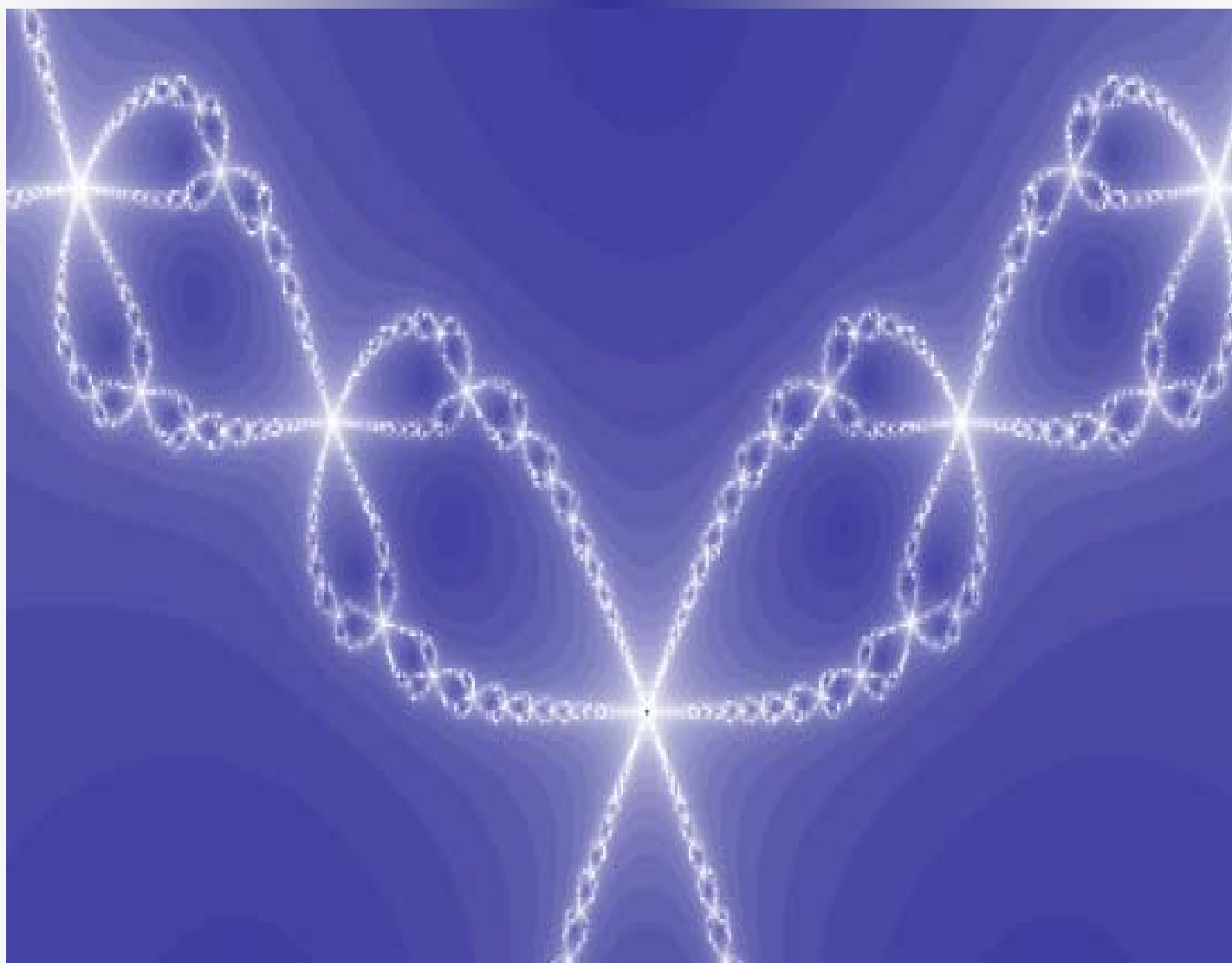


FORUM ON

COMPLEXITY AND ECONOMIC POLICY

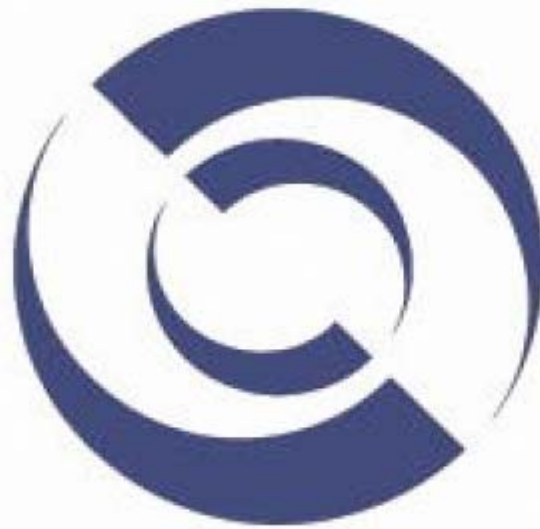
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Catalyst Institute for Applied Policy

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Welcome

to the [Catalyst Forum on Complexity and Economic Policy](#), our second Forum of a four part series exploring the nexus between complexity and public policy.

Policy instruments of the industrialized era are inadequate to the challenges we face in the globalized, 21st-century information age. New ways of defining problems and structuring solutions, as well as new forms of leadership are needed. An analytical framework uniquely suited to the highly-integrated nature of the modern world is offered by complexity science. The purpose of this Forum is to promote and assist in the migration of the concepts and techniques of this new science to the social sciences in general and to the analysis and formulation of public policy in particular.

Current rigorous applications of complexity science to social systems are, at best, embryonic. There are even those who question the legitimacy of the pursuit. Catalyst has assembled the leading thinkers in this field to examine the assumptions, and to engage in dialogue with you about the possibilities that might be unleashed by this new way of thinking. Complexity science is inherently collaborative, and our hope is to engender an ongoing, mutually beneficial exchange between you, the policy experts, and these and other complexity scientists so that we can cooperatively discern the way forward. Note that it is not our objective to create analogies or mine the romanced metaphors offered by complexity science (e.g. the butterfly effect); rather our objective is to enable the rigorous migration of the concepts and techniques offered by complexity science to the analysis of social systems.

We hope you enjoy the Forum, and use it as an opportunity to share your best thinking on your most difficult challenges.



Vision

The 21st Century is driven by complex systems. In particular, our social, economic, and political systems are highly complex. Complexity occurs when the mix of human activity becomes dense, and lines of causal interaction intersect at random, unpredicted, and/or uncontrolled points. From any given point, it is possible to determine in retrospect what has happened and why, but it is not possible to predict or control in advance what will happen because there are interactive dynamics in the system which are not explicitly defined, often not even seen.

The value of the complexity perspective is that it enables the analyst, protagonist, or change agent to view the system in terms of its component parts, and to assess possibilities in terms of the behavior of these parts. There is potentially infinite variety, and therefore significant creativity, involved in identifying the key system components that will make change possible. Artfully identifying and defining these components with vision and insight can release untold power and potential that did not previously exist. The objective of this process is to allow for the recombination of component parts in a manner that will support innovation. The best way to generate change is to build on what is. These system parts are the building blocks of what is. Combining them in new ways, forging new relationships, adding new perspectives or lines of communication, can allow resources to be used more effectively, and make cooperation possible that was heretofore not imagined. This is the role of Catalyst. Catalyst is a 21st Century solution to the challenges we face in this rapidly changing global milieu. It is the missing ingredient needed to trigger important changes in complex systems. As agents of change we bring to the table vision, established relationships, experience and expertise.

Mission

Catalyst's mission is to create a new intellectual space for the definition, analysis, and resolution of social issues. We are a group of experts in the functional fields of education, housing and community development, economic strategy, and public policy with years of experience in the operational techniques of business, government, academia, and non-profit organizations. More importantly, we employ an approach to systems analysis, problem solving, and development which is based on the system's possibilities, not on its limitations or its past performance. Our commitment is to assist in identifying, and then in creating the conditions necessary to realize those possibilities. Our techniques involve generating new partnerships and new ways of thinking, while building on what is, with the intention that solutions will be taken to scale. Our focus is on large systems to which the resources of government, business, foundations, and community institutions can cooperatively be brought to bare. Our problem solving techniques are derived from complexity science with the objective of demonstrating the applicability of these techniques to a wide range of systems, issues, and opportunities.



Methodology and Theory of Change

The overarching dynamic of modern complex systems is interaction. Today's problems are multi-dimensional and inter-disciplinary. They operate primarily in the interstitial spaces of organizational and institutional intent. Organizations sacrifice breadth and depth of influence for effectiveness and control. This often leads to silos of operations that exhibit a serious mismatch not only between the organization and the environment within which it must operate, but also between the organization and the true nature of the issue or problem it is designed to address. Further, such organizations and institutions find it difficult to adjust in a timely fashion to the new circumstances generated by the constant change typical of our fast paced, information- driven, technological society.

These circumstances are particularly challenging under the conditions of complexity created by today's global, open-architecture systems. Straight line, cause and effect methodologies fail to accommodate the externalities generated by the unimaginable maze of possibilities created by crossing, overlapping, intermingling and outright canceling out of causal lines put in motion by traditional intervention strategies. There is no question that focused straight line strategies have produced remarkable results for humanity in their time; however, leaving aside issues of political intent and resources availability, still our lack of understanding of the behavior of complex systems has ushered us into the 21st century with an antiquated system of public education, environmental pollution, increasing disparities along racial and economic divides, and a disintegrating commonweal. One of the reasons why traditional interventions are ineffective is that outcomes are more a function of system interactions than of intervention design.



Catalyst has evolved an agent-based applied policy strategy that allows the problem to speak for itself, is interactive and evolutionary, forms partnerships and engages stakeholders, and builds on what is.

Catalyst views society as a complex system with its many parts woven together in an intricate network of relationships, beliefs, behaviors, needs and resources that portend infinite possibilities. The particular present manifestation of its many possibilities is at once magnificent and problematic. Our intention is to so engage with its institutions as to shift it to a manifestation that is more magnificent than problematic and closer to the Pareto optimum that we all know is available to us, even within current resource constraints.

Forum Program

11:30 Claudia Pharis, Catalyst Chair and CEO

WELCOME

11:45 Dr. Brian Arthur, Santa Fe Institute

NON-EQUILIBRIUM ECONOMICS

After two hundred years of studying equilibria—patterns of consistency that call for no further behavioral adjustments—economists are beginning to study the economy out of equilibrium. This new way of doing economics is being birthed from the complexity approach to economics and from agent-based modeling. It is not in competition with equilibrium theory, nor is it a minor adjunct to the standard economic theory. It is economics done in a more general, non-equilibrium way; and within it, standard equilibrium economics becomes a special case. When viewed out of equilibrium, the economy reveals itself not as deterministic, predictable and mechanistic; but as process-dependent, organic and evolving. Economic patterns sometimes simplify into a simple equilibria of standard economics. But often they do not. Often they are ever-changing, showing perpetually novel behavior and complex characteristics.

ISSUE PANEL

12:45 Dr. Rob Axtell, Santa Fe Institute
Moderator

1:00 Dr. Scott E. Page, Santa Fe Institute

THINKING DIFFERENT: A LOGIC OF DIVERSITY'S BENEFITS

In a complex adaptive system, diversity often drives innovation. In the neoclassical paradigm, which highlights uncertainty, diversity provides insurance through a portfolio effect, but in a complex adaptive system, the benefits of diversity can be super additive. Thus, productive economic, political, and social systems must produce diversity to remain vital. However, too much diversity can spell trouble by preventing the system from exploiting innovations.

1:45 Dr. Herbert Gintis, Santa Fe Institute

COMPLEXITY ECONOMICS EXPLAINS THE WELFARE STATE

Support for and opposition to the welfare state in the advanced economies has been widely misunderstood by economists and political scientists who base their model of human action on an empirically implausible theory of selfish human motivation often summarized by the term *Homo economicus*. Behavioral game theory reveals dimensions of human motivation that are difficult to explain in terms of self-interest. One of these is strong reciprocity, a predisposition to cooperate with others, and to punish those who defect, at personal cost, even when these

Presenter Bios



Brian Arthur is External Professor at the Santa Fe Institute, and Visiting Researcher in the Intelligent Systems Lab at PARC. He is best known for his pioneering theoretical work on positive feedbacks or increasing returns in the economy—what happens when products that gain market share find it easier to gain further market share—and their role in locking markets in to the domination of one or two players. He holds degrees in operations research, economics, mathematics and electrical engineering. He won the Schumpeter Prize in Economics in 1990, and is a Fellow of the Econometric Society and of the World Economic Forum. He is currently writing a book on the nature of technology and of innovation. His website is www.santafe.edu/arthur



Rob Axtell is External Professor at the Santa Fe Institute and a founding member of the Center on Social and Economic Dynamics (CSED) there. CSED is a research center dedicated to promulgating agent-based computational modeling techniques across the social sciences. He is co-author of Growing Artificial Societies: Social Science from the Bottom Up with J.M. Epstein (MIT Press, 1996). His research has been published in leading general science journals (e.g., "Science," "Proceedings of the National Academy of Sciences") as well as disciplinary journals. His new book, Artificial Economies of Adaptive Agents, will appear soon.



Herbert Gintis is External Faculty at the Santa Fe Institute, and Professor of Economics at the Central European University. He and Professor Robert Boyd (Anthropology, UCLA) head a multidisciplinary research project, the *MacArthur Network on the Nature and Evolution of Norms and Preferences*, that studies empathy, reciprocity, insider/outsider bias, vengefulness, and other human behaviors absent from the traditional economic model of the self-regarding agent. Herbert Gintis published Game Theory Evolving (Princeton: Princeton University Press, 2000), and is coauthor of Foundations of Human Sociality: Economic Experiments and Ethnographic Evidence from Fifteen Small-scale Societies (Oxford: Oxford University Press, 2004). His web site, www-unix.oit.umass.edu/~gintis, provides further information.



Scott Page is Professor of Complex Systems, Political Science, and Economics, at the University of Michigan – Ann Arbor. He is Senior Research Scientist for the Center for Policy Studies and an External Faculty Member of the Santa Fe Institute. He holds a Masters degree in mathematics from the University of Wisconsin (1988), a Masters of Science in business and a Ph. D. in Managerial Economics and Decisions Sciences from Northwestern University (1993). His research on complex systems has been published in several journals and he is currently working on his next book "*Complex Adaptive Social Systems: The Interest In Between* (with John Miller) Forthcoming Princeton Press Spring 2007. His website is: www.cscs.umich.edu/~spage/



Claudia Pharis is a 30 year veteran of service to government and industry. Her experience in politics and public policy is broad and deep: Chief of Staff and then Senior Policy Advisor to Congressman Chaka Fattah; Senior staff at the Department of Housing and Urban Development; and, Senior Policy Advisor for the Office of Management and Budget, and the U.S. Congress on both the House and the Senate Budget Committees. Later, she ran a successful small business in NYC and founded Mentor Systems International which developed multimedia educational products. Ms. Pharis is Founder and CEO of the Catalyst Institute for Applied Policy, a social systems intermediary that is engaged in problem solving in large complex systems. She has earned a BS in Physics from the University of Hawaii, an MBA from the Harvard University School of Business Administration, and is currently pursuing a Ph.D in Public Policy at George Mason University.

Suggested Reading

- Growing Artificial Societies: Social Science from the Bottom Up*, JM Epstein and Dr. R Axtell (1996)
- The Complexity of Exchange*, Economic journal, Volume 115, Dr. Robert Axtell (2005)
- Making Things Work: Solving Complex Problems in a Complex World*, Dr. Yaneer Bar-Yam (2005)
- Dynamics of Complex Systems (Studies in Non-Linearity)* (2003)
- The Meme Machine*, Susan Blackmore (1999)
- Global Brain: The Evolution of Mass Mind from the Big Bang to the 21st Century*, Howard Bloom, (2000)
- Economics as Distributed Computation: Meeting the Challenge of Social Problems via Agent-based Simulation*, H. Deguchi, K. Takadama, and T. Terano (editors)
- Chaos: Making a New Science*, James Gleick (1988)
- Emergence: From Chaos to Order*, Dr. John Holland (1998)
- Hidden Order: How Adaptation Builds Complexity*, Dr. John Holland (1995)
- Chaos: Theory in the Social Sciences*, Kiel and Elliot (1996)
- Why Agents? : On the Varied Motivations for Agent Computing in the Social Sciences, Agent Simulation: Applications, Models and Tools*, Macal and Sallach (2000)
- Complexity: The Emerging Science at the Edge of Order and Chaos*, Mitchell Waldrop (1992)
- The Dream Machine: J.C.R. Licklider and the Revolution that Made Computing*, Mitchell Waldrop (2002)
- Democracy and Complexity*, Daniel Zolo (1992)

Film

- Contested Streets: Breaking NYC Gridlock*, Cicala Filmworks and Transportation Alternatives, The New Mobility Agenda: www.newmobility.org



Organizations Engaged in Complexity-Related Research

Santa Fe Institute
Krasnow Institute
New England Complex Systems Institute
Center for Interdisciplinary Research on Complex Systems at Northeastern University
Plexus Institute
IBM Almaden Research Center
Center for Complex Systems Research, University of Illinois
University of Michigan Center for the Study of Complex Systems
Institute Para Limes of the European Union
Centre for Policy Modeling - Manchester Metropolitan University (UK)
Program on Social Complexity - George Mason University
Complexity Research Programme - London School of Economics (UK)
Computational and Experimental Economics Laboratory - University of Trento (Italy)
Center for Computational Finance and Economic Agents - University of Essex (UK)
Center for Interdisciplinary Research - University of Bielefeld (Italy)
Cluster on Complex Agent-Based Dynamic Networks (CABDYN) - Oxford (UK)
Center on Social and Economic Dynamics - The Brookings Institution
Center for Complexity Studies - Bucharest, Romania
The Center for the Study of Institutions, Population, and Environmental Change, Indiana U.
The LABORatorio Riccardo Revelli, University of Torino
The Center for Nonlinear Dynamics in Economics and Finance, University of Amsterdam
MIT System Dynamics Group - Sloan School of Management
Center for Complex System Studies - Kalamazoo College
Complex Systems Research Center - University of New Hampshire
Duke Center for Nonlinear and Complex Systems - Duke University
Center for Human Complex Systems - UCLA
Complex Adaptive Systems Group- Iowa State University
Institute for Systems Biology - Seattle, Washington
Institute for Advanced Interdisciplinary Research - Houston, Texas
Complexity and Management Centre - University of Hertfordshire
Center for Complex Systems and Visualization- University of Bremen
Centre for Social Theory and Technology - Keele University
The Centre for Complexity and Change - The Open University
Max Planck Institute for the Physics of Complex Systems - Dresden, Germany
Complex Systems Management Centre - Cranfield University
Austrian Institute for Nonlinear Studies - Vienna, Austria
Computational Analysis of Social and Organizational Systems- Carnegie Mellon University
Complexity in Social Sciences- European Commission Network
Chaos and Innovation Research Unit - Aristotle University of Thessaloniki, Greece
Society for Organizational Learning - Cambridge, MA
T-13 Complex Systems Group - Los Alamos National Laboratory
Center Leo Apostel for Interdisciplinary Studies, Belgium
Clemson Research Institute for the Study of Complex Social System
NSF Center for Discrete Mathematics & Theoretical Computer Science
The Rand Corporation Science and Technology Policy Institute

Stay tuned

Part four of the series will be announced
shortly:

Complexity Science and Social Policy

Pre-Register at :
www.catalystdc.org

“I think the next century will be the century of complexity.”

Stephen Hawking
San Jose Mercury News, 2000

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