4UC Human Complex Systems Consortium

Complexity Science Conference

Saturday, March 08, 2008
UCLA Haines Hall 352

- Registration Fee: $15 (free for undergraduates), includes continental breakfast and lunch (vegetarian food will be available).
- Seating is limited. Reserve by email: jbragin@ucla.edu.
- To guarantee a place, mail a check made out to **UC Regents** by March 01 to: **John Bragin, UCLA 341 Haines Hall, Los Angeles, CA 90095-1553.**

Program:

09:00a: Continental Breakfast.

09:15a: Prologue: Dwight Read, Chair, UCLA Human Complex Systems.

09:30a: "The Domain of the Replicators: cultural evolution and the neutral theory". J Steven Lansing, University of Arizona, Anthropology & Santa Fe Institute.

Darwinian models of cultural evolution consist of three types. If culture affects biological evolution, then cultural evolution is the heritable non-genetic transmission of anything that affects the reproductive success of individuals. Alternatively, culture may be viewed as a domain apart from biology, which evolves by Darwinian selection. Finally, in models of gene-culture co-evolution, selection occurs in both culture and biology. Evolutionary game theory offers a mathematical foundation for understanding evolution in all three cases, and interest in this approach is growing. Proponents argue that game theory is the appropriate tool whenever the success of an individual depends upon others. An evolutionary dynamic is added by modeling selection with the replicator equation, which instantiates Fisher's Fundamental Theorem of Natural Selection (1930). But Fisher's Theorem became obsolete in genetics after the discovery of DNA and has been forgotten by most geneticists. Geneticists and ecologists now infer selection by showing departure from Kimura's null model of neutrality. Kimura's approach shifts the level of analysis from the fitness of individuals to the effects of selection at the population level.

A central tenet of human behavioral ecology holds that facultative behaviors, such as dominance, produce fitness effects that are subject to cultural selection. But evidence for such selection is indirect, based on short-term statistical associations between behavior and fertility. Kimura's neutral theory can be adapted to test for cultural selection in non-coding regions of DNA. Analyses of haplotype distributions defined by neutral microsatellites on the non-recombining Y-chromosome from 43 Indonesian communities show that differential selection among men is uncommon. Male dominance seldom translates into increased fertility over deep timescales, and short-term reproductive skew rarely produces long-term evolutionary benefits. The discovery that neutral processes explain most haplotype distributions in these communities parallels earlier results from the development of neutral theory in genetics and ecology.

J. Stephen Lansing is a professor of anthropology at the University of Arizona, with a joint appointment in Ecology and Evolutionary Biology. He is also a professor at the Santa Fe Institute, and director of Yayasan Somia Pretiwi, an Indonesian foundation promoting collaborative research on environmental problems in the tropics. Lansing chaired the anthropology department of the University of Southern California for five years and later became a professor in the School of Natural Resources & Environment and Department of Anthropology at the University of Michigan. He has been a Fulbright Fellow, a lecturer at Udayana University, and a Fellow at the Center for Advanced Study in the Behavioral Sciences at Stanford, and the Institutes for Advanced Study at Princeton and Durham University. Publications include *Evil in the Morning of the World: Phenomenological Approaches to a Balinese Community (1974), The Three Worlds of Bali (1983), Priests and Programmers: Technologies of Power in the Engineered Landscape of Bali (2nd revised edition 2007), The Balinese (1994)* and *Perfect Order: Recognizing Complexity in Bali (2006).* Documentary films include *The Three Worlds of Bali* (1981), The *Goddess and the Computer* (1988), and a segment of *The Sacred Balance (2003).* Recent publications are available at http://www.ic.arizona.edu/~lansing/home.htm

11:00: "Internet Traffic Classification and User Profiling: A Graph-Based Approach". Michalis Faloutsos, UCR, Computer Science.

Who uses the Internet? What kind of applications do we see? Can we detect attacks and viruses? Can we detect *when* a user is under attack? In this talk, we provide an overview of our work to answer these questions. More specifically, we address the problems of Internet traffic classification (for example, web applications, emails or viruses), and user profiling (for example, does the user participate in file-sharing?). We present a fundamentally different approach to classifying traffic according to the applications that generate them. Most previous approaches use statistics such as packet sizes and inter-packet delays. By contrast, our approach looks at the social behavior of users by modeling the interactions of the users as a graph. This kind of modeling gives rise to novel and powerful ways to: (a) visualize the traffic, (b) model the behavior of

applications, and (c) detect abnormalities, including attacks. Experimental validation suggests that our graph-based approach is very promising.

Michalis Faloutsos is a faculty member in the Computer Science Department at University of California, Riverside. He got his bachelor's degree at the National Technical University of Athens and his M.Sc. and Ph.D. at the University of Toronto. His interests include Internet protocols and measurements, peer-to-peer networks, network security, BGP routing, and *ad hoc* networks. Dr Faloutos is actively involved in the community as a reviewer and a TPC member in many conferences and journals. With his two brothers, he co-authored the paper on power laws of the Internet topology (SIGCOMM'99) which is one of the top ten most cited papers of 1999. His most recent work on peer-to-peer measurements has been widely cited in popular printed and electronic press such as *slashdot*, *ACM Electronic News*, *USA Today*, and *Wired*. Most recently he has focused on the classification of traffic and identification of abnormal network behavior. He also works in the area of Internet routing (BGP), and *ad hoc* networks routing, and network security, with emphasis on routing. http://www.cs.ucr.edu/~michalis/

12:15p: Lunch: Buffet in Haines Hall 352.

01:00p: "Gang Recruitment and Growth: A Cellular Automata and Directed Graph Approach to the Statistics of Gang Sizes". William I Newman, UCLA Earth & Space Sciences, Mathematics and Astronomy/Astrophysics.

Cellular automata models can be developed to describe the evolution of emergent dynamical systems that maintain a discrete character, including those with an implicit hierarchical character. Moreover, these models can be related to directed graphs. These methods have found widespread application in condensed matter physics (e.g., diffusion limited aggregation and crystal growth, sand piles and self-organized criticality) as well as in earth and environmental physics (e.g., models of earthquakes and river networks). In particular, models developed for forest fires are manifestly complex systems that show well-preserved scaling laws relating to the frequency of forest fires relative to their size. In sociological studies of conflict and deadly quarrels, similar statistical scaling laws have been observed, e.g., Richardson, with identical power-law indices. In earlier work, Gabrielov, Newman, and Turcotte (1999) succeeded in deriving from first principles those scaling laws. Here, we show that a simple redefinition of terms makes it possible for the statistics of gangs to be obtained from these other cellular automata models. In particular, by equivalencing the recruitment of gang members in the sociological problem with the planting of trees in the environmental problem, the observed statistics of gang populations and their prevalence can be derived.

William I. Newman, Ph. D. is Professor of Planetary Physics, Astronomy, and Mathematics at UCLA where he has been on the faculty since 1980. He is a John Simon Guggenheim Foundation Fellow (visiting both Cornell University and the U.S.S.R.

Academy of Sciences in 1987-88), the Stanislaw Ulam Distinguished Scholar in Nonlinear Studies at Los Alamos National Laboratory in 1990-91 and the Morris Belkin Visiting Professor in Computer Science and Applied Mathematics at the Weizmann Institute in Israel in 2000-01. His current research focuses on complexity theory and computational methods in application to problems in planetary physics (origins of terrestrial planetary atmospheres, and the dynamics of planetary orbits), astrophysical jets, geophysics (theoretical dynamics of earthquakes), and mathematical biology (branching networks and their role in physical and social systems).
http://www.ess.ucla.edu/faculty/newman/index.asp

02:30p: "The Sub-Prime Housing Financial Crisis: a human complex system phenomenon". Paul Jorion, UCLA Human Complex Systems Program.

Explanations of the *subprime* crisis typically combine partial explanations, illustrations, "speaking" analogies, etc. treading at different levels: from the "elementary particle" level where the consumer and the financial trader are acting, to that of the "field" level where entities such as "market distrust" or "credit crunch" are being invoked as observables. Understanding is assumed to derive unproblematically from such an impressionistic portrait where intuition is expected to fill the gaps of an overall explanation.

What is presented here is what aims to be instead a total explanation of the *subprime* crisis, connecting in an integrated whole the "particle" and "field" levels of the financial system which provides the economy with its bloodstream. The mechanics of the financial instruments involved in the process (*Asset-Backed Securities*; *Collateralized Debt Obligations*; *Asset-Backed Commercial Paper* and *Credit-Default Swaps*) is first presented: their anatomy and their physiology where the circulation of cash flows underlines their analogy with hydraulic systems regulated by *control structures*. Is then added to the picture, the human agents' interaction with them, their representations of these instruments' behavior - or lack of it – as models and their failed as well as successful attempts, based on these models, at correcting what they observe as the unintended consequences of these instruments.

Human models are shown to imply in most cases unwarranted assumptions about the feasibility of accurate forecasting. Adequate models typically favor homeostasis as they suggest ways for implementing corrective behavior or negative feedback while inadequate models typically encourage "herd behavior" or positive feedback leading to catastrophes. Positive feedback is however shown to be the leading dynamics of some core financial processes such as speculative pricing (i.e. pricing as an intrinsic dynamics severed from fundamentals); leverage (providing a multiplier to chances of gains and of losses) and derivatives (allowing to replicate the chances of gains and losses of an underlying instrument into a new "synthetic" one).

Crises within human institutions derive often from an incomplete understanding of the processes at work. The paper has therefore the pragmatic aim of providing means for countering future disasters within the financial system.

Paul Jorion is Doctor in the Social Sciences from the Free University Brussels. He holds MAs in sociology and social anthropology. He's lectured at the universities of Brussels, Cambridge, Paris VIII and at the University of California at Irvine. He was also a United Nations Officer (FAO), working on development projects in Africa. Heir of (among others) Luc de Heusch, Claude Lévi-Strauss, Sir Edmund Leach, Jacques Lacan and Georges-Théophile Guilbaud, his training in social anthropology has led him on various field trips, be it on the Island of Houat in Brittany or in West Africa. He is the author of several books, among which *Les pêcheurs de Houat* (Hermann: 1983), *La transmission des savoirs* (with Geneviève Delbos, Éditions de la Maison des Sciences de l'Homme: 1984*), Principes des systèmes intelligents* (Paris: Masson, 1990), Investing in a Post-Enron World (McGraw-Hill, 2003) and *Vers la crise du capitalisme américain?* (La Découverte 2007), as well as of many papers, published in particular in *L'Homme*. He's also an Associate of Behavioral and Brain Sciences (BBS) and one of the editors of Mathematical Anthropology and Cultural Theory. Since 1990, he has been working in the financial world, first as a Trader on Futures markets (Banque de l'Union Européenne, Paris) then as a pricing specialist in the mortgage and home equity industries (IndyMac, Pasadena; Wells Fargo, San Francisco; Countrywide, Calabasas).
http://www.pauljorion.com

03:45p: Epilogue: Doug White, UCI, Chair, 4UC Videoconference Series.

Convening Committee:
John Bragin UCLA, Dwight Read UCLA, and Doug White UCI.