Newberger Goldstein (2011-2012), philosopher Daniel Dennett (2010), and quantum mechanic Seth Lloyd (2010). 🗨️

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