RESEARCH NEWS

Comparing worldviews across cultures and time

All human societies, past and present, have a belief system. Comparing these worldviews, or "cosmologies," across cultures may offer glimpses into universal human traits that help define individual cultures.

A September workshop at SFI, "Cosmology and Society in the Ancient Amerindian World," brought together researchers in several fields including astronomy, linguistics, physics, archaeology, and folklore to explore these universals and examine their adaptation value.

The meeting was co-organized by SFI Distinquished Fellow Murray Gell-Mann and External Professors George Gumerman and Linda Cordell, both with the School for Advanced Research, Archeology, and Anthropology.

A similar workshop was held at SFI two years ago, at which participants compared world views in prehistory societies of the southeastern and southwestern U.S. and Mesoamerica.

The goal for this year's workshop, George says, was to understand the processes that play roles in the evolution of cosmological principles. An edited volume is planned.

RESEARCH NEWS

Cracking the secrets of viruses

Recent research into the hepatitis C virus (HCV) and influenza has uncovered new challenges in understanding these common, and devastating, viruses.

SFI Science Board member and External Professor Alan Perelson, a viral dynamics modeler at Los Alamos National Lab, recently brought together at SFI a select group of theoreticians and experimentalists to discuss approaches to studying them.

The late-August workshop explored the roles and mechanisms of virus action and drug response. Type I interferon, for example, is an infection-fighting protein that, when applied therapeutically, works about half the time in HCV-infected patients. Why some people respond and others don't is an unresolved question, as is how to model human response when it varies so greatly.

Also discussed was how the antiviral drug Ribavirin works, and whether it acts similarly in fighting HCV, influenza, and polio. How resistance to new HCV antiviral drugs develops rapidly was examined as well.

The researchers asked whether lessons learned about one virus can be applied to another.

"I'm hoping the collaborations that were formed here will lead to better understanding and abilities to defend against these viruses," Alan says.
Distant language relationships: The current perspective; Murray Gell-Mann; Peiros, I.; Starostin, G.; Journal of Language Relationship 3

Intelligent data analysis of intelligent systems; David Krakauer; Jessica Flich; Simon Dedeo; Danny Farmer; Dan Rockmore; Advances in Intelligent Data Analysis IX; Proceedings 6065, 2010

Germicidal oxygen of eukaryotic RNAs; Biochimica et Biophysica Acta 1794, 9, 657-64; Kriván, T.; Engelhardt, J.; Prihaska, S.J.; Stajšek, S.; Peter Stadler; BMC Genomics 11, April 2010

Avoiding transcription factor competition at promoter engagement; Engelhardt, J.; Prohaska, S.J.; Steigele, S.; Bermudez-Santana, C.; Attolini, C.S.O.; Kirsten, T.; Farmer; Dan Rockmore

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RESEARCH NEWS

Seeking intelligence...and no biology allowed

Human beings are proof that intelligence is possible, but we don’t have a monopoly. Computers, although not on par with people for some tasks, compute even tricky chemical reactions. Computations. Perhaps that’s where we should be looking for intelligence: embodied in the world around us, says SFI External Professor Jim Crutchfield. “The paradigm we’ve come to associate with digital computing is very limited,” Jim says, “and there might very well be other kinds of biological, chemical, and physical intelligence that transcend this digital, discrete computation paradigm.” So he and SFI External Professor Arthur Hübner have set out to find it. They’ve just received a grant from DARPA to define, identify, and measure intelligence in physical systems. But they have a strict ground rule: “No biology is allowed,” says Jim. “No neurons, no cells, no human being, no subjective criteria like the Turing test.” Instead, they’re looking at structures like simulating dendritic trees, self-replicating RNA, and metal-organic frameworks. Furthermore, the intelligence they find must be rigorously measurable, Jim says. “The artificial intelligence model is ‘We know it when we see it.’ Our physical intelligence model is ‘We know it when we measure it.’”

RESEARCH NEWS

Workshop takes a fresh look at the peopling of the Americas

When the Last Glacial Maximum finally relaxed its grip on the planet, the vanishing glaciers from Beijing to British Columbia allowed people from Asia to trickle into a new world. The newcomers spread throughout North and South America, where they shaped their cultures around their environments over thousands of years. Much of what we know of these early times has been gleaned through modest data and theoretical tools. Today, recent advances in biology, language studies, and modeling, along with new archaeological finds, have prompted SFI to hold a workshop that takes a new look at the peopling of the Americas. “It’s high time there was a meeting,” says SFI Distinguished Fellow Murray Gell-Mann. Many aspects of how and when people arrived in the Americas are still debated, he says. For example, how strong is the evidence for cultures earlier than the Clovis culture of twelve and a half thousand years ago? Another example: If we look at the linguistic map of North America, the northernmost layer, Eskimo and Aleut, appears as the latest arrivals, preceded by a layer of “Na-Dene,” including Athabaskan and Tlingit. But who arrived just before that? The adjacent layer of “Aglac,” including Algonquian and related languages? Or is the layer approach too naive? The September 25-26 “Peopling of the Americas” workshop is co-organized by Murray, SFI External Professor David Krakauer (Alamos National Lab) and regular SFI visitor Ira Peiros. Participants will include geneticists, physical anthropologists, linguists, mythologist expert Yuri Berzinsh from the Russian Academy of Sciences, and many archaeologists. “It will be exciting to see what comes out of bringing together so many distinguished scholars from diverse disciplines to discuss our topic,” says Murray.

2010 Trustees, Business Network symposium to explore regulation

Regulation – the rules, constraints, limits, controls, tolerances, and preferences that keep life in balance – is a key component of most complex systems. Financial markets, for example, are regulated not only by formal rules such as business and tax laws, but also by implicit constraints such as the analyses, opinions, and moods of traders and major economic, social, and political events. Similarly, an ecosystem is regulated by a balance between the number of predators and prey.

SFI’s 2010 Business Network and Trustee Symposium November 11-13 will explore the roles of regulation in systems as diverse as the economy, the Internet, health care, biomedicine, space, biology, and international affairs.

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INSIDE SFI

ECOLOGY – SFI’s science and investment portfolio is increasingly vibrant and important, and the Institute’s budget is, at least for 2010, problem-free. In part, this is due to the Institute’s careful approach: In late July, following a line-by-line review of expected revenue and expenditures, Jerry announced to SFI’s researchers and staff a series of measures intended to make balancing the budget for 2010 more achievable.

Two shifts occurred that prompted the cutsbacks.

First, a number of SFI donors either lowered their giving amounts or, because of the economic uncertainty, adopted a wait-and-see approach before making their planned gifts for 2010. Although many of these donors might still give toward the end of the year, SFI cannot count on this revenue, he says.

Second, the amount of grant revenue coming in to SFI is less than expected; although the total number of new grants has risen, he says, the amount of funding per grant is down considerably. Jerry estimated to the Board that the amount of funding per grant is down for 2010 has been another tough year: for the Institute’s budget is, at least for 2010, problem-free. In part, this is due to the Institute’s careful approach: In late July, following a line-by-line review of expected revenue and expenditures, Jerry announced to SFI’s researchers and staff a series of measures intended to make balancing the budget for 2010 more achievable.

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The cutsbacks, effective August 1, included:

• Salary reductions (graded by salary level) of 5, 7.5, or 10 percent for all SFI researchers and staff for the remainder of the year
• Temporary suspension of SFI postdoc positions
• Temporary freeze on hiring
• Temporary freeze on new commitments for workshops, working groups, and visitors
• Belt tightening in all programs and projects

These measures save SFI approximately $850,000, says Jerry. As of September 1, additional savings and new gifts had lowered to about $312,000 the revenue-to-be-raised figure about $312,000 the revenue-to-be-raised figure.

Thursday, September 16, “Using Networks To Make Predictions”

Mark, a member of SFI’s Science Board, is a professor of physics and complex systems at the University of Michigan. He has studied networked systems ranging from sociology and economics to computer science and biology, contributed to the fundamental understanding of network science, and made computer models of many networks. His most recent book, Networks: An Introduction, was published in February 2009. The book is about the science of networks and its applications.

SFI’s Ulam Lecture series is named for Pol-


dish mathematician and Manhattan Project contributor Stanislaw Ulam (1909-1984). SFI Public Lectures are free and open to the public. They are supported in part by funding from Los Alamos National Bank.

10th Ulam Lectures: Why networks matter

On certain summer afternoons at SFI, a brave researcher enters a strange and very унrth, an untested notion yearning to breathe life, he says. “We had to undertake an unfortunate, but wise, approach of aggressive cost cutting across all segments of SFI.”

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"SFI views its role as ensuring that the highest quality inquiries describing rigorous, empirically grounded science are invited to submit full proposals," says SFI President Jerry Saltz.
A mammal is a mammal is a mammal

Despite 100 million years of evolutionary divergence, people, platypuses, and kangaroos all allocate the same proportional amount of energy to reproduction and offspring development, according to a recent study in Proceedings of the Royal Society B: Biological Sciences.

“This is more evidence that fundamental metabolic constraints underlie the development of wildly different mammals on different branches of the tree of life,” says SFI Postdoctoral Fellow Marcus Hamilton, the paper’s lead author.

The researchers compared data from three lineages of mammals: placentals (wombed mammals), marsupials (pouched mammals), and monotremes (egg-laying mammals).

Historically these groups diversified rapidly on different land masses as the supercontinent Pangaea fragmented and drifted apart – and each evolved conspicuously distinct reproductive and lifespan energy tradeoff strategies.

Marsupials, for example, are born sooner at a smaller size and are nurtured in the pouch. Placentals are born later and are nourished longer by lactation until they become independent.

The researchers find that despite their very different life histories and reproductive physiologies, all three groups of mammals produce new body mass at an equivalent and predictable rate. Their work supports the belief among a growing number of scientists that many properties of living things, such as life spans, growth rates, and reproductive capacities, change in predictable ways with organisms’ body sizes – a phenomenon known as allometric scaling.

Such scaling theories, based in part on past work by SFI External Professor Jim Brown, distinguished Professor Geoffrey West, and External Professor Brian Enquist, point to constraints imposed by a mammal’s metabolic processes. Essentially, the bigger the organism, the more slowly its transport networks (such as blood vessels) deliver resources to cells. Based on the size of the organism, resources can be delivered to cells efficiently but only so efficiently.

“Metabolic processes underlie the fundamental characteristics of mammalian life, and [our findings] add support to the notion that metabolism is to ecology as genetics is to evolution,” Hamilton says. “In essence, placental, marsupial, and monotreme mammals are simply evolutionarily equivalent ways of being a mammal.”

The paper’s co-authors are Ana Davidson of the Universidad Nacional Autonoma de Mexico, Richard Blyth at the University of Reading, and Jim Brown, SFI and the University of New Mexico.

INSIDE SFI

Music-science event to explore planets

For the second year, SFI and the Santa Fe Symphony Orchestra are collaborating to produce a unique event exploring the interface between science and music.

Voyages of Discovery: The Planets will feature the works of Claude Debussy (Nocturnes) and Gustav Holst (The Planets) and projection images of the solar system by Dr. Jose Francisco Salgado of Chicago’s Adler Planetarium.

The music will be interspersed with commentary by Salgado and SFI Omidyar Fellow Simon DeDeo, who will discuss exoplanets. The concert is October 31 at 4:00 p.m. at the Lensic Performing Arts Center in Santa Fe.

A cocktail buffet reception will follow at the Eldorado Hotel.

On October 30 at 4:00 p.m., the symphony will perform a one-hour version of the event just for children and families, called Voyages of Discovery: Family Adventure. Tickets for the concerts and the reception are available at the Symphony box office, at www.santasymphony.org, or at (505) 983-1414.

The concerts are underwritten by the Ralph B. Rogers Foundation, and the reception by SFI Trustee Diana MacArthur.

DONOR PROFILE

Q&A with Dr. Penelope Penland

Dr. Penelope Penland says her approach to her own work as a licensed psychologist trained in systems theory has become more reflective of complex issues since her association with the Institute. Ideas from SFI have informed her specializations – the psychology of money, philanthropy in particular, and estate planning.

Update: When and how did you first hear about SFI?

Penelope: I started attending SFI public lectures in 1991 and, by one particular evening, an Institute person – Susan Bellotti perhaps – made a request to the audience for financial underworld subjects for the series. Frankly, it had never occurred to me that support was needed. I thought it was very generous of SFI to offer those wonderful lectures to all of us for free, and I was motivated to respond. I’ve written at least one lecture every year since then, and it has been tremendously rewarding.

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

Penelope: SFI is coming up with better, more nuanced ways of looking at and understanding life and the world around us. I enjoy moving toward science – and different paradigms – and then taking ideas back to my chosen field of psychology to see how the different perspectives complement and illuminate each other.

BOOK NEWS

Networks, science, disease, & depopulation

A book co-authored by SFI External Professor Tim Kohler, Leaving Meso Verde: Peril and Change in the Thirteenth-Century Southwest (University of Arizona Press, July 28, 2010, 464 pages), presents views from anthropology about past epidemics, assesses today’s public health institutions, speculates about future outbreaks, and explores new ways of understanding them.

In a new book co-edited by SFI External Professor Alan Swedlund, Plagues and Epidemics: Infected Spaces Past and Present (Berg Publishers, April 2010, 416 pages), highlights the most important breakthroughs in network science from math, physics, computer and information sciences, biology, and the social sciences.

In Praise of Science: Curiosity, Understanding, and Progress (MIT Press, March 2010, 192 pages), SFI External Professor Sander Bais reveals the importance of natural sciences, explores what makes scientists tick, seeks to bridge the gaps between culture and science, and reviews science’s impact on the human condition.

In Shadows in the Valley: A Cultural History of Illness, Death, and Loss in New England, 1840–1916 (University of Massachusetts Press, April 2010, 272 pages), SFI External Professor Alan Swedlund examines the history of mortality in western Mass-