



Update

January / February 2011



State of the Institute 2011: Jerry Sabloff on SFI's budget, science, and special responsibility to complexity science

At the turn of the new year, SFI President Jerry Sabloff gave the *Update* his thoughts on SFI's status and future.

Update: SFI had another tough budget year. In August you drastically cut expenditures, including salary reductions for SFI's people, and redoubled fundraising efforts. What does 2011 look like, and how is SFI adapting to what might be the new fiscal norm?

Jerry: Clearly 2010 was a tough budget year, not just for SFI but for all nonprofits. A host of issues, most notably the economy, led to many of our best philanthropic donors being more careful with their giving this year than in the past. By all accounts 2011 will be a tight year as well. We're hopeful some of the uncertainties will pass, particularly if the economy continues to improve, but there are still a lot of ifs. We'll have to wait and see.

We've gone through incredible belt tightening, and there is no fat in our current budget. The faculty, postdocs, and staff have been terrific in examining every dollar we spend and eliminating unnecessary costs. The science is going strong. But this austerity is only a short-term tactic to get us past this difficult time. If we want to keep SFI's character intact, our revenue base is the fundamental issue.

In particular we're looking for new sources to fund our research. Part of our research budget comes from grants from the National Science Foundation, but we need to be broader because NSF also has tight budgets. We're looking at the possibility of working with other government agencies, acknowledging that they too have tight budgets.

We also are looking at a much broader range of private foundations. This year, for example,

we have a new grant from the Rockefeller Foundation, and we are evaluating proposals relating to complexity science for the Templeton Foundation. And, of course, our Business Network is growing with the addition of the exploratory membership [see article on page 3]. We had a great set of meetings in 2010 and that is another area where we are looking for even more interaction.

Finally, we're looking at drastically revising our business model in some areas. Education is a good example, where Ginger Richardson is taking on the challenge I presented of finding ways education can be a break-even operation and, in the future, actually bringing in revenues. For the first time in 2011 we will be charging tuition to attend our very popular Complex Systems Summer School, but we'll reserve funds to offer scholarships to about one-third of the students.

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RESEARCH NEWS

Market simulations in high definition

A new National Science Foundation grant is allowing SFI researchers to model financial markets in greater detail than before, potentially helping uncover factors that have seemingly eluded investors and policymakers.

The recent economic crisis revealed how poorly economists understand dynamics of the economy. In some important models, for example, corporations and banks were assumed to have acted independently and without impact, but they actually exerted influences that collectively cause patterns.

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BUSINESS NETWORK NEWS

Healthcare as a complex system

Humana Inc. and SFI's Business Network are co-hosting a February meeting to focus on the latest developments in healthcare economics and new approaches to health and disease.

The percentage of the U.S. economy associated with healthcare is 16 percent and rising, says SFI VP for Administration Chris Wood, who manages the Business Network. Employee health and healthcare expenses have become major concerns of American businesses.

The meeting will examine the notion of health as the integrity of a complex system, improved medical intervention using social-network-based models of disease spread, behavioral economics and the paradox of incentives, and agent-based modeling approaches to large-scale economic models, among other topics.

Attendees also will have an opportunity to take part in a role-playing simulation, Humana's Health Economy Simulator, in which participants will develop a shared view of the health system and an understanding of the perspectives and interplay among key stakeholders. ■

RESEARCH NEWS

Having trouble saving for the future? It's only human

Saving for the future is difficult. Having a new car now always somehow seems more important than saving for a house later.

Now SFI External Professor Matthew Jackson (Stanford) and coauthor Leeat Yariv (Caltech) have shown that groups of people, from families to Congress, have the same problem, and there's almost no way around it.

We all would rather have a car, a vacation, or an ice cream cone today rather than tomorrow.

Economists call this discounting; we discount the value of something in the future because we are impatient, which, after all, counts for something.



(Image: Pavlen, istockphoto.com)

But things get interesting when time scales change: when you consider, say, the car in ten years versus the house in eleven years. Rational people, economists often assume, have time-consistent preferences. That is, they'll have the same preferences no matter how far into the future the relative payoffs are.

In reality, people don't have time-consistent preferences. People will say they want the house ten years from now, but as that decision

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LIT BITS

Complexity, the Santa Fe approach, and non-equilibrium economics; **W. Brian Arthur**; *History of Economic Ideas* 18 (2), 2010

Frugal and truthful auctions for vertex covers, flows, and cuts; Kempe, D.; Salek, M.; **Cris Moore**; *Proceedings of the 51st IEEE Symposium on the Foundations of Computer Science*, 2010

A novel family of plasmid-transferred anti-sense ncRNAs; Findeiss, S.; Schmidtke, C.; **Peter Stadler**; Bonas, U.; *RNA Biology* 7 (2), March-April 2010

A damage-mechanics model for fracture nucleation and propagation; Yakovlev, G.; Gran, J.D.; Turcotte, D.L.; **John Rundle**; Holliday, J.R.; Klein, W.; *Theoretical and Applied Fracture Mechanics* 53 (3), June 2010

Rationality and common knowledge; **Herbert Gintis**; *Rationality and Society* 22 (3), August 2010

Quantifying structure in networks; Olbrich, E.; Kahle, T.; Bertschinger, N.; **Nihat Ay**; **Jürgen Jost**; *Euro-pean Physical Journal B* 77 (2), September 2010

Intrinsic and designed computation: Information processing in dynamical systems beyond the digital hegemony; **Jim Crutchfield**; Ditto, W.L.; Sinha, S.; *Chaos* 20 (3), September 2010

Synchronization and control in intrinsic and designed computation: An information-theoretic analysis of competing models of stochastic computation; **Jim Crutchfield**; Ellison, C.J.; James, R.G.; Mahoney, J.R.; *Chaos* 20 (3), September 2010

Optimal causal inference: Estimating stored information and approximating causal architecture; Still, S.; **Jim Crutchfield**; Ellison, C.J.; *Chaos* 20 (3), September 2010

Genome size, self-organization, and DNA's dark matter; **Ricard Solé**; *Complexity* 16 (1), September-October 2010

Limitations of quantum coset states for graph isomorphism; Hallgren, S.; **Cris Moore**; Roetteler, M.; Russell, A.; Sen, P.; *Journal of the ACM*, October 2010

An application of queuing theory to SIS and SEIS epidemic models; Hernandez-Suarez, C.M.; **Carlos Castillo-Chavez**; Lopez, O.M.; Hernandez-Cuevas, K.; *Mathematical Biosciences and Engineering* 7 (4), October 2010

The Jerusalem game: Cultural evolution of the Golden Rule; **Jon Wilkins**; **Stefan Thurner**; *Advances in Complex Systems* 13 (5), October 2010

Measuring social dynamics in a massive multiplayer online game; Szell, M.; **Stefan Thurner**; *Social Networks* 32 (4), October 2010

How demography, life history, and kinship shape the evolution of genomic imprinting; **Jeremy Van Cleve**; **Marcus Feldman**; Lehmann, L.; *American Naturalist* 176 (4), October 2010

Spatiotemporal dynamics of the Clovis-Folsom transition; Collard, M.; Buchanan, B.; **Marcus Hamilton**; O'Brien, M.J.; *Journal of Archaeological Science* 37 (10), October 2010

Human APOBEC3G-mediated editing can promote HIV-1 sequence diversification and accelerate adaptation to selective pressure; Kim, E.Y.; **Tanmoy Bhattacharya**; Kunstman, K.; Swantek, P.; Koning, F.A.; Malim, M.H.; Wolinsky, S.M.; *Journal of Virology* 84 (19), October 2010

Transitions between male and female heterogamety caused by sex-antagonistic selection; **Sander van Doorn**; Kirkpatrick, M.; *Genetics* 186 (2), October 2010

Evolutionary bargaining with intentional idiosyncratic play; Naidu, S.; Hwang, S.H.; **Sam Bowles**; *Economic Letters* 109 (1), October 2010

Individualization as driving force of clustering phenomena in humans; Mas, M.; Flache, A.; **Dirk Helbing**; *PLoS Computational Biology* 6 (10), October 2010

Genetic signatures in the envelope glycoproteins of HIV-1 that associate with broadly neutralizing antibodies; Gnanakaran, S.; Daniels, M.G.; **Tanmoy**

Volunteer at SFI

SFI has many volunteer opportunities. Volunteers work alongside SFI staff and researchers to provide valuable assistance in an intellectually vigorous environment. If you are interested in volunteering at SFI, please contact volunteer coordinator Melissa Williams at volunteer@santafe.edu. ■

SFI BOOK NEWS

Ants, networks, diversity, and culture change



SFI and Princeton University Press recently published the first two volumes in their collaborative series "Primers in Complex Systems." The first, *Ant Encounters: Interaction Networks and Colony Behavior* by SFI Science Board Member Deborah Gordon, provides an accessible look into ant behavior from the complex systems perspective. The second volume, *Diversity and Complexity* by SFI External Professor Scott Page, shows how diversity makes fundamental contributions to system performance in complex adaptive systems. The series is intended for non-specialists at the advanced undergraduate level or above. SFI Professor John Miller is executive editor of the series.



SFI Omidyar Fellow Scott Ortman has won the Don D. and Catherine S. Fowler Prize in Anthropology for his book *Genes, Language, and Culture in Tewa Ethnogenesis*. The

book, based on his PhD dissertation, looks at two questions that have remained without consensus among archaeologists for almost a century: Why was the Mesa Verde region depopulated, and why did the Rio Grande Pueblos rise at about the same time? The Fowler Prize is awarded annually to one book-length, single-author manuscript in anthropology submitted for publication to the University of Utah Press. ■

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The *SFI Update* is published bi-monthly by the Institute to keep its community informed. Please send comments or questions to John German at jdg@santafe.edu.



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RESEARCH NEWS

Scientists + Google + Facebook = better climate modeling

Creating a comprehensive model of global climate change involves much more than mapping out and testing patterns in the world's forests, oceans, or atmosphere.

To learn about the complex way the earth is transforming, you need to build a dynamic planetary picture that includes policy decisions, human behavior, and technological strategies, according to SFI External Professor Jim Crutchfield, director of the Complexity Sciences Center at UC Davis.

But assembling a large-scale model that pulls all these facets together requires a massive amount of computer and brain power – not just from one place, but from all over the world.

And that's led Jim to look to Google and Facebook for network-enabled solutions, he says.

"Specialists are experts in their domains, but it's hard to get them to talk to each other and speak the same language," he says. "So one response is to explore technological tools that bring

people together. That brought me to Google. They love this kind of thing. A network-based collective modeling platform is exactly how Google thinks."



Google has immense technological strengths, and Jim has been collaborating with SFI Trustee Graham Spencer, Google's engineering director, on the project.

A key design element involves collective models geared at scientists and others that help them interact in ways similar to social networks like Facebook and the game Second Life, Jim says.

"Right now we're assessing what technology is out there and who's interested in working on it," Graham says. "It's a couple of years away, but in the end the system could really enable a conversation between many different sorts of experts." ■

> Markets in high definition continued from page 1

Another lesson has been the profound effects of leverage. Leverage, in which borrowed money is used to increase an individual's or company's investments, boosts gains and losses alike. It can drive economic growth, but only in healthy doses; too much leverage helped contribute to the crisis in 2008, and too little leverage has slowed the recovery. The various roles leverage plays in market swings and how they interact remain unclear.

These knowledge gaps prompted SFI researchers Stefan Thurner, Dooyne Farmer, and John Geanakoplos to model financial markets using a few major types of players. Their simulations included banks, traders, and investors and attempted to emulate real-world behavior, showing how greater leverage lowers prices and how feedback mechanisms emerge.

"Leverage is a classic example of something that creates nonlinear feedback loops – a central principle in complex systems," says Dooyne, an SFI Professor.

The new NSF grant (with SFI's Fabrizio Lillo) will let them expand their model. Its network of borrowers and lenders, with more choices for banks and investors, will offer insight into optimal leverage and uncover more network effects, Dooyne believes.

"This is an exciting chance to better understand what causes financial crises – a trillion-dollar problem – and shed light on generic problems in complex systems," he says. "Our dream would be to advise policymakers on how to set leverage to make the system work efficiently." ■

RESEARCH NEWS

Informing U.S. policy in the Middle East

An SFI working group in February will explore how data, examined through a complexity lens, might inform U.S. policy makers as they encourage long-term sustainable development in conflict-prone nations such as Afghanistan and Pakistan.

"Developing foreign policy is a very complex endeavor, and policy makers need more tools to lend focus to the challenges of sustainable development," says meeting organizer Bill Frej, a former United States Agency for International Development (USAID) mission director for Afghanistan who is spending a year as SFI's first Diplomat in Residence. "I think SFI and the academic community can be a positive force in looking at policy problems through a more scientific, evidence-based, responsible lens than in the past."

The February 23-25 meeting, "Frontiers of data analysis: Foreign policy as a complex system," brings together leading scholars and senior-level policy makers and practitioners from the U.S., Afghanistan, and Pakistan. SFI researchers will lead discussions about data analysis, collection, and potential application to policy issues.



Bill Frej

Participants will explore evidence-based approaches to sustaining development, preventing and countering insurgencies, building credible governments, defining and measuring success, and other topics.

While at SFI, Bill is working with researchers to explore the interface between science and national policy, especially relating to the Middle East. He is planning a second meeting for spring 2011 to examine the exploitation of natural resources in Afghanistan.

Watch him discuss his work in an online interview at www.santafe.edu/news. ■



SFI Diplomat in Residence Bill Frej kicks off SFI's 2011 Public Lecture series on Wednesday, March 2, with "Conflict to sustainable development: The complexities of a way forward in Afghanistan" (7:30 p.m., James A. Little Theater, Santa Fe). See the full 2011 SFI Public Lecture schedule on page 4.

LIT BITS

Bhattacharya; Lapedes, A.S.; Sethi, A.; Li, M.; Tang, H.L.; Greene, K.; Gao, H.M.; Haynes, B.F.; Cohen, M.S.; Shaw, G.M.; Seaman, M.S.; Kumar, A.; Gao, F.; Montefiori, D.C.; **Bette Korber;** *PLoS Computational Biology* 6 (10), October 2010

Current demographics suggest future energy supplies will be inadequate to slow human population growth; DeLong, J.P.; Burger, O.; **Marcus Hamilton;** *PLOS One* 5 (10), October 5, 2010

Better living through physics; **David Krakauer;** **Jessica Flack;** *Nature* 467 (7316), October 7, 2010

Cooperation, norms, and revolutions: A unified game-theoretical approach; **Dirk Helbing;** Johansson, A.; *PLOS One* 5 (10), October 12, 2010

The dynamics of risk perceptions and precautionary behavior in response to 2009 (H1N1) pandemic influenza; Ibuka, Y.; Chapman, G.B.; **Lauren Ancel Meyers;** Li, M.; Galvani, A.P.; *BMC Infectious Diseases* 10, October 14, 2010

Estimating time since infection in early homogeneous HIV-1 samples using a Poisson model; Giorgi, E.E.; Funkhouser, B.; Athreya, G.; **Alan Perelson;** **Bette Korber;** **Tanmoy Bhattacharya;** *BMC Bioinformatics* 11, October 25, 2010

Homicide in black and white; O'Flaherty, B.; **Rajiv Sethi;** *Journal of Urban Economics* 68 (3), November 2010

Extended analysis of hydroxyacetone in the torsional ground state; **Rogier Braakman;** Drouin, B.J.; Weaver, S.L.W.; Blake, G.A.; *Journal of Molecular Spectroscopy* 264 (1), November 2010

Credit cards and inflation; **John Geanakoplos;** Dubey, P.; *Games and Economic Behavior* 70 (2), November 2010

Resilience and rewiring of the passenger airline networks in the United States; Wuellner, D.R.; Roy, S.; **Raissa D'Souza;** *Physical Review E* 82 (5 pt 2), November 2, 2010

Urban scaling and its deviations: Revealing the structure of wealth, innovation, and crime across cities; **Luis Bettencourt;** Lobo, J.; Strumsky, D.; **Geoffrey West;** *PLoS One* 5 (11), November 10, 2010

Simple model of recovery dynamics after mass extinction; **Ricard Solé;** Saldana, J.; Montoya, J.M.; **Doug Erwin;** *Journal of Theoretical Biology* 267 (2), November 21, 2010

Visualization of graph products; Janicke, S.; Heine, C.; Hellmuth, M.; **Peter Stadler;** Scheuermann, G.; *IEEE Transactions on Visualization and Computer Graphics* 16 (6), November-December 2010

Response to "Big Macs and Eigenfactor scores: The correlation conundrum"; West, J.D.; Bergstrom, T.; **Carl Bergstrom;** *Journal of the American Society for Information Science and Technology* 61 (12), December 2010

Consequences of adaptive behaviour for the structure and dynamics of food webs; Valdovinos, F.S.; Ramos-Jiliberto, R.; Garay-Narvaez, L.; Urbani, P.; **Jennifer**

Dunne; *Ecology Letters* 13 (12), December 2010

Search for interstellar methoxyacetone and cyanoethanol: Insights into coupling of cyano- to methanol and ammonia chemistry; **Rogier Braakman;** Belloche, A.; Blake, G.A.; Menten, K.M.; *Astrophysical Journal* 724 (2), December 1, 2010

Diversity, competition, extinction: The ecophysics of language change; **Ricard Solé;** Corominas-Murtra, B.; Fortuny, J.; *Journal of the Royal Society Interface* 7 (53), December 6, 2010

Understanding hepatitis C viral dynamics with direct-acting antiviral agents due to the interplay between intracellular replication and cellular infection dynamics; Guedj, J.; **Avidan Neumann;** *Journal of Theoretical Biology* 267 (3), December 7, 2010

Your place or mine? A phylogenetic comparative analysis of marital residence in Indo-European and Austronesian societies; **Laura Fortunato;** Jordan, F.; *Philosophical Transactions of the Royal Society B-Biological Sciences* 365 (1559), December 12, 2010

> State of the Institute continued from page 1

In addition, following on the great success of Melanie Mitchell's short course on complexity, we're going to do more short courses for professionals and others interested in complexity science, in a number of venues.

For the future, we need to broaden our base of support and not be as reliant as we have been on a limited number of funding agencies or a limited number of individuals who have been particularly generous, so that a significant dip in one source will not be catastrophic to our work. We need to diversify. That's our adaptive strategy.

Update: You've said that despite the austerity, SFI's science has remained strong. How?

Jerry: That's right. Given the situation we're in, we're still functioning well. Our science has not suffered significantly. David Krakauer has found creative ways to bring sabbatical visitors here at little or no cost to us, and he's worked with people who are proposing workshops and working groups and finding ways to share the costs with them so that we can maintain the necessary level of collaboration. Still, if the same stringencies continue to hold, it will impact the number of workshops we can host and the number of workshops and working groups we can have in 2011. Over the long term, that could be a detriment to our science.



"I believe many of the problems we are just now beginning to worry about as a society...are going to result in a great deal of conflict."

Update: A few of SFI's research areas are just now gaining some traction. The economics and market risk work led by Doyme Farmer is, for example, beginning to turn the heads of a few mainstream economists in the wake of the financial crisis. That program has its roots in the Institute's earliest research interests. Other current SFI research areas have for many years attracted accomplished scientists who wanted to think freely about the big questions. As you look at the rest of SFI's research, are we now thinking about the right problems?

Jerry: At least some of them! Two other areas where we are seeing progress, not only in terms of the scientific research but also in terms of an emerging acknowledgement, is the work on urbanization and scaling led by Luis Bettencourt and Geoffrey West, and the work on conflict led by Jessica Flack. The growth of cities and all the problems that come with urbanization is going to be a key problem for humanity in the coming years, and the cities work is already having some outcomes that are very relevant to urban planning. Also, as an archaeologist, I believe many of the problems we are just now beginning to worry about as a society, those around resources and environmental stress for example, are going to result in a great deal of conflict. We've seen that in past human societies, and we will likely see it again. So understanding the nature of conflict and finding ways to manage it is going to become much more important.

Beyond those, there is a lot of other fantastic work going on at SFI in understanding cognition, the chemical origins of life, human behavior, ecological complexity, technological evolution, and many other areas too numerous to mention here. These are all interesting problems in their own right. They all require a transdisciplinary approach where the tools of physics, the natural sciences, history, the humanities, and the law come to bear on the underlying problems. Studying them in this way is giving us new insights and new perspectives and building our theoretical understandings of complex systems generally. And I have a sense that someday each of them will emerge as really significant societal concerns.

On a more pragmatic note, we have thought about many of these issues for a long time on a relative shoestring. I'd like to be able to bring in some more intellectual firepower – more researchers and more postdocs, and have access to more data – so that we can make indelible contributions to all of them.

Update: After 17 months as SFI's President, what do you see as the Institute's special role in the world?

Jerry: At the most basic level what complex systems science reveals is that some of the systems we rely on as human beings have very significant internal connectivities, and making them better is not a simple X leads to Y; that is, if you simply change X it may have all kinds of unanticipated and surprising system-wide changes that we might like or we might not, and so we better understand these systems better if we want them to work. I think our society needs to start thinking in terms of complex systems. We can see it clearly in all the recent discussions of the economy and the financial world, and we know complexities underlie many of the other systems we are concerned about – urbanization, ecology, climate, and conflict. I think it is important that SFI, as the locus of complex systems science, inform people of its significance and value, not only other scientists but also policy makers and the public.

So SFI is making and is in a position to make fundamental contributions to scientific theory and to society. If anything I'm even more impressed today by what SFI is doing than when I arrived. And I am confident that the SFI model has been successful and it is the right one – a small resident faculty core, an active postdoc influence, a superb group of external faculty and science board members, plenty of transdisciplinary collaboration, and an environment that is unfettered by the constraints of a university or government agency. This way of thinking, and of doing science, and of addressing complex systems has explanatory power across the realm of human experience. That is clear by the number of SFI-like institutions that have sprung up all over the world. But SFI is still the driving force behind complexity science, and we still have a long way to go to find the common principles underlying all complex systems. My own ambition is to build a foundation that maintains SFI as a special place and that enhances its ability to make even bigger contributions for at least another 25 years. ■

800 attend benefit Fair Game premiere

The November 5 Santa Fe premiere of *Fair Game*, a film portraying SFI's Valerie Plame Wilson and her experiences as a former CIA agent, included an after-screening panel discussion with Valerie, her husband Ambassador Joe Wilson (center), and director Doug Liman (right). Nearly 800 people attended the screening, a sellout at Santa Fe's Lentic Performing Arts Center. The event drew such dignitaries as actress Shirley MacLaine, then New Mexico Governor Bill Richardson, U.S. Senator Tom Udall, and Santa Fe Mayor David Coss. Proceeds benefited SFI and three other local nonprofits. The event was sponsored by the Thornburg Charitable Foundation; a reception was sponsored by the Collected Works book store in Santa Fe.



PEOPLE

Sam Shepard is SFI's third Miller Scholar

Actor-playwright-director Sam Shepard is the Institute's third Miller Scholar. He arrived at the Institute in late December and plans to conduct research and write at SFI intermittently through May.



us, and provide us with another unique perspective to think from."

Sam is author of several plays, short stories and essays, and memoirs, and he received the Pulitzer Prize for Drama in 1979 for his play *Buried Child*. He has played roles in more than 40 films, most notably his portrayal of pilot Chuck Yeager in *The Right Stuff*, which earned him an Academy Award nomination in 1983. He has directed several of his own plays.

Former Institute Board Chair Bill Miller underwrites the Miller Scholars program to bring to SFI high-profile intellectuals to catalyze cross-disciplinary interactions. SFI's first two Miller Scholars were Daniel Dennett, renowned philosopher of science, consciousness, and evolutionary theory, and Seth Lloyd of MIT, whose research centers on the interplay of information with complex systems, especially quantum systems. ■

SFI Faculty Chair David Krakauer says a diverse environment made up of thoughtful people from a variety of fields, including the sciences and the arts, is one reason the Institute is a source of intriguing ideas and tends to attract brilliant, interesting people.

"Good ideas rarely come when you're trying to have them," he says. "They come when you are out of your element, when you are thinking in new ways. Sam is a very accomplished, thoughtful person, and I know he will challenge

BUSINESS NETWORK NEWS

Cerelink is BNet's first exploratory member

SFI's Business Network has created a new Exploratory Membership category specifically designed for smaller companies, start-ups, and partnerships whose resources might not, in the past, have allowed full membership, says Chris Wood, SFI VP for Administration and Director of the Business Network.

For \$10,000 (a quarter of the full Business Network's annual membership fee) an Exploratory Member receives all BNet mailings and can send up to two participants each to two topical meetings and to SFI's annual meeting. After two years as an Exploratory Member, the company can choose full BNet membership or opt out.

"We think the Exploratory Membership helps give smaller companies a chance to participate and gauge whether membership is valuable to them," says Chris.

In November the Network welcomed its first exploratory member, Cerelink Inc. Cerelink President Rod Sanchez says the perspective a small business like his brings to an issue is different than that of a big company. He notes that his company is an example of small and



Rod Sanchez

large businesses innovating together in a way that influences an entire industry.

Cerelink, a Corrales, New Mexico-based cloud computing provider to the motion picture industry, recently supplied on-demand cloud computing server capacity located

in New Mexico to DreamWorks Animation for its rendering of two major animated pictures: *Shrek Forever After* and *How to Train Your Dragon*. The company now has contracts with several other major studios.

As Cerelink began to scale up quickly and fend off competition, Sanchez says, he "needed to think of ways to approach business with a more academic, methodological, analytical perspective."

Membership in BNet, Sanchez says, provides him with a "diverse set of insights and interaction with some of the world's most creative companies." ■

SFI IN THE NEWS

On November 10 *New Scientist* covered a recent study in which SFI External Professor Luis Bettencourt and Distinguished Professor Geoffrey West propose ditching traditional per capita measures of metropolitan areas in favor of more scientific metrics that take into account the natural advantages of larger cities.

In a November 12 *Science News* cover story offering an overview of quantum mechanics, the contributions of SFI Distinguished Fellow Murray Gell-Mann and External Professor James Hartle are featured.

SFI Professor Doyne Farmer and two SFI collaborators were featured in a November 30 *Wall Street Journal* article describing the search for new kinds of economic models.

The *Santa Fe New Mexican* on December 3 featured Project GUTS, an SFI education program that engages middle school students in science. The article was written by a student who participated in Project GUTS in 2007.

Several Bay Area newspapers covered a December 7 Thiel Foundation event at which Silicon Valley investors heard presentations from phil-

anthropic organizations, including SFI, who Peter Thiel believes are at the forefront of science and technology.

Miller-McCune magazine on December 13 featured former SFI Omidyar Fellow Aaron Clauset and his search for universal patterns hidden in human conflicts – patterns that he hopes might one day allow scientists to predict long-term terrorist threats.

In a December 16 *FastCompany.com* article, former SFI Omidyar Fellow Nathan Eagle is mentioned among the expert contributors to the Institute for the Future's 10-year forecast on the future of cities, information, and inclusion.

The December 17 *New York Times* magazine featured SFI Distinguished Professor Geoffrey West and his search for, with External Professor Luis Bettencourt, the hidden laws underlying the seeming chaos of cities. Ezra Klein also mentioned the work in his December 27 *Washington Post* blog.

Find these articles and more SFI news – and sign up to receive notifications via Twitter, Facebook, and RSS – at www.santafe.edu.

SFI's 2011 Public Lecture lineup

SFI's Public Lectures for 2011 will continue to explore the frontiers of complex systems science and its relevance to many of human society's most significant problems.

The series kicks off March 2 with SFI Diplomat in Residence Bill Frej on the complexities of sustainable development in Afghanistan.

All lectures are at the James A. Little Theater in Santa Fe and begin at 7:30 p.m.

The 2011 lineup includes:

- **Wednesday, March 2** - "Conflict to sustainable development: The complexities of a way forward in Afghanistan," SFI Diplomat in Residence Bill Frej, career minister in the United States Foreign Service and former USAID mission director in Afghanistan
- **Wednesday, April 13** - "Post-quantum cryptography," SFI Professor Cris Moore, professor of computer science, physics, and astronomy, University of New Mexico
- **Wednesday, May 18** - "Risk in financial

markets," Andrew Lo, Harris & Harris Group, professor in the MIT Sloan School of Management and director of the MIT Laboratory for Financial Engineering

- **Wednesday, June 29** - "Collective behavior: From cells to animals to us," Iain Couzin, assistant professor of ecology and evolutionary biology, Princeton University
- **Wednesday, August 17** - "The ecology of indoor environments," SFI External Professor Jessica Green, University of Oregon assistant professor, Center for Ecology and Evolutionary Biology, and director, Biology and the Built Environment Center
- **Tuesday, Wednesday, & Thursday, September 13, 14, & 15** - SFI's 2011 Ulam Memorial Lectures: "The emergence of intelligence on Earth," SFI Professor David Krakauer
- **Wednesday, October 12** - "Copyright in the digital age," Molly Van Houweling, faculty director, Berkeley Center for Law & Technology, UC Berkeley

DONOR PROFILE

Jenne Britell: SFI fosters a 'life of the mind'



Jenne Britell is Chairman of the Board of United Rentals, Inc., the world's largest equipment rental company. She is also a director of Crown Holdings, Inc., Quest Diagnostics, Inc., the U.S.

Russia Investment Fund, and the U.S. Russia Foundation for Entrepreneurship and the Rule of Law. In March 2010 she was named a senior managing director of Brock Capital Group LLC. She has held senior management positions at several major corporations and has served on many boards of directors. She was just named one of six Outstanding Directors of public companies for 2011 by the Outstanding Directors Exchange, a division of the *Financial Times*. Her thoughts follow:

Update: When did you first hear about SFI?

Britell: I've known about the Institute for years, but it really came to my attention just over a year ago when I sat next to SFI Science Board member Liz Bradley at the 10th anniversary of the Radcliffe Institute for Advanced Study. Liz told me about the research going on at SFI, the colloquia, the lectures that are open to the public, and I was intrigued. I later visited with SFI VP for Development Nancy Deutsch and got to meet some of the researchers and leadership.

Update: Why is SFI's work meaningful to you?

Britell: I have always been interested in a "life of the mind," and I think there is great opportunity for research that crosses disciplines. I know SFI doesn't use the word "applied" very often, but I think there is enormous potential to translate its work into outcomes that are good for civilization. In particular, I think the economics and risk work is important. Also, I started my career as a historian, so the historiography work that SFI Faculty Chair David Krakauer is doing is interesting to me. And I'm struck by the Institute's science and math education programs for young people. The more I learn about SFI, the more of its work I find fascinating.

Update: What are the most important contributions SFI can make?

Britell: The Institute attracts outstanding scholars from many different fields to work on a variety of problems, which is important in its own right. The knowledge we have today is a result of such thinking in the past. If we want society to move forward, we need to have places where a life of the mind flourishes. There are so many compelling needs and questions right now. Places like SFI must be supported. ■

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gets closer, many will end up buying the car. The researchers show that because a group's individual members will have differing levels of impatience, most groups also will have time-inconsistent preferences.

Matthew offers this example: A husband and wife must decide what to do with \$100. The wife prefers to save the money and collect interest, while the husband wants to spend the money now. If they make the decision today, the husband's strong preference ends up dominating. If they're only talking about what to do with the money in either ten or eleven years, however, the husband doesn't really care that much, so the wife's patience dominates. Even though the husband and wife

are rational, as a couple they make different decisions depending on whether it matters now or ten years in the future.

This problem, Matthew says, is endemic. Congress, for example, might vote one way today on a finance bill, but have a change of heart when faced with more immediate consequences in the future. Such results challenge how economists and political scientists model institutions like Congress or businesses, Matthew says.

Usually we simplify things, he says, by treating government as one particular agent that has well-defined objectives over time. "We should rethink this a little bit," he says. ■

SFI Online

Multimedia and supplementary content available at www.santafe.edu



Video: Why anthropologists should 'go public or perish'

In the distinguished lecture at the American Anthropological Association's 2010 annual meeting, SFI President Jerry Sabloff examines the importance of communication between anthropologists and their publics.



Video: SFI's promise to science & society

At a December 7 Thiel Foundation event highlighting the work of several cutting-edge scientific nonprofits, SFI VP for Administration Chris Wood gives Silicon Valley investors an overview of SFI's research, and its promise.



Video: The path forward in Afghanistan and Pakistan

SFI Diplomat in Residence Bill Frej describes his exploration of the interface between science and national policy, especially relating to Afghanistan, Pakistan, Iraq, and the Middle East.



Q&A: Statistical mechanics meets earthquake modeling

In an online Reuters interview, SFI External Professor John Rundle discusses his work to apply statistical mechanics to earthquake modeling.



Video: Why cities survive and companies die

In a Yahoo! Labs "Big Thinkers" presentation, SFI's Geoffrey West explains why cities survive and companies die.



Audio: Looking back on progress in quantum physics

A November 12 NPR Science Friday interview, *Science News* editor Tom Siegried highlights the contributions to quantum mechanics made by SFI Distinguished Fellow Murray Gell-Mann and External Professor James Hartle.



Q&A: Dispatches from the frontiers of complexity science

In an online interview with the Phi Beta Kappa Society, SFI External Professor Melanie Mitchell discusses complexity science, surprises from her research, and her award-winning book *Complexity: A Guided Tour*.



Video: Murray Gell-Mann on challenging accepted ideas

Nobel laureate and SFI Distinguished Fellow Murray Gell-Mann discusses the difficulties physicists had accepting his quark scheme in light of the prevailing ideas of the time.



Video: Moving to an intelligent, adaptive power grid

In an SFI seminar, Institute for Energy and Environmental Research President Arjun Makhijani reviews alternative energy sources and explores the promise and the technology of distributed generation delivered via an intelligent power grid.



Video: How debt collapses into financial black holes

In an SFI seminar, SFI Miller Scholar Seth Lloyd of MIT presents a simple statistical mechanical model of how financial systems become unstable due to debt and draws a parallel between the mathematical "collapse" conditions that give rise to both bankruptcy and black holes.

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