

Una Introducción a los Sistemas Complejos

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- Institut des Systèmes Complexes en Normandie, Normandie, France.
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Seminario de Investigación

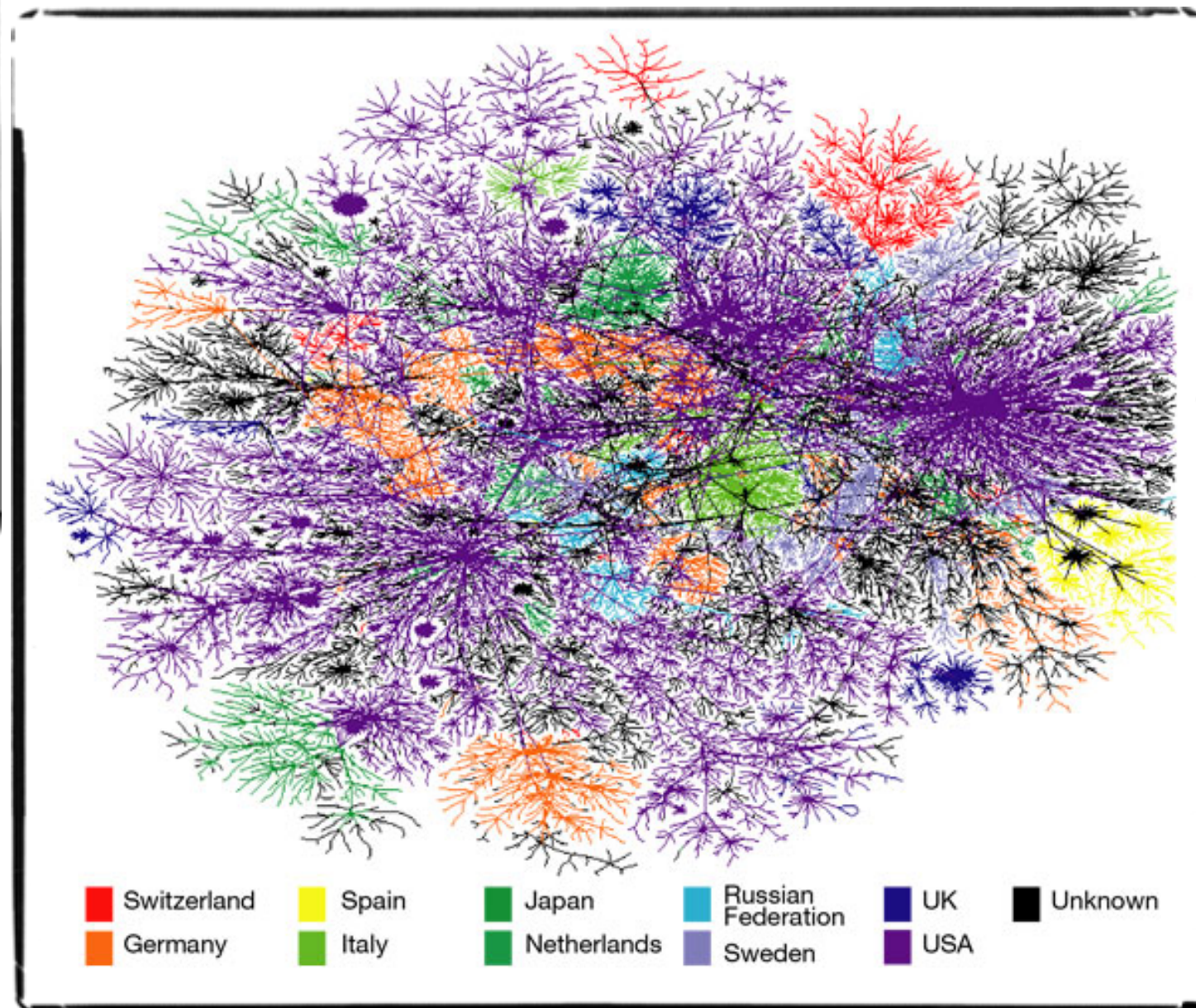
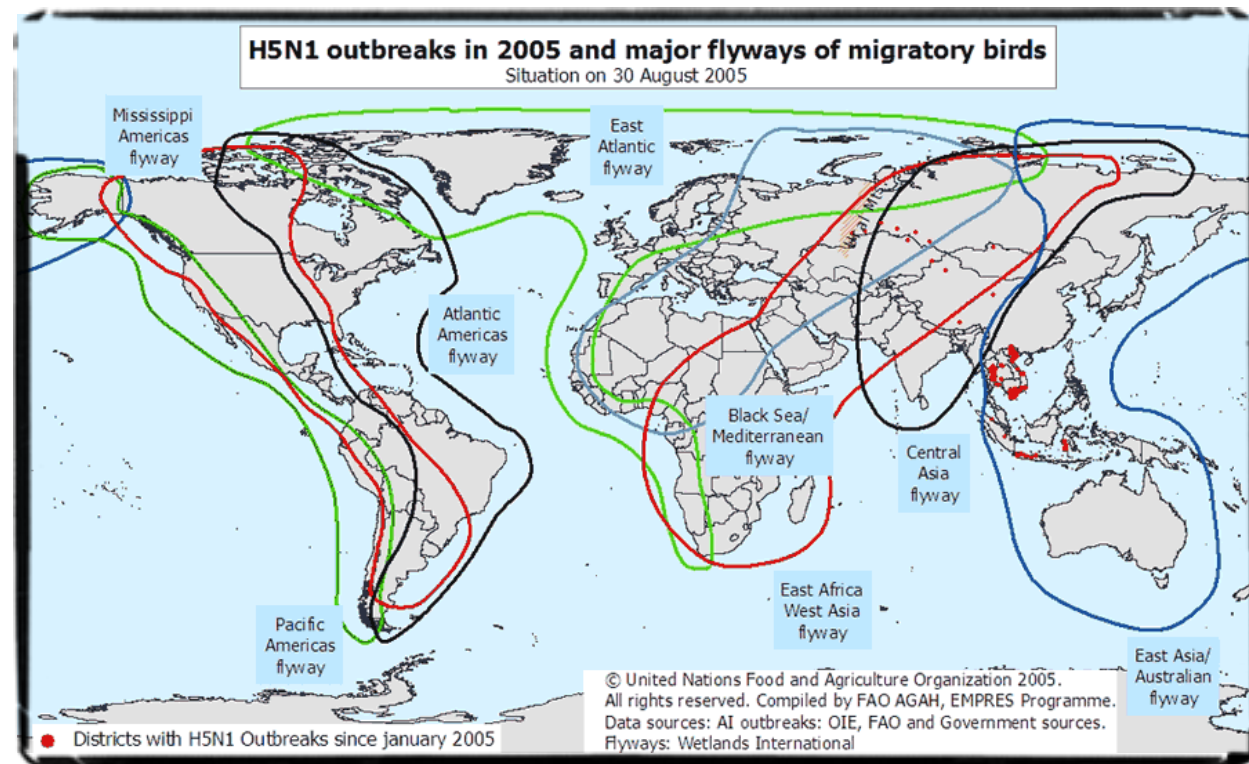
Escuela Superior de Cómputo del Instituto Politécnico Nacional

15 de febrero de 2013, México, D.F.

Algunas preguntas para empezar

- ¿Cómo tratar de entender la naturaleza de ciertos procesos no-lineales? En la física, química, biología, ciencias sociales, medicina, economía, astronomía, epidemiología...
- ¿Qué son los sistemas complejos?
- ¿Sistemas discretos o continuos?
- ¿Qué tan importante es el manejo de la información?
- ¿Cómo llevar un sistema de complejidad dinámica a proyectar una complejidad cada vez mayor?

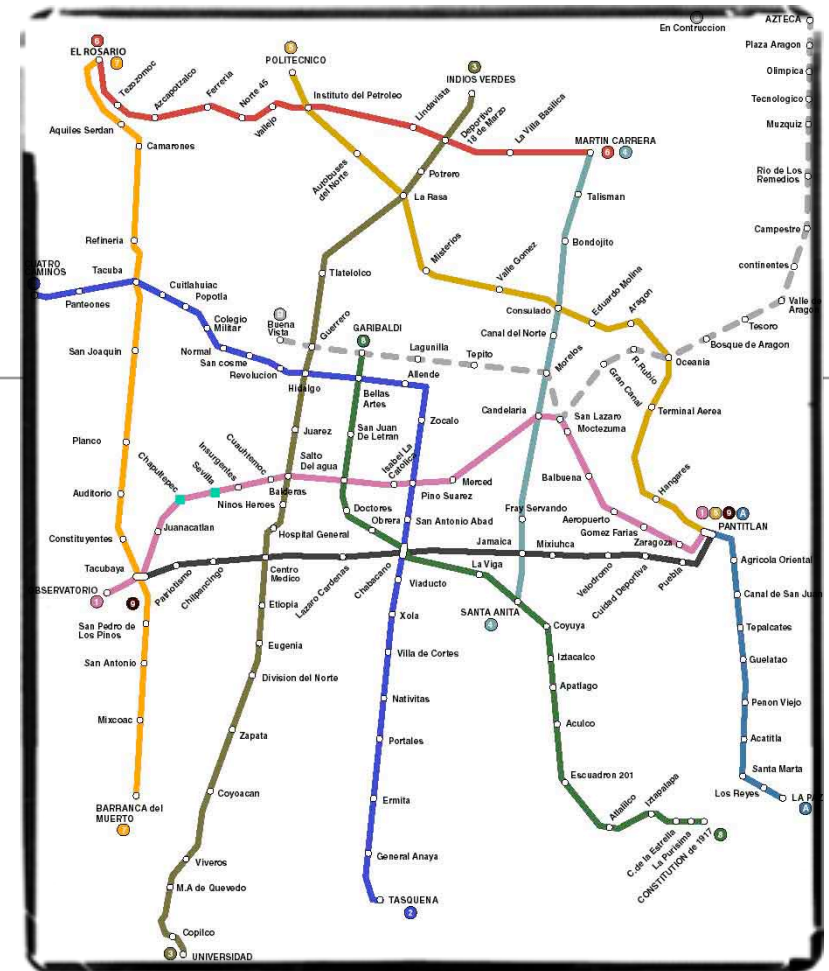
Algunas motivaciones



Non-trivial collective behaviour



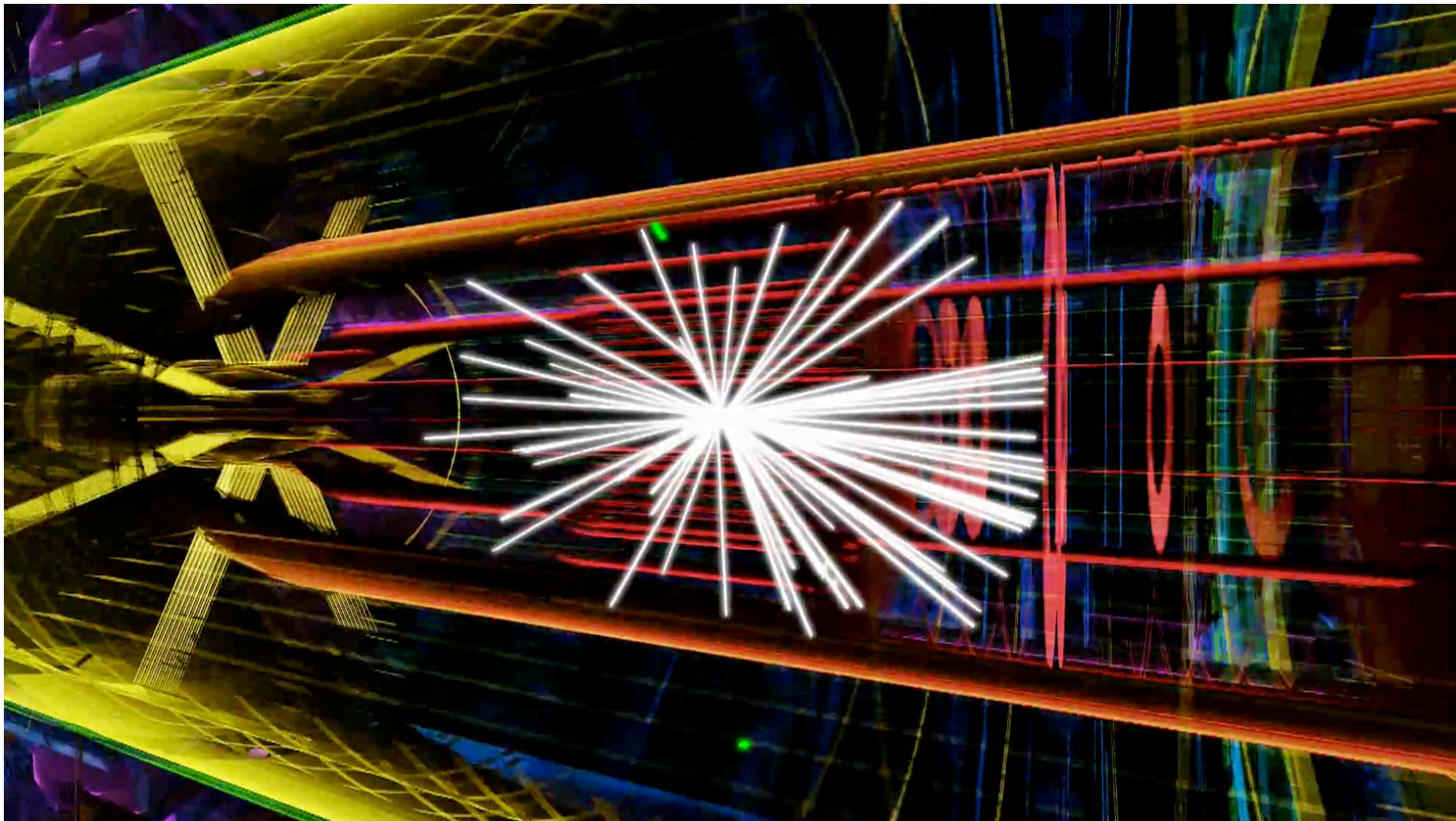
Public transport



Robotics development



Collision theory



Human behaviour



Antecedents in Complex Systems:

Macy conferences (1946-1953)

The Macy Conferences were a set of meetings of scholars from various disciplines held in New York by the initiative of Warren McCulloch and the Josiah Macy, Jr. Foundation from 1946 to 1953. The principal purpose of these series of conferences was to set the foundations for a general science of the workings of the human mind.

It was one of the first organized studies of *interdisciplinarity*, spawning breakthroughs in *systems theory*, *cybernetics*, and what later became known as *cognitive science*.

Some titles include:

Feedback Mechanisms and Circular Causal Systems in Biological and Social Systems

The scientists participating in all or most of the conferences are known as the "core group." They include:^[3]

- William Ross Ashby; psychiatrist and a pioneer in cybernetics
- Gregory Bateson; anthropologist, social scientist, linguist, visual anthropologist, semiotician and cyberneticist
- Julian Bigelow; pioneering computer engineer
- Heinz von Foerster; biophysicist, scientist combining physics and philosophy and architect of cybernetics
- Lawrence K. Frank; social scientist
- Ralph W. Gerard; neurophysiologist and behavioral scientist known for his work on the nervous system, nerve metabolism, psychopharmacology, and biological basis of schizophrenia
- Molly Harrower; pioneering clinical psychologist
- Lawrence Kubie; psychiatrist
- Paul Lazarsfeld; sociologist and founder of Columbia University's Bureau for Applied Social Research
- Kurt Lewin; psychologist, often regarded as the founder of social psychology
- Warren McCulloch (chair); psychiatrist, neurophysiologist and cybernetician
- Margaret Mead; cultural anthropologist
- John von Neumann; one of the foremost mathematicians of the 20th century
- Walter Pitts; logician and co-author of the paper that founded *neural networks*
- Arturo Rosenblueth; researcher, physician, physiologist and a pioneer of cybernetics
- Leonard J. Savage; mathematician and statistician
- Norbert Wiener; mathematician and founder of cybernetics

In addition to the core group several invited guests participated in the conferences. Amongst many others:

- Max Delbrück; geneticist and biophysicist
- Erik Erikson; developmental psychologist and psychoanalyst known for his theory of social development
- Claude Shannon; electronic engineer and mathematician, "the father of information theory"
- Talcott Parsons; sociologist.

- * What are the information and computation?
- * How are they manifested in living organisms?
- * What analogies can be made between living systems and machines?
- * What is the role of feedback in complex behaviour?

Yaneer Bar-Yam

Dynamics of Complex Systems, 1997.



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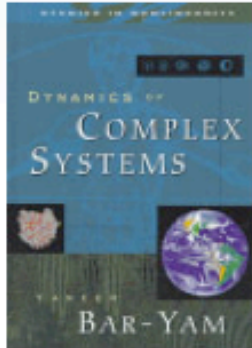
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Dynamics of Complex Systems

Yaneer Bar-Yam



Textbook for seminar/course on complex systems.

The study of complex systems in a unified framework has become recognized in recent years as a new scientific discipline, the ultimate of interdisciplinary fields. Breaking down the barriers between physics, chemistry and biology and the so-called soft sciences of psychology, sociology, economics, and anthropology, this text explores the universal physical and mathematical principles that govern the emergence of complex systems from simple components.

Dynamics of Complex Systems is the first text describing the modern unified study of complex systems. It is designed for upper-undergraduate/beginning graduate-level students, and covers a wide range of applications in a wide array of disciplines. A central goal of this text is to develop models and modeling techniques that are useful when applied to all complex systems. This is done by adopting both analytic tools, from statistical mechanics to stochastic dynamics, and computer simulation techniques, such as cellular automata and Monte Carlo. In four sets of paired, self-contained chapters, Yaneer Bar-Yam discusses complex systems in the context of neural networks, protein folding, living organisms, and finally, human civilization itself. He explores fundamental questions about the structure, dynamics, evolution, development and quantitative complexity that apply to all complex systems. In the first chapter, mathematical foundations such as iterative maps and chaos, probability theory and random walks.

Stephen Wolfram

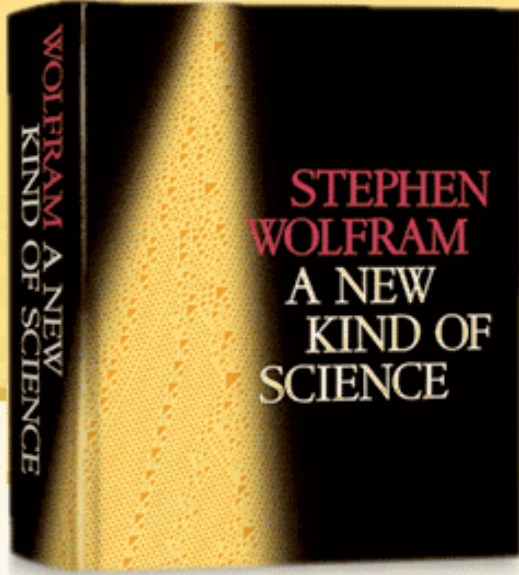
A New Kind of Science, 2002.



Browser tabs: Gmail - Inbox - genarojm@... Stephen Wolfram: A New Kind of Science

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more science isn't delivered this way."
— New York Times*

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Published by Wolfram Media (2002)
ISBN 1-57966-092-8

Melanie Mitchell

Complexity: A Guided Tour, 2009.



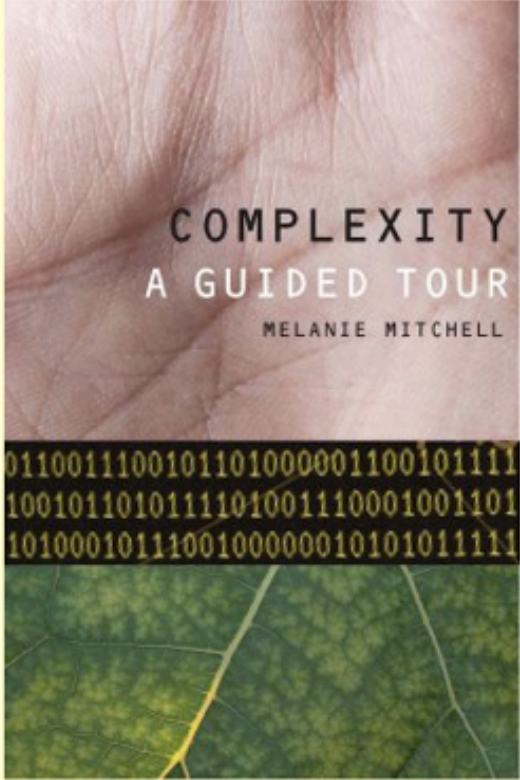
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Complexity: A Guided Tour

by Melanie Mitchell



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Featured in Amazon.com's [Top 10 Science Books of 2009](#)

Longlisted (one of 12) for the 2010 [Royal Society Science Book Prize](#)

From the back cover:

"Melanie Mitchell has written a scholarly yet entertaining travelogue through the fundamental concepts of complexity, wonderfully demonstrating how key ideas from computation help to unify seemingly disparate phenomena."
—Simon A. Levin, George M. Moffett Professor of Biology and Director of the Center for Biocomplexity, Princeton University

"Finally! For years people have been asking me where they can learn the basics of complexity theory. Now I've got the answer: Read Melanie Mitchell's book. It's clear, gentle, and fair to the skeptics

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—Mark Pagel University of Santa Fe Ins
"An able ar

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Melanie Mitchell Receives 2010 ΦBK Science Book Award

For Immediate Release
November 9, 2010

WASHINGTON, D.C. — Melanie Mitchell (right) will receive the Phi Beta Kappa Book Award in Science for *Complexity: A Guided Tour* (Oxford University Press, 2009).

FROM THE SECRETARY

To read John Churchill's weekly blog [CLICK HERE](#).

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¿Qué se entiende por un sistema complejo?

algunas propiedades ...

- Un **sistema complejo** es un grupo u organización que es construido desde la interacción de muchos elementos primitivos.
- En tales sistemas, las *partes individuales* (conocidos como `componentes'), y la *interacción* entre ellos, frecuentemente conducen a comportamientos en gran escala, que no son fáciles de predecir desde un conocimiento dado de sus componentes individuales, tal efecto de este comportamiento es llamado **emergente**.
- Aquí podemos encontrar palabras como: **auto organización**, *auto reproducción*, *auto reparación*, *formación de patrones*, *evolución*, *criticalidad*, *adaptación*, **comportamiento colectivo no-trivial**, *caos*, *control*, *cibernética*.

Algunas modelos y herramientas relacionadas para simular sistemas complejos

Modelos

- * Autómata celular
- * Vida artificial
- * Inteligencia artificial
- * Agentes
- * Redes neuronales
- * Redes complejas
- * Redes de Petri
- * Redes del mundo real
- * Algoritmos genéticos
- * Programación evolutiva

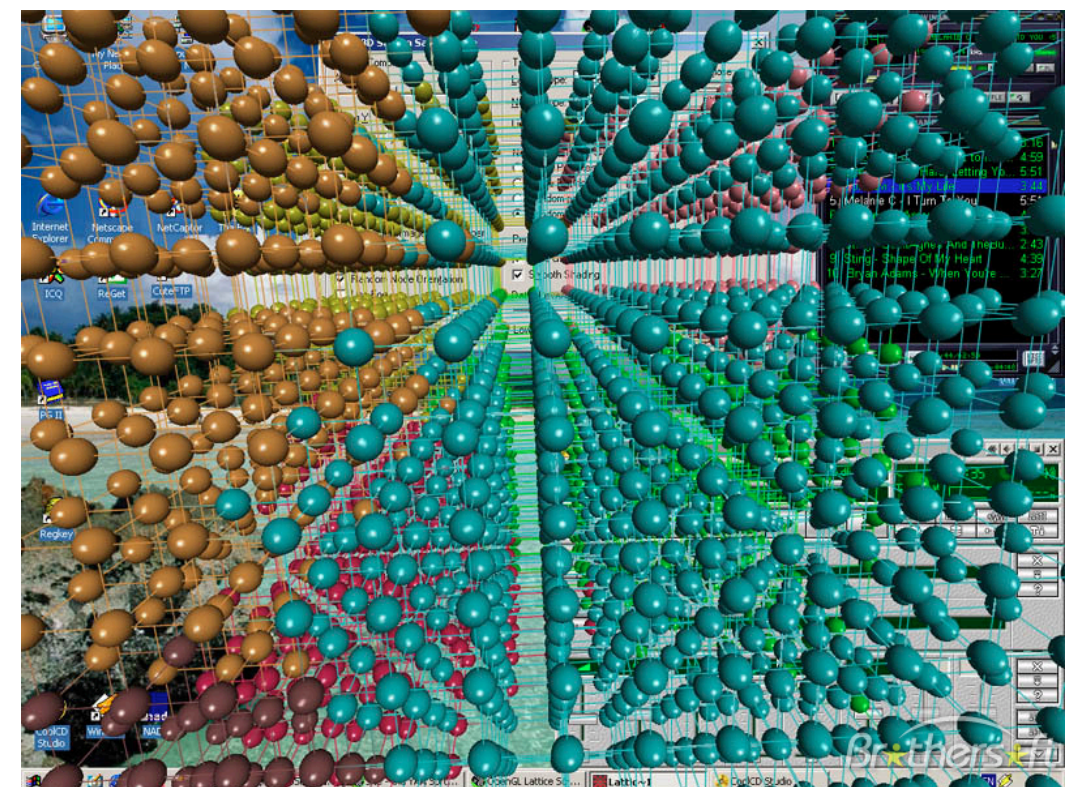
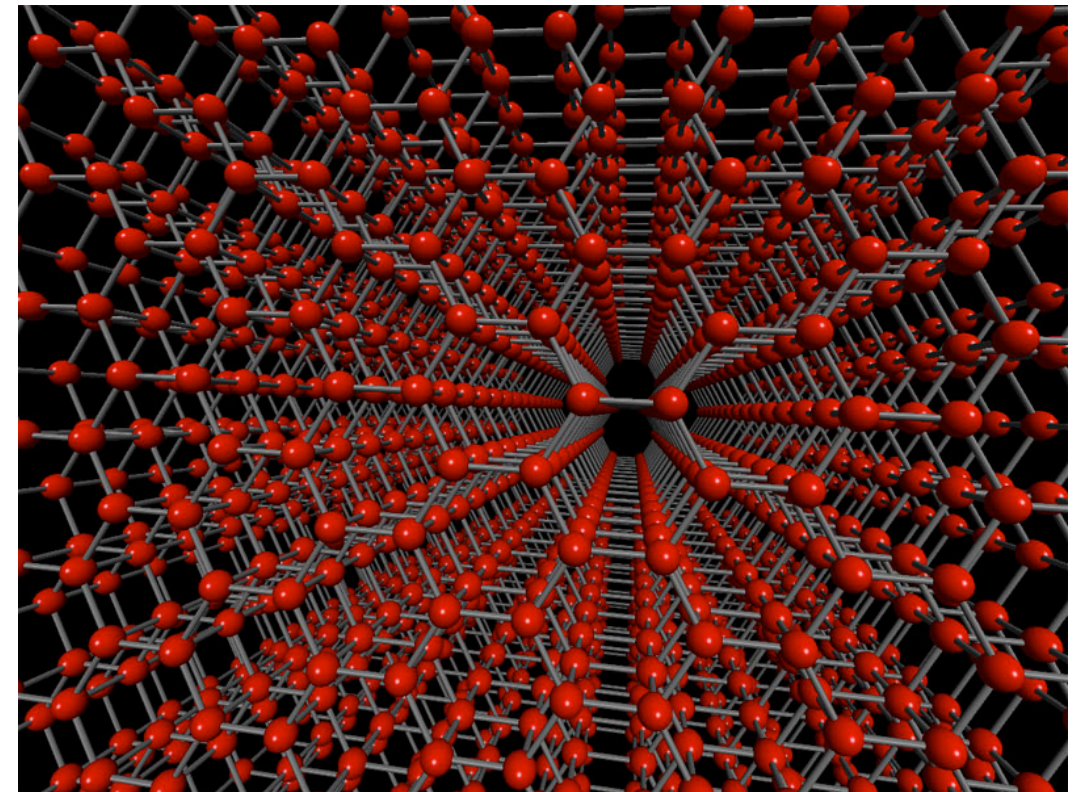
Software

- * Macsima (maxima)
- * Maple
- * Mathematica
- * MatLab
- * DDLab
- * StarLogo

Para ilustrar estos conceptos, rápidamente, nos apoyaremos en la *teoría de autómatas celulares*

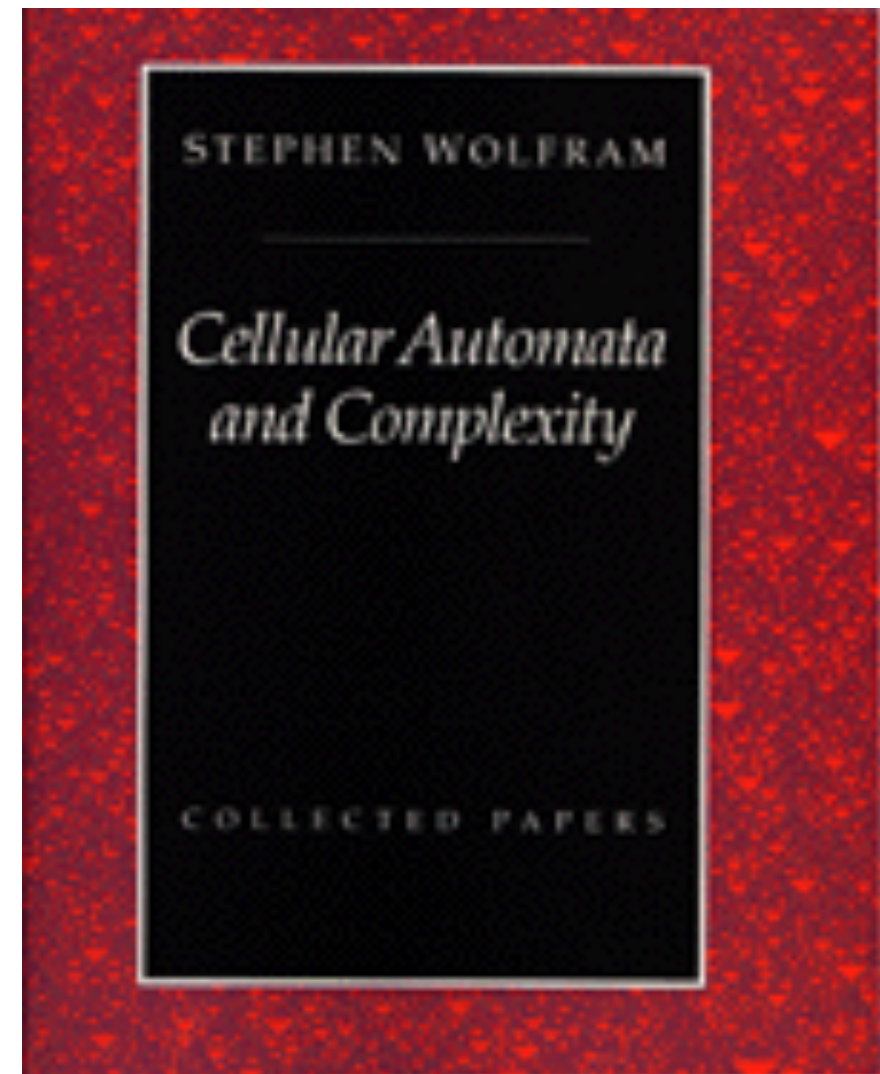
¿Qué es un autómatata celular?

- Un *autómata celular* (AC) es un sistema dinámico discreto (en estados y tiempo) evolucionando en un arreglo regular.
- En AC el comportamiento emergente es capturado desde su efecto colectivo, dado por señales, partículas, estructuras periódicas o caóticas; luchando por un espacio sobre la evolución misma antes de alcanzar su estado final.
- De esta manera, AC sirven como modelos abstractos para tratar de estudiar y entender sistemas complejos a partir de funciones simples. En nuestro caso, serán de utilidad para ilustrar el objetivo de la plática.



Wolfram's classes and conjectures: *the cellular automata case*

Stephen Wolfram (1959-?)

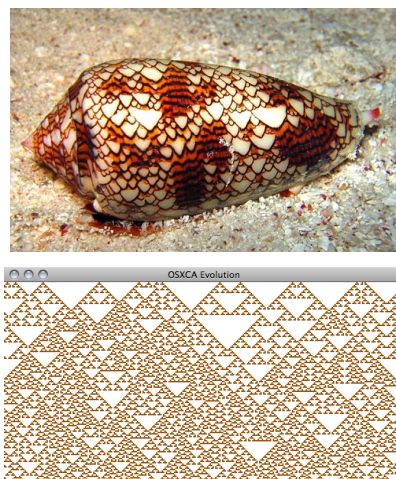


Stephen Wolfram's
A NEW KIND OF SCIENCE
The Crucial Experiment

How Do Simple Programs Behave?

2002

Complex systems are
computationally
universal!



$complexity \Rightarrow \begin{cases} uniform \\ periodic \\ chaotic \\ complex \end{cases}$

Estructura del autómata celular conocido como el *Juego de la Vida*: ejemplo de un programa simple

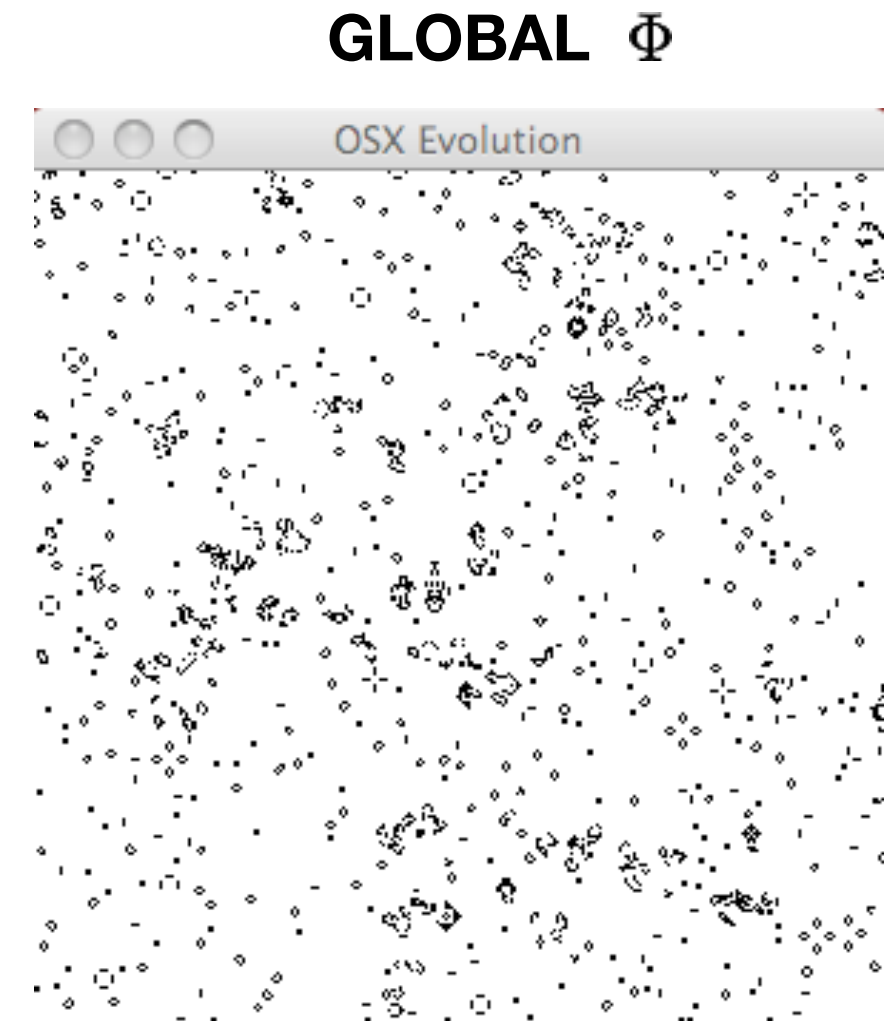
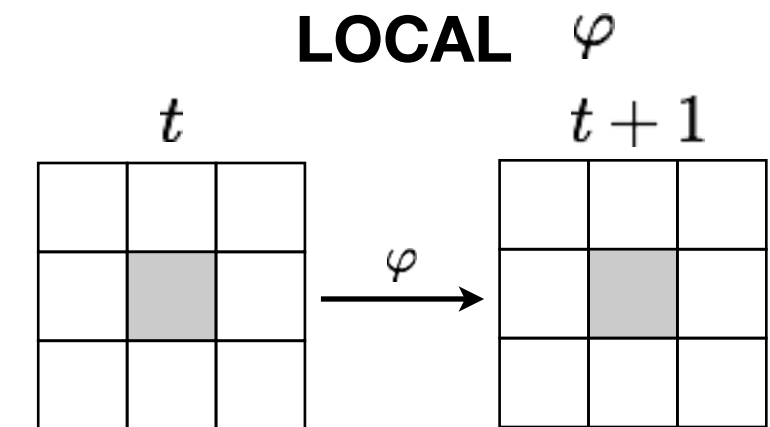
El autómata celular inventado por John Conway a finales de los 60's conocido como "*The Game of Life*", es llamado así por su relación que tiene con la modelación de sistemas biológicos, tal como ecosistemas, incendios forestales, vida artificial, comportamientos colectivos de seres vivos, entre otros. Sea $\Sigma = \{0, 1\}$ el conjunto de estados, el estado 0 representa una célula muerta (color blanco) y el estado 1 representa una célula viva (color negro).

Conway hace un amplio análisis para poder determinar una regla de evolución que tuviera dos características fundamentales:

1. Una configuración c_i no debe desaparecer rápidamente.
2. Una configuración c_i debe crecer ilimitadamente.

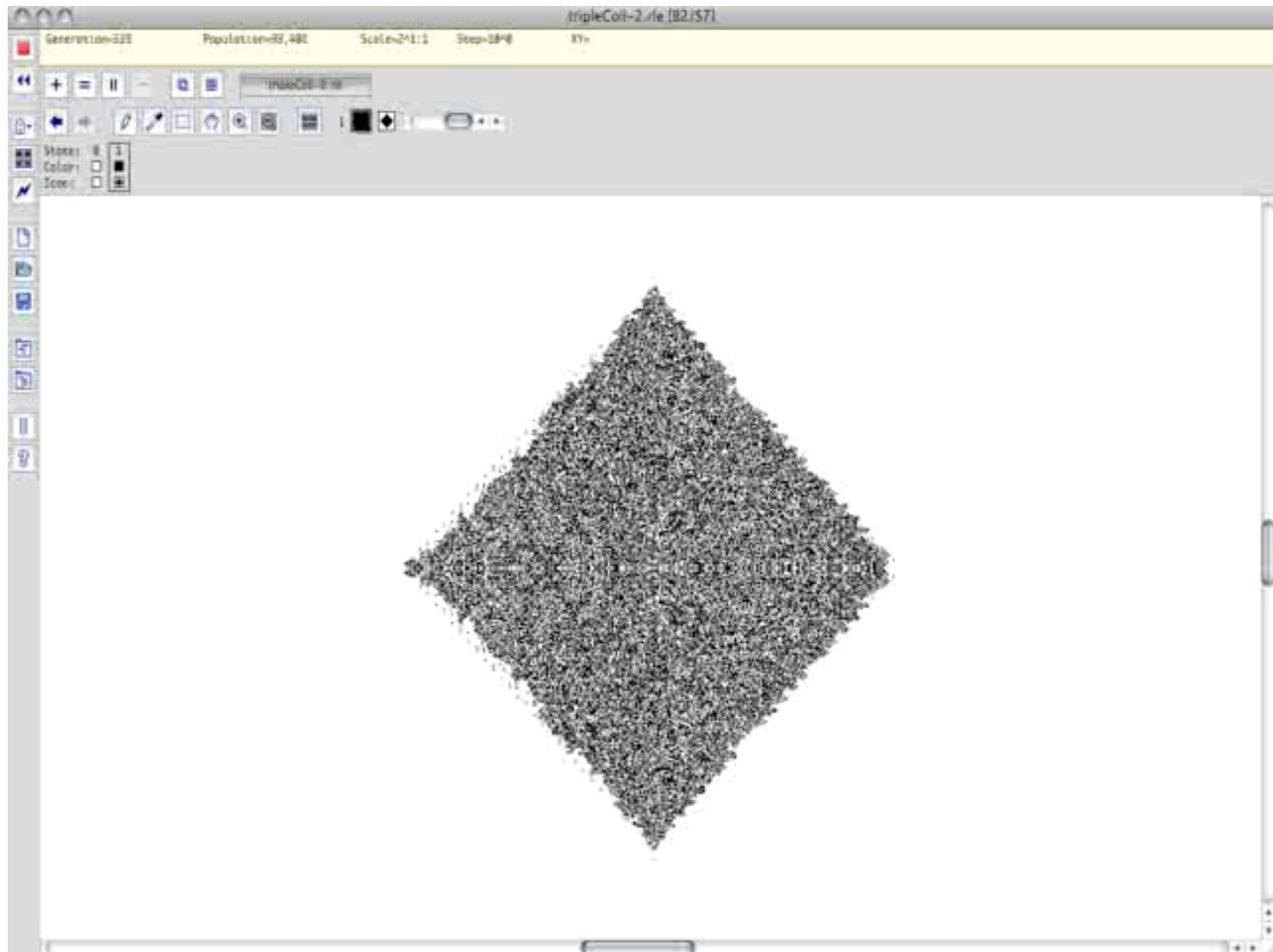
además se deben de definir tres condiciones, cuándo una célula debe de *nacer*, *sobrevivir* o *morir*. Estas condiciones son muy importantes para obtener las características mencionadas.

- (a) **Nacimiento.** Una célula muerta en el tiempo t llega a vivir en el tiempo $t + 1$ si tiene exactamente tres de sus vecinos vivos en el tiempo t .
- (b) **Muerte por sobre-población.** Si una célula vive en el tiempo t y tiene cuatro o mas de sus ocho vecinos vivos en el tiempo t , esta célula debe morir en el tiempo $t + 1$.
- (c) **Muerte por aislamiento.** Si una célula vive en el tiempo t y tiene un vecino vivo o ninguno en el tiempo t , esta célula debe morir en el tiempo $t + 1$.
- (d) **Sobrevivencia.** Una célula que vive en el tiempo t deberá permanecer viva en el tiempo $t + 1$, si y solo si, tiene dos o tres vecinos vivos en el tiempo t .



configuración inicial aleatoria

¿El origen de *un universo artificial* desde un modelo matemático abstracto? *Un mini big bang*. Diffusion Rule CA



Construcciones cada vez más complejas



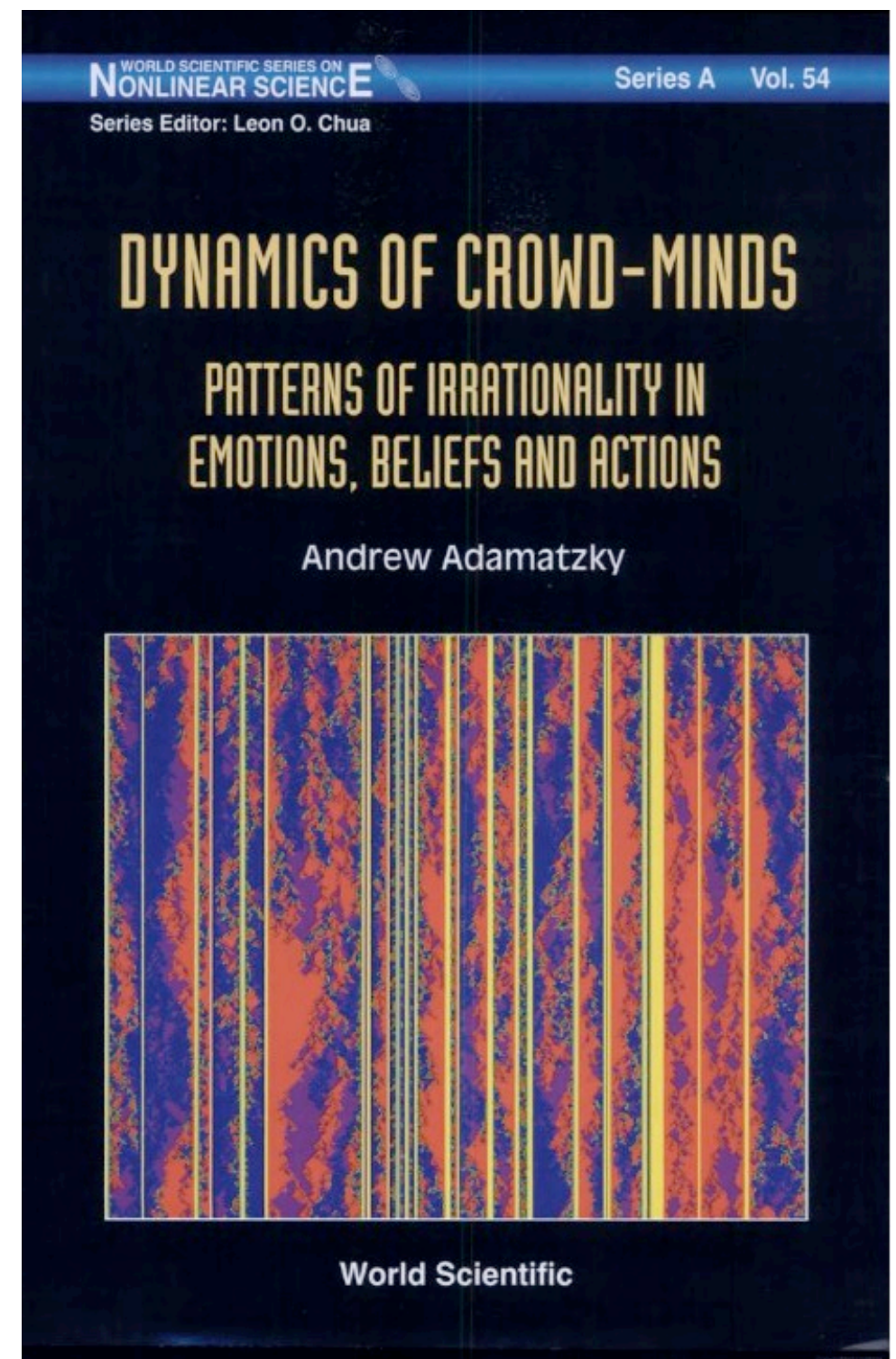
Complex systems applications

La dinámica en la agrupación de mentalidades: patrones de irracionalidad en emociones, creencias y acciones

Computational experiments demonstrate that the irrational and nonsensical behaviour of individual entities of crowd-minds results in complex, rich and non-trivial spatio-temporal dynamics of the agent collectives. Mathematical models employ theory and techniques of cellular automata and lattice swarm, applied algebra, theory of finite automata and Markov chains, and elementary differential equations.

Readership: academics and researchers in computers science, physics, mathematics, social sciences and psychology.

World Scientific Press, Series A, Vol. 54, 2005.





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In Response to the Tragedy in Newtown, CT

Yaneer Bar-Yam

by Yaneer Bar-Yam, President of NECSI
December 18, 2012

We are deeply saddened by the tragedy that occurred in Newtown, CT on December 14th. We offer our condolences to family and friends deprived of their loved ones, and we are without words to describe the lifetimes of opportunity and experience stolen from those who were killed.

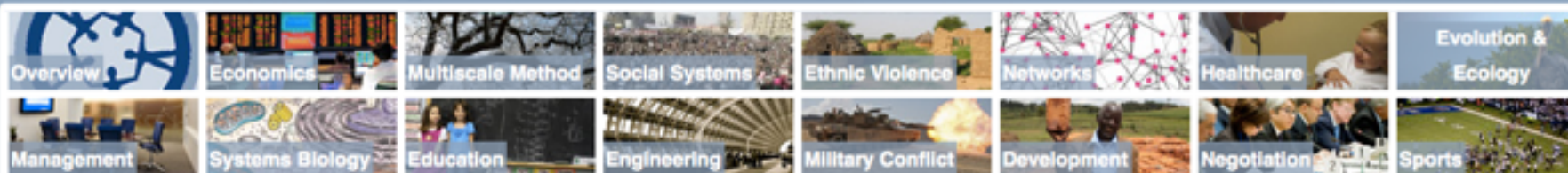
In the wake of these events, many people are asking what can be done to prevent such horror from recurring. I offer the following thoughts about the way forward:

Simple statements to characterize a cause are inadequate. It is not sufficient to assert that the prevalence of guns is the sole cause, nor the perpetrator's mental instability, his social isolation, or his desire for infamy and media attention. We must realize that multiple factors create the conditions for such calamity, and we must responsibly address them together.

Conditions of society which cause more stress than some individuals can bear are a critical component. Each individual's unique situation, in psychological and social contexts, must be recognized and addressed, whether this involves medical attention or social support. Ready availability of firearms and widespread violence in the press and entertainment play a key role. To argue that a healthy, balanced individual in a supportive context would not abuse the power of firearms is beside the point. Protecting society requires recognition of the existence of many diverse individuals. Laws about firearms and limits on exposure to violent media should reflect the risks of the most vulnerable.

Individuals subject to trying conditions, exposed to violence, with sensitive psyches and access to firearms present the greatest risk for the tragedies we have seen in Newtown, Aurora, Virginia Tech, Columbine, and elsewhere. We should also recognize that such extreme acts of violence are only the most visible manifestations. Many lesser incidents combining psycho-social strain and the exposure, motivation, and opportunity for violence also lead to intense suffering. To create social policies capable of averting future tragedies, it is necessary to set aside narrow, ideological and single-issue perspectives in favor of systemic approaches.

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The Food Crises: A Quantitative Model of Food Prices Including Speculators and Ethanol Conversion

Cite as M. Lagi, Yavni Bar-Yam, K.Z. Bertrand, Yaneer Bar-Yam, **The Food Crises: A Quantitative Model of Food Prices Including Speculators and Ethanol Conversion**. arXiv:1109.4859, September 21, 2011.

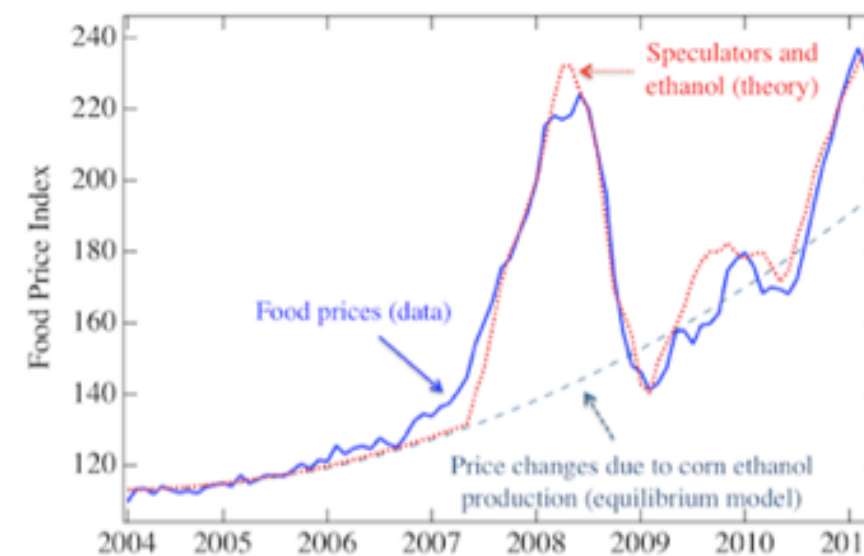
Abstract

Recent increases in basic food prices are severely impacting vulnerable populations worldwide. Proposed causes such as shortages of grain due to adverse weather, increasing meat consumption in China and India, conversion of corn to ethanol in the US, and investor speculation on commodity markets lead to widely differing implications for policy. A lack of clarity about which factors are responsible reinforces policy inaction. Here, for the first time, we construct a dynamic model that quantitatively agrees with food prices. The results show that the dominant causes of price increases are investor speculation and ethanol conversion. Models that just treat supply and demand are not consistent with the actual price dynamics. The two sharp peaks in

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Figures

Other NECSI Food Crisis Research

Paper on Food Prices | Update 2/2012 | Update 7/2012
 Paper on Food Riots
 Violence in Yemen | Mexican Corn Imports
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Complex Systems

Volume 21, Issue 2

On Soliton Collisions between Localizations in Complex Elementary Cellular Automata: Rules 54 and 110 and Beyond [Download PDF](#)

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Abstract

In this paper, a single-soliton two-component cellular automaton (CA) model of waves is presented as mobile self-localizations, also known as particles, waves, or gliders, in addition to its version with memory. The model is based on coding sets of strings where each chain represents a unique mobile self-localization. The original soliton models in CAs proposed with filter automata are briefly discussed, followed by solutions in elementary CAs (ECAs) domain with the famous universal ECA rule 110, and reporting a number of new solitonic collisions in ECA rule 54. A mobile self-localization in this study is equivalent to a single soliton because the collisions of the mobile self-localizations studied in this paper satisfy the property of solitonic collisions. A specific ECA with memory (ECAM), the ECAM rule ØR9maj:4, is also presented; it displays single-soliton solutions from any initial codification (including random initial conditions) for a kind of mobile self-localization because such an automaton is able to adjust any initial condition to soliton structures.

On Soliton collisions between localizations in complex elementary cellular automata: rules 54 and 110 and beyond

3. Solitons in One-Dimensional Cellular Automata

A soliton is a solitary wave with nonlinear behavior that preserves its form and speed, interacting with some kind of perturbation. The latter can be another wave or some obstacle, continuing its travel affecting only its phase and position since each collision. One example is a water wave traveling and interacting with other waves; they can be found also in optics, sound, and molecules [12].

The solitary wave described by Scott become formally represented by the Korteweg–de Vries equation [2] as

$$u_t + u_{xxxx} + uu_x = 0, \tag{6}$$

where the function u measures high-wave and x -position at time t , and every subindex represents partial differences. The second term represents scattering-wave and the last term is the nonlinear term [5].

On Soliton collisions between localizations in complex elementary cellular automata: rules 54 and 110 and beyond

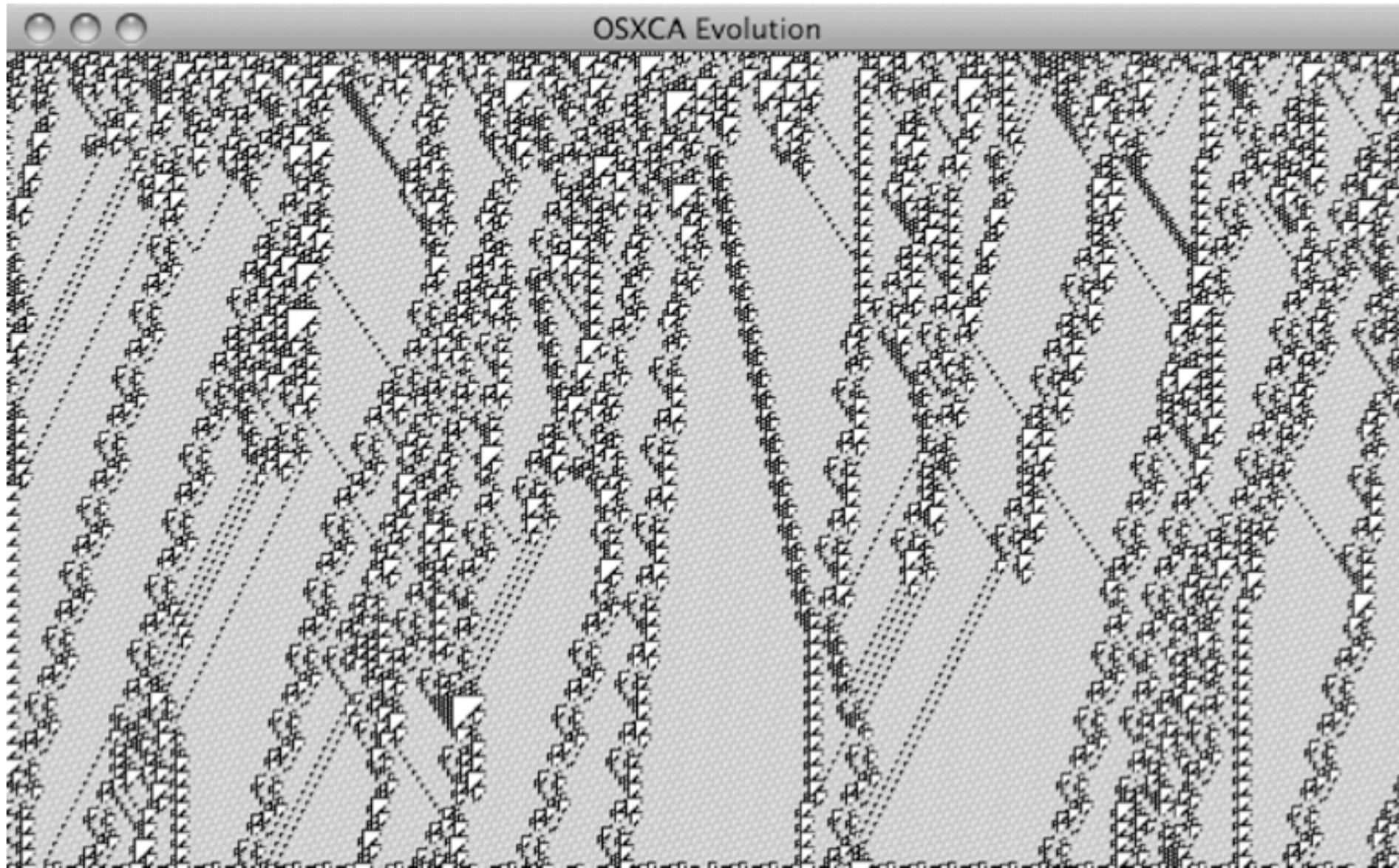


Figure 3. Random evolution in rule 110 on a ring of 644 cells to 375 generations. White cells represent state 0 and black cells state 1 starting on 50% of density. A filter is selected to get a better view of mobile self-localizations on its periodic background.

On Soliton collisions between localizations in complex elementary cellular automata: rules 54 and 110 and beyond

Mobile Self-Localization	Shift	Period	Speed	Volume
A	2	3	$2 / 3 \approx 0.666666$	6
B	2	4	$-1 / 2 = -0.5$	8
C_1	0	7	$0 / 7 = 0$	9–23
C_2	0	7	$0 / 7 = 0$	17
$\bar{E}$	8	30	$-4 / 15 \approx -0.266666$	21
F	4	36	$-1 / 9 \approx -0.111111$	15–29
G^n	14	42	$-1 / 3 \approx -0.333333$	24–38

Table 1. Mobile self-localizations properties such as solitons.

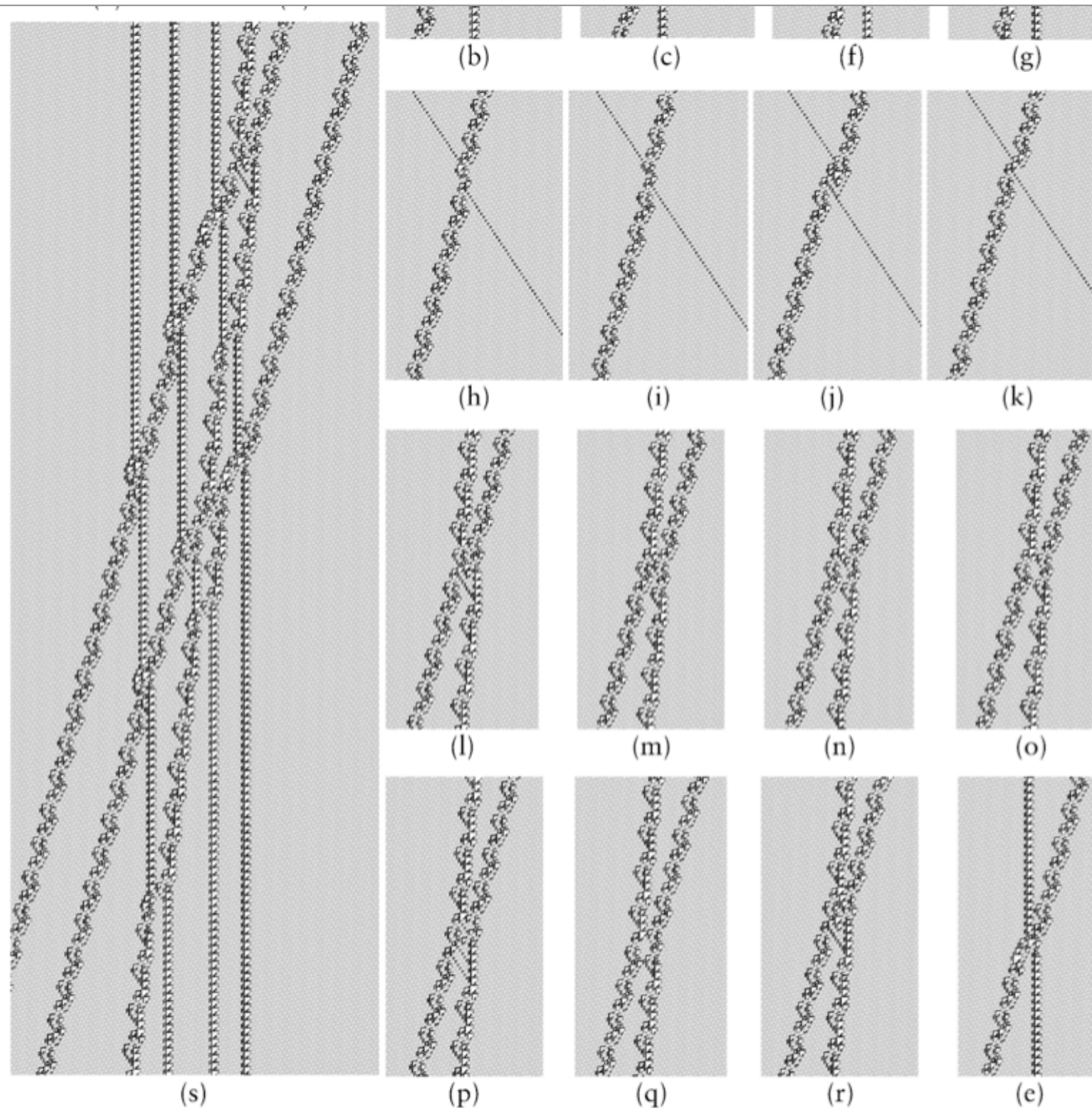
The notation proposed to codify initial conditions in rule 110 by phases is as follows:

$$\#_1 (\#_2, f_i - 1), \tag{8}$$

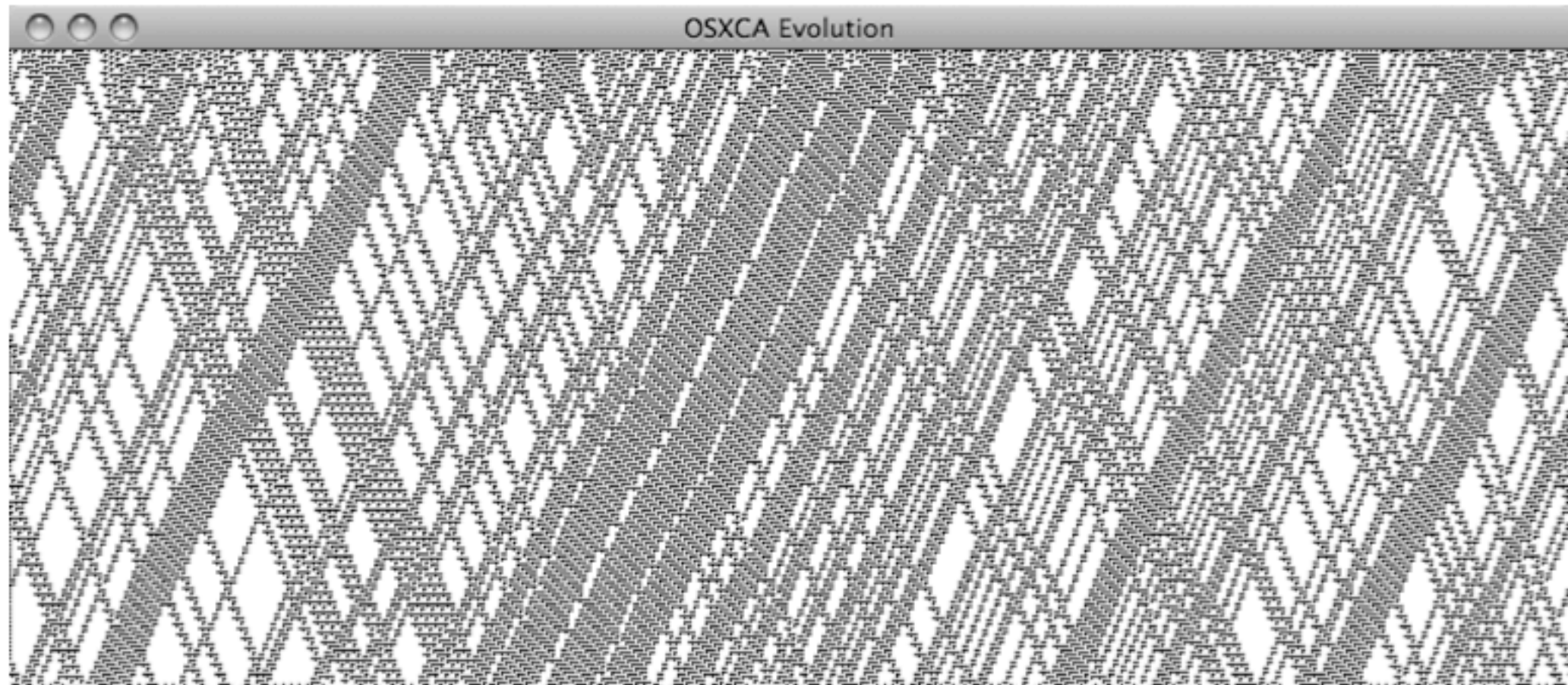
On Soliton collisions between localizations in complex elementary cellular automata: rules 54 and 110 and beyond

- (a) Soliton 1: $A(f_1 - 1) - 6 e - G(C, f_1 - 1) \rightarrow \{G, A\}$
- (b) Soliton 2: $C_1(A, f_1 - 1) - 3 e - \bar{E}(B, f_1 - 1) \rightarrow \{\bar{E}, C_1\}$
- (c) Soliton 3: $C_1(A, f_1 - 1) - 3 e - \bar{E}(C, f_1 - 1) \rightarrow \{\bar{E}, C_1\}$
- (d) Soliton 4: $F(A, f_1 - 1) - 3 e - B(f_4 - 1) \rightarrow \{B, F\}$
- (e) Soliton 5: $C_2(A, f_1 - 1) - 3 e - \bar{E}(C, f_1 - 1) \rightarrow \{\bar{E}, C_2\}$
- (f) Soliton 6: $C_1(A, f_1 - 1) - 2 e - F(B, f_1 - 1) \rightarrow \{F, C_1\}$
- (g) Soliton 7: $C_2(A, f_1 - 1) - 2 e - F(A, f_1 - 1) \rightarrow \{F, C_2\}$
- (h) Soliton 8: $A(f_1 - 1) - 4 e - \bar{E}(A, f_1 - 1) \rightarrow \{\bar{E}, A\}$
- (i) Soliton 9: $A(f_1 - 1) - 4 e - \bar{E}(B, f_1 - 1) \rightarrow \{\bar{E}, A\}$
- (j) Soliton 10: $A(f_1 - 1) - 4 e - \bar{E}(C, f_1 - 1) \rightarrow \{\bar{E}, A\}$
- (k) Soliton 11: $A(f_1 - 1) - 4 e - \bar{E}(H, f_1 - 1) \rightarrow \{\bar{E}, A\}$
- (l) Soliton 12: $F(A, f_1 - 1) - e - \bar{E}(A, f_1 - 1) \rightarrow \{\bar{E}, F\}$
- (m) Soliton 13: $F(A, f_1 - 1) - e - \bar{E}(C, f_1 - 1) \rightarrow \{\bar{E}, F\}$

On Soliton collisions between localizations in complex elementary cellular automata: rules 54 and 110 and beyond



On Soliton collisions between localizations in complex elementary cellular automata: rules 54 and 110 and beyond



(c)

Figure 11. Typical snapshots of ECAM rule $\phi_{R9_{maj};4}$. (a) Starts with an initial density of 10%. (b) Presents an initial density of 80%. (c) Has an initial density of 50%. All evolutions are filtered for the best visualization of mobile self-localization interaction; the evolutions are on a ring of 776 cells for 315 generations.

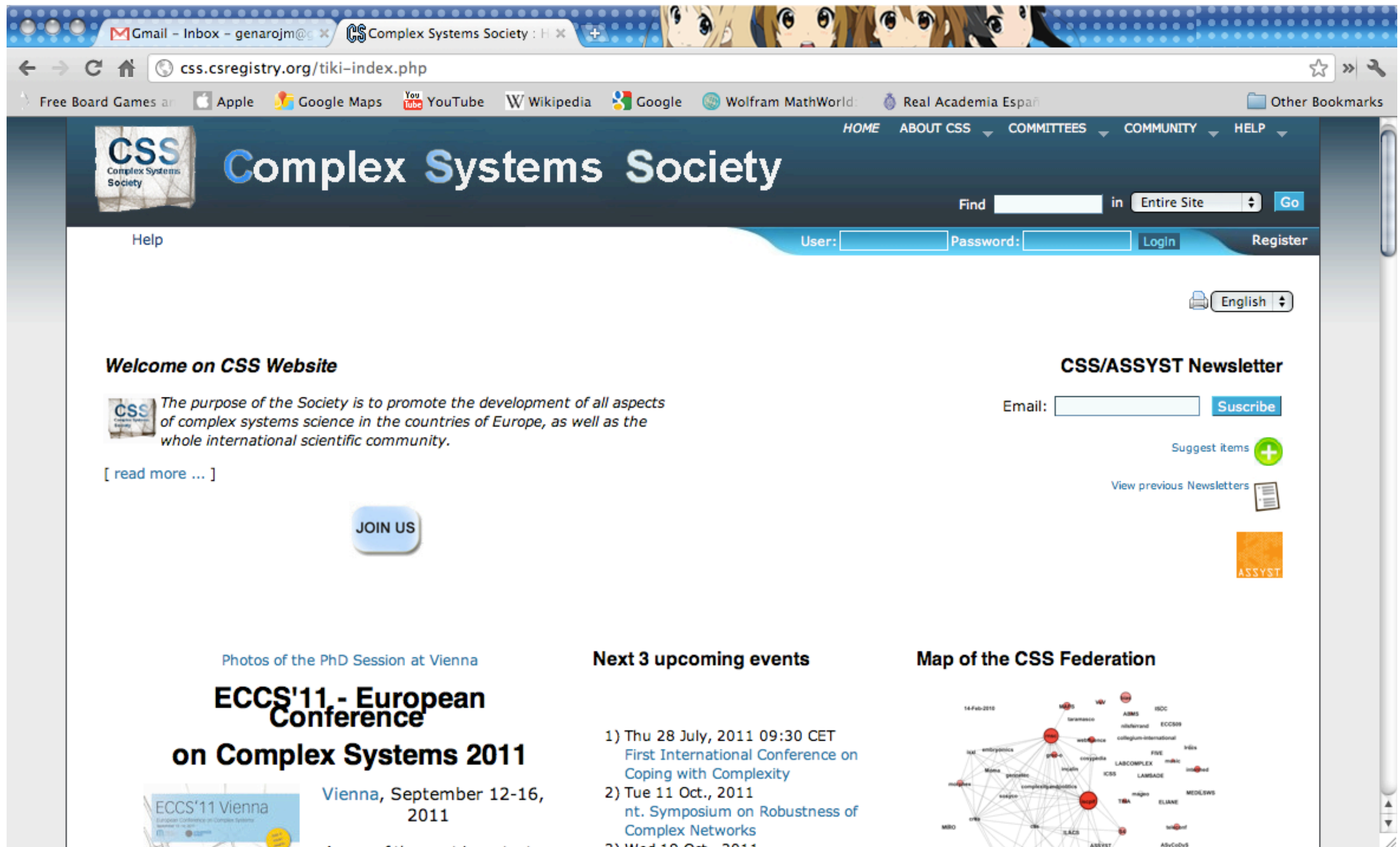
Complex systems institutions around the world

Complex Systems institutions around the world

- **Complex Systems Society (CSS)**, <http://css.csregistry.org/>
- **Santa Fe Institute: complexity research expanding the boundaries of science**, <http://www.santafe.edu/>
- **New England Complex Systems Institute (NECSI)**, <http://necsi.edu/>
- **L'institut des Systèmes Complexes – Paris Île-de-France (ISC-PIF)**, <http://www.iscpif.fr/>
- **Park Center for Complex Systems MIT**, <http://web.mit.edu/pccs/>
- **CoMPLEX: Centre for Mathematics and Physics in the Life Sciences and Experimental Biology**, <http://www.ucl.ac.uk/complex/>
- **Complex Systems UCSB Physics**, <http://web.physics.ucsb.edu/~complex/>
- **Institute for Complex Systems Simulation**, <http://www.icss.soton.ac.uk/>
- **Complexity in Human, Natural, and Engineered Systems: The Ohio State University**, <https://complex-systems.wikidot.com/>
- **UNC Charlotte to hold Forum on the Future of Complex Systems Research and Applications**, <http://complexity.uncc.edu/UNC-Charlotte-to-hold-Forum-on-the-Future-of-Complex-Systems-Research-and-Applications>
- **IKEGAMI Lab.: Complex Systems and Artificial Life**, <http://sacral.c.u-tokyo.ac.jp/>
- **Center for Complex Systems and Brain Sciences**, <http://www.ccs.fau.edu/>
- **A New Kind of Science: The NKS Forum**, <http://forum.wolframscience.com/>
- **Complex Open Systems Research Network (COSNet)**, <http://www.complexsystems.net.au/>
- **Complexity Digest**, <http://comdig.unam.mx/>
- **Complex Systems Forum**, http://serendip.brynmawr.edu/forum/viewforum.php?forum_id=138&palette=lightyellow
- **Complexity Science**, <http://groups.google.com/group/complexity-science?hl=en&lnk=>

Complex Systems Society

<http://css.csregistry.org/>



The screenshot shows a web browser window with the URL css.csregistry.org/tiki-index.php. The browser's address bar and tabs are visible at the top. The website's header features the CSS logo and the text "Complex Systems Society". A navigation menu includes links for HOME, ABOUT CSS, COMMITTEES, COMMUNITY, and HELP. A search bar is located on the right side of the header. Below the header, there is a "Help" link and a "User: Password: Login Register" section. A language selector is set to "English".

Welcome on CSS Website

 The purpose of the Society is to promote the development of all aspects of complex systems science in the countries of Europe, as well as the whole international scientific community.

[read more ...]

JOIN US

CSS/ASSYST Newsletter

Email: **Suscribe**

[Suggest items](#) 

[View previous Newsletters](#) 

Photos of the PhD Session at Vienna

ECCS'11 - European Conference on Complex Systems 2011

 Vienna, September 12-16, 2011

Next 3 upcoming events

- 1) Thu 28 July, 2011 09:30 CET
First International Conference on Coping with Complexity
- 2) Tue 11 Oct., 2011
nt. Symposium on Robustness of Complex Networks
- 3) Wed 19 Oct. 2011

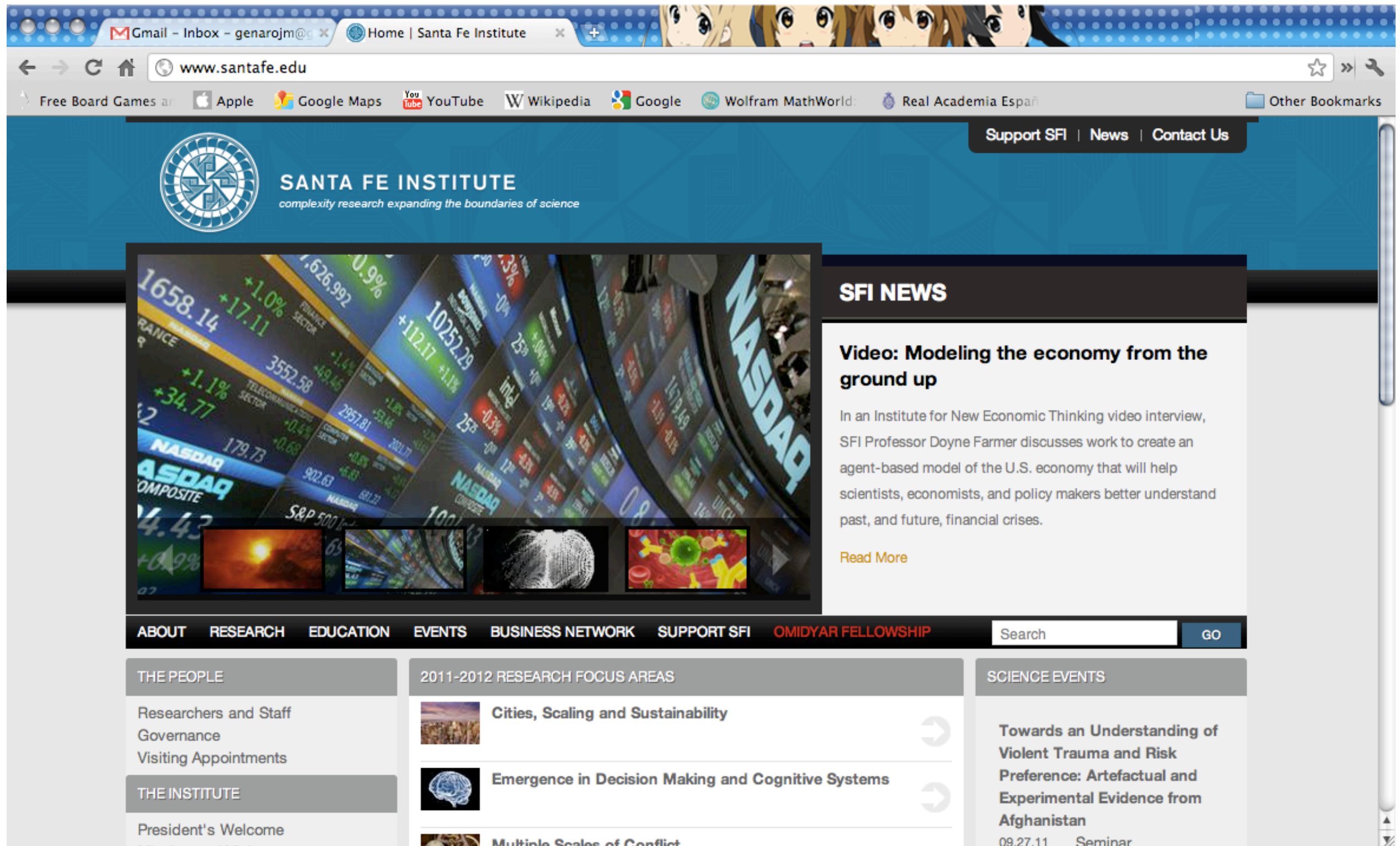
Map of the CSS Federation



The network diagram shows a complex web of connections between various organizations and individuals. Nodes are represented by colored circles (red, blue, green) and are labeled with names such as "ECCS", "ASSYST", "ECCS09", "ECCS10", "ECCS11", "ECCS12", "ECCS13", "ECCS14", "ECCS15", "ECCS16", "ECCS17", "ECCS18", "ECCS19", "ECCS20", "ECCS21", "ECCS22", "ECCS23", "ECCS24", "ECCS25", "ECCS26", "ECCS27", "ECCS28", "ECCS29", "ECCS30", "ECCS31", "ECCS32", "ECCS33", "ECCS34", "ECCS35", "ECCS36", "ECCS37", "ECCS38", "ECCS39", "ECCS40", "ECCS41", "ECCS42", "ECCS43", "ECCS44", "ECCS45", "ECCS46", "ECCS47", "ECCS48", "ECCS49", "ECCS50", "ECCS51", "ECCS52", "ECCS53", "ECCS54", "ECCS55", "ECCS56", "ECCS57", "ECCS58", "ECCS59", "ECCS60", "ECCS61", "ECCS62", "ECCS63", "ECCS64", "ECCS65", "ECCS66", "ECCS67", "ECCS68", "ECCS69", "ECCS70", "ECCS71", "ECCS72", "ECCS73", "ECCS74", "ECCS75", "ECCS76", "ECCS77", "ECCS78", "ECCS79", "ECCS80", "ECCS81", "ECCS82", "ECCS83", "ECCS84", "ECCS85", "ECCS86", "ECCS87", "ECCS88", "ECCS89", "ECCS90", "ECCS91", "ECCS92", "ECCS93", "ECCS94", "ECCS95", "ECCS96", "ECCS97", "ECCS98", "ECCS99", "ECCS100".

Complexity Research Expanding the Boundaries of Science

Santa Fe Institute, NM, USA
<http://www.santafe.edu/>



The screenshot shows the Santa Fe Institute website in a web browser. The browser's address bar displays 'www.santafe.edu'. The website's header features the Santa Fe Institute logo, which is a circular emblem with a stylized 'S' and 'F' inside, and the text 'SANTA FE INSTITUTE' and 'complexity research expanding the boundaries of science'. To the right of the logo is a navigation bar with links for 'Support SFI', 'News', and 'Contact Us'. Below the header is a large banner image showing a close-up of a stock market ticker board with various financial data points. To the right of the banner is a section titled 'SFI NEWS' with a featured article titled 'Video: Modeling the economy from the ground up'. The article text describes a video interview with SFI Professor Doyne Farmer about his work on creating an agent-based model of the U.S. economy. Below the article is a 'Read More' link. At the bottom of the page is a navigation bar with links for 'ABOUT', 'RESEARCH', 'EDUCATION', 'EVENTS', 'BUSINESS NETWORK', 'SUPPORT SFI', and 'OMIDYAR FELLOWSHIP'. To the right of these links is a search bar with a 'GO' button. Below the navigation bar are three main content areas: 'THE PEOPLE' (listing 'Researchers and Staff', 'Governance', and 'Visiting Appointments'), 'THE INSTITUTE' (listing 'President's Welcome'), '2011-2012 RESEARCH FOCUS AREAS' (listing 'Cities, Scaling and Sustainability', 'Emergence in Decision Making and Cognitive Systems', and 'Multiple Scales of Conflict'), and 'SCIENCE EVENTS' (listing 'Towards an Understanding of Violent Trauma and Risk Preference: Artefactual and Experimental Evidence from Afghanistan' with the date '09.27.11' and the event type 'Seminar').

SANTA FE INSTITUTE
complexity research expanding the boundaries of science

SFI NEWS

Video: Modeling the economy from the ground up

In an Institute for New Economic Thinking video interview, SFI Professor Doyne Farmer discusses work to create an agent-based model of the U.S. economy that will help scientists, economists, and policy makers better understand past, and future, financial crises.

[Read More](#)

ABOUT **RESEARCH** **EDUCATION** **EVENTS** **BUSINESS NETWORK** **SUPPORT SFI** **OMIDYAR FELLOWSHIP**

Search **GO**

THE PEOPLE

- Researchers and Staff
- Governance
- Visiting Appointments

THE INSTITUTE

- President's Welcome

2011-2012 RESEARCH FOCUS AREAS

- Cities, Scaling and Sustainability**
- Emergence in Decision Making and Cognitive Systems**
- Multiple Scales of Conflict**

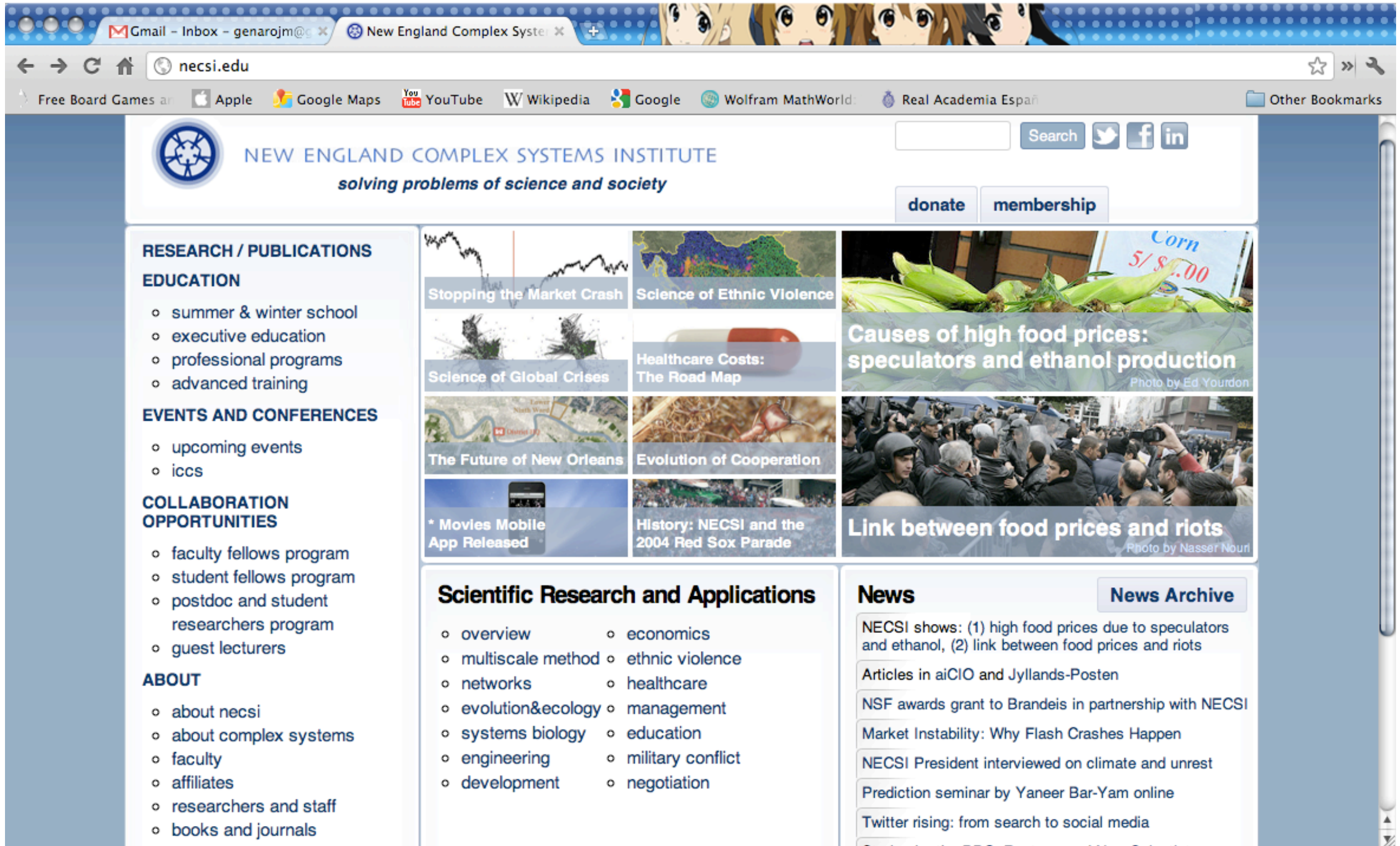
SCIENCE EVENTS

- Towards an Understanding of Violent Trauma and Risk Preference: Artefactual and Experimental Evidence from Afghanistan**
09.27.11 Seminar

The New England Complex Systems Institute (NECSI)

New England Complex Systems Institute, MA, USA

<http://necsi.edu/>

A screenshot of the NECSI website as it appeared in the early 2010s. The browser window shows the URL 'necsi.edu' and several open tabs including Gmail and New England Complex Systems Institute. The website header features the NECSI logo, the name 'NEW ENGLAND COMPLEX SYSTEMS INSTITUTE', and the tagline 'solving problems of science and society'. Navigation links for 'donate' and 'membership' are present. The main content area is divided into several sections: 'RESEARCH / PUBLICATIONS', 'EDUCATION' (listing summer & winter school, executive education, professional programs, and advanced training), 'EVENTS AND CONFERENCES' (listing upcoming events and iccs), 'COLLABORATION OPPORTUNITIES' (listing faculty fellows, student fellows, postdoc and student researchers, and guest lecturers), and 'ABOUT' (listing information about necsi, complex systems, faculty, affiliates, researchers, and books/journals). A central grid of featured articles includes 'Stopping the Market Crash', 'Science of Ethnic Violence', 'Science of Global Crises', 'Healthcare Costs: The Road Map', 'The Future of New Orleans', 'Evolution of Cooperation', 'History: NECSI and the 2004 Red Sox Parade', 'Causes of high food prices: speculators and ethanol production', and 'Link between food prices and riots'. A 'Scientific Research and Applications' section lists topics like overview, economics, multiscale method, ethnic violence, networks, healthcare, evolution&ecology, management, systems biology, education, engineering, military conflict, development, and negotiation. A 'News' section with a 'News Archive' link lists recent articles such as 'NECSI shows: (1) high food prices due to speculators and ethanol, (2) link between food prices and riots', 'NSF awards grant to Brandeis in partnership with NECSI', and 'Market Instability: Why Flash Crashes Happen'.

L'institut des Systèmes Complexes – Paris Île-de-France (ISC-PIF)

Paris, France

<http://www.iscpif.fr/>



The screenshot shows a web browser window with the URL www.iscpif.fr. The browser's address bar and tabs are visible at the top. The website's header features the ISC-PIF logo on the left and navigation links for 'CALENDRIER', 'JOBS', and 'CONTACT' on the right. Below the header is a dark navigation bar with links for 'À PROPOS DE L'ISC', 'RECHERCHE', 'PERSONNES', 'ÉVÉNEMENTS', and 'RESSOURCES'. A search bar is located on the right side of this bar. The main content area has a light background and includes a large ISC-PIF logo on the left. To the right of the logo is a paragraph of text in French. Further right is a section titled 'L' ISC-PIF en quelques chiffres' with a circular graphic. Below this is a section titled 'Les actualités de l'ISC-PIF' which includes a sub-section for 'SynBioCCC' with a date and location. At the bottom right, there is a section titled 'Launching the Complex Systems Community Explorer' with an 'Online' button.

CALENDRIER JOBS CONTACT

S'INSCRIRE CONNEXION

À PROPOS DE L'ISC RECHERCHE PERSONNES ÉVÉNEMENTS RESSOURCES

> english

INSTITUT DES SYSTÈMES COMPLEXES
ISC
PARIS ÎLE-DE-FRANCE

L'institut des Systèmes Complexes – Paris Île-de-France (ISC-PIF) rassemble des chercheurs issus de disciplines différentes et qui souhaitent travailler ensemble sur la problématique des systèmes complexes.

Véritable tête de pont d'un réseau qui regroupe tous les acteurs académiques et privés concernés par la science des systèmes complexes, l'ISC-PIF crée de nouveaux liens au-delà des frontières des laboratoires et des centres R&D

L' ISC-PIF en quelques chiffres

Les actualités de l'ISC-PIF

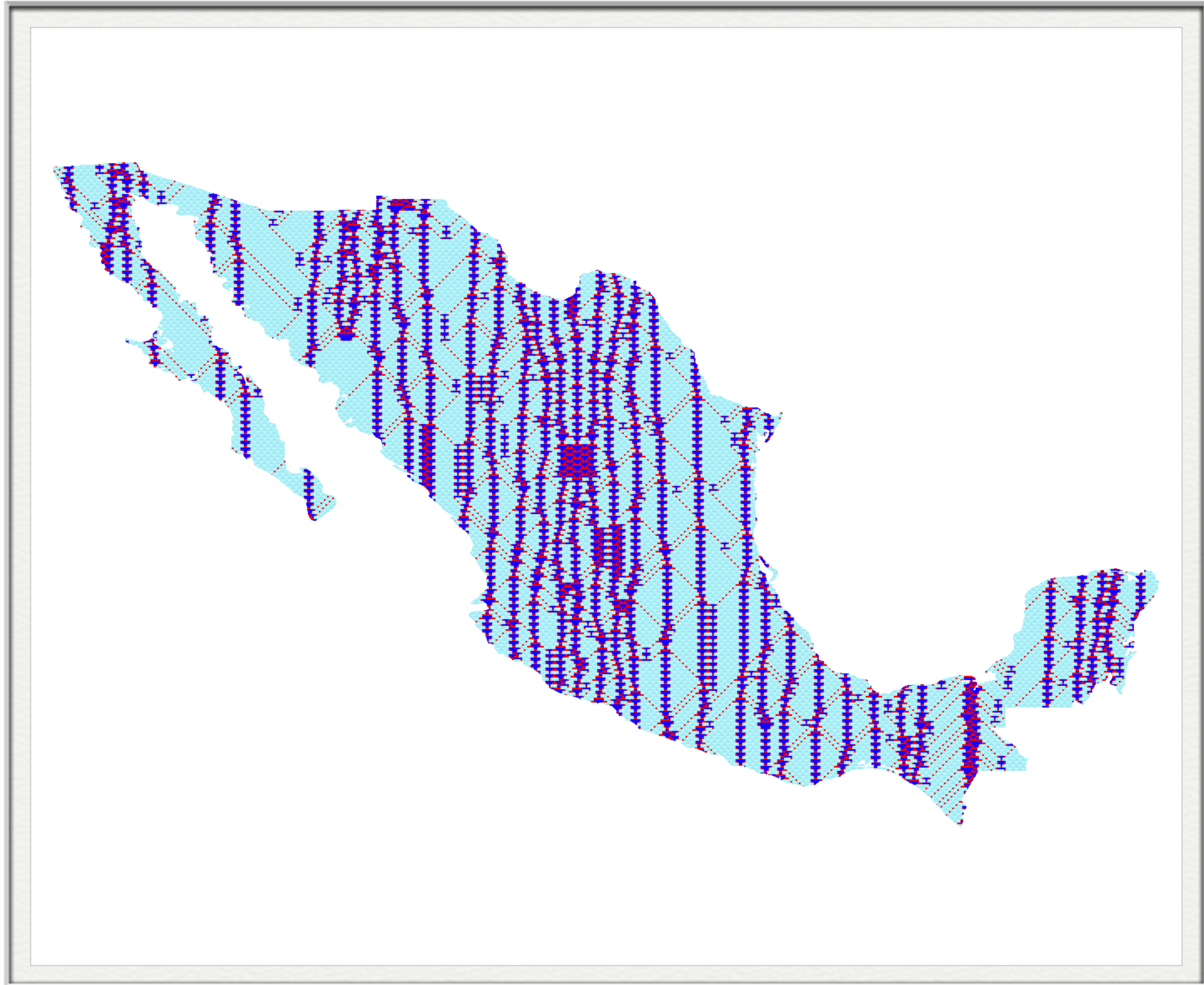
SynBioCCC
Monday 08 August, 2011, Cité Internationale Universitaire de Paris

Synthetic Biology
SynBioCCC will be the first workshop on synthetic biology in ECAL. It aims at providing a forum for electrical and computer science/engineering researchers who wish to be introduced to, or present their own work in.

Launching the **Complex Systems Community Explorer**

Online

Some Mexican institutions starting studies about complex systems



Some Mexican institutions starting studies about complex systems

Browser tabs: Gmail - Inbox - genarojm@... Bienvenidos a la MDNLYSC

Address bar: www.nolineal.org.mx

Bookmarks: Free Board Games an Apple Google Maps YouTube Wikipedia Google Wolfram MathWorld Real Academia Españ Other Bookmarks

Logo: DNL y SC Maestría en Dinámica No Lineal y Sistemas Complejos

Search bar: buscar...

Navigation menu: Maestría | Estudiantes | Servicios | Eventos | Contactar | WebLog | Acceso

Secondary navigation: Orígenes y Antecedentes | Personal | Líneas de Investigación | Documento Maestro | Artículos | Preguntas Frecuentes

Section: **Presentación**



Convocatoria de Ingreso a la maestría 2011

Escrito por Fernando Ramírez Alatríste
Martes, 05 de Abril de 2011 13:47

**La Universidad Autónoma de la Ciudad de México
CONVOCA
a los interesados en cursar la
Maestría en Dinámica no Lineal y Sistemas Complejos**

Presentación
La Universidad Autónoma de la Ciudad de México (UACM) ofrece la Maestría en Dinámica no Lineal y Sistemas Complejos (MDNLYSC) orientada al estudio de los sistemas físicos, biológicos y sociales en donde los enfoques lineales son notoriamente insuficientes para comprender el comportamiento del todo. La MDNLYSC está dirigida a profesionistas interesados en la matemática de los sistemas dinámicos no lineales y sus aplicaciones al estudio de la complejidad y en la construcción, para sí, de una cultura

MDNLYSC

- Maestría**
 - Orígenes y Antecedentes
 - Personal
 - Líneas de Investigación
 - Documento Maestro
 - Artículos
 - Preguntas Frecuentes
- Estudiantes**
- Servicios**
- Eventos**
- Contactar**
- WebLog**
- Acceso**

Some Mexican institutions starting studies about complex systems

Gmail - Inbox - genarojm@... Proyecto - Programa de Estu...
https://sites.google.com/site/uamxpecci/proyecto
Free Board Games an Apple Google Maps YouTube Wikipedia Google Wolfram MathWorld: Real Academia Españ... Other Bookmarks

Programa de Estudios sobre Complejidad, Cognición e Instituciones (PECCI). UAM-X

Navegación

- Proyecto
- Miembros
- Complejidad
- Cognición
- Instituciones
- Cooperación
- Productos
- Links
- Foros y Eventos
- Contacto

Proyecto



<http://www.foto-gratis.es>

Definición del proyecto

El Programa de Estudios sobre Complejidad, Cognición e Instituciones (PECCI), fundado en 2008, busca aportar elementos para analizar y explicar, de una manera no reduccionista, la complejidad de los fenómenos sociales. Surge como un proyecto que aspira a la colaboración multidisciplinaria entre las ciencias sociales y humanidades, la biología y la computación. El programa es conducido por un grupo de investigadores y estudiantes, de posgrado y posdoctorado, provenientes de

Translate

Some Mexican institutions starting studies about complex systems

The screenshot shows a web browser window with the URL `transdisciplinario.cinvestav.mx/PlandeEstudios.aspx`. The browser's address bar and tabs are visible at the top. The website's header features the logo of the **Portal del Programa Transdisciplinario** and the **Cinvestav** logo. A search bar and the date **14 / 09 / 2011** are also present. The main content area is divided into two columns. The left column contains a navigation menu with links: **Inicio**, **Misión**, **Perfil de Egresados**, **Plan de Estudios** (highlighted), **Trabajo de Investigación**, **Obtención del Grado**, **Profesorado**, **Inscripción y Admisión**, and **Eventos Académicos**. The right column displays the **PLAN DE ESTUDIOS** section, which includes a list of three phases and three thematic units. A red horizontal line separates this section from the **TRABAJO DE INVESTIGACIÓN** section, which is partially visible on the right. The **TRABAJO DE INVESTIGACIÓN** section includes a list of classes for the thesis and a brief description of the research process.

Portal del Programa Transdisciplinario

14 / 09 / 2011

Buscar

Cinvestav

Register | Login

Plan de Estudios

El plan de estudios comprende tres fases:

1. Fundamentos conceptuales, que se enfocan hacia la construcción de recursos básicos, incluyendo el lenguaje y la caracterización de formas de pensamiento asociadas con las ciencias exactas, biomédicas, ingenierías, tecnología y ciencias sociales;
2. Cuatro unidades temáticas sobre ciencia y tecnología en el tiempo, desarrollo de la ciencia y la tecnología en México, y temas sobre innovación, tecnología y sociedad;
3. Un módulo de cursos optativos relacionados con el trabajo directo de cada alumno en un proyecto de investigación aprobado por el Colegio Académico del programa.

Unidades temáticas

PRIMERA UNIDAD. Ciencia y Tecnología en el Tiempo: Pasado, Presente y Futuro

1. Interdependencia histórica avance científico - avance tecnológico
2. Desarrollo de la física
3. Desarrollo de la química
4. Desarrollo de la biología
5. Desarrollo de las matemáticas
6. Desarrollo de la informática
7. Desarrollo de las ciencias sociales
8. Lenguajes de representación para un enfoque transdisciplinario

SEGUNDA UNIDAD. Desarrollo de la Ciencia y la Tecnología en México

1. Tradición local y desarrollo científico-tecnológico
2. Construcción de instituciones científicas y tecnológicas
3. Las comunidades académicas mexicanas
4. Evolución de la ciencia y la tecnología mexicanas en el periodo 1950-2000
5. Regionalización de la actividad científica y tecnológica en México
6. Desarrollo de la ingeniería en México
7. Los organismos y asociaciones promotores de la ICT
8. Factores determinantes de la productividad de los científicos mexicanos

TERCERA UNIDAD. Ciencia y Tecnología en México Hoy

1. Analfabetismo científico
2. Difusión, divulgación y vulgarización de la ciencia y la tecnología
3. Enseñanza de las ciencias a nivel profesional y de posgrado

TRABAJO DE INVESTIGACIÓN

Clases de proyectos para la tesis

En el adiestramiento para investigación, los estudiantes deberán aprender el entrelazamiento eficaz de aportaciones individuales para el abordaje colectivo de problemas generales de investigación:

- Desarrollo y Prospectiva de las Ciencias y la Tecnología (DPCT)
- Integración de la Ciencia, la Tecnología y la Sociedad (ICTS)
- Innovación para la Salud, la Industria y el Campo (ISIC)

Las tesis para obtener el grado de Doctor en Ciencias deberán dar lugar a publicaciones internacionales, sean éstas títulos propios de los intereses del programa de Tecnología & Society– o bien publicaciones reconocidas dentro de alguna revista especializada.

Some Mexican institutions starting studies about complex systems

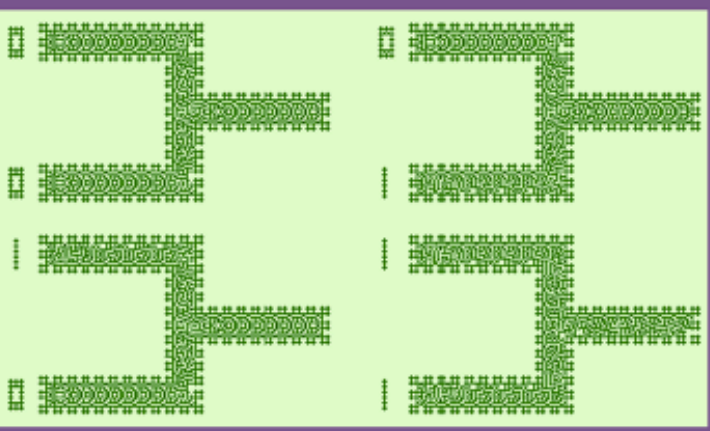
Gmail - Inbox - genarojm@... Laboratorio de Ciencias de la Computación

uncomp.uwe.ac.uk/LCCOMP/Principal.html

Free Board Games an Apple Google Maps YouTube Wikipedia Google Wolfram MathWorld Real Academia Españ Other Bookmarks

Principal Miembros Archivos Anuncios Contacto Créditos

LCCOMP Laboratorio de Ciencias de la Computación (LCCOMP) English



La figura superior muestra la evolución de autómatas celulares reversibles por bloques, la siguiente figura muestra un diagrama de ciclos (atractores), ambos en autómatas celulares de una dimensión. El video de la derecha muestra la implementación de la compuerta AND a través de competición de patrones en una regla del tipo Life.

Introducción

El **Laboratorio de Ciencias de la Computación (LCCOMP)**, con sede en la ciudad de México, centra sus intereses en *modelos de computación convencional y no-convencional*. Asimismo, se realizan estudios e investigaciones en *teoría de la computación y lenguajes, autómatas celulares, sistemas complejos, simulación de fenómenos físicos, caos, redes celulares neuronales, fenómenos no-lineales, vida artificial, computación natural, computadoras de reacción y difusión, biocomputación, computación cuántica, algoritmos genéticos, sistemas dinámicos, redes, agentes, historia de la computación e impacto social de la computación*. En la modelación de mecanismos abstractos para la implementación de computaciones, como son: *computación por choques de partículas, computación por competición de patrones, computación basada en ciclotrones (super choques)*. Explotando poderosas máquinas: *diagramas de de Bruijn, diagramas de subconjuntos y diagramas de parejas*.

© LCCOMP México 2010-2011

Some Mexican institutions starting studies about complex systems



The screenshot shows the website of the Centro de Ciencias de la Complejidad (C3) at UNAM. The browser window displays the URL c3.fisica.unam.mx. The website has a blue header with navigation links: En la Prensa, Foro Científico, Convocatorias, Multimedia, Intranet, Reporta, Enlaces, and Contacto. The main content area features a large banner with the text "COMPLEJIDAD SOCIAL" and a background image of a complex system. To the left of the banner is a vertical menu with the following items: Incubadora de megaproyectos, El C3, Investigación, Educación, Seminarios, Eventos, and Vinculación. To the right of the banner is a sidebar with six categories, each accompanied by a small image: COMPLEJIDAD ECOLÓGICA (image of a bee), INTELIGENCIA COMPUTACIONAL (image of a brain scan), COMPLEJIDAD SOCIAL (image of a group of people), COMPLEJIDAD Y BIOLOGIA CELULAR (image of cells), and COMPLEJIDAD Y SALUD PUBLICA (image of a person in a lab). At the bottom of the page, there is a section for "Eventos Próximos" (Upcoming Events) listing "12.09.2011 ECCS'11 European" and "Coloquio de Sistemas Complejos como Modelos de Computación (WCSCM2011)".

Free Board Games an Apple Google Maps YouTube Wikipedia Google Wolfram MathWorld: Real Academia Españ Other Bookmarks

En la Prensa Foro Científico Convocatorias Multimedia Intranet Reporta Enlaces Contacto

c3 centro de ciencias de la complejidad

Incubadora de megaproyectos

El C3

Investigación

Educación

Seminarios

Eventos

Vinculación

COMPLEJIDAD SOCIAL

COMPLEJIDAD ECOLÓGICA

INTELIGENCIA COMPUTACIONAL

COMPLEJIDAD SOCIAL

COMPLEJIDAD Y BIOLOGIA CELULAR

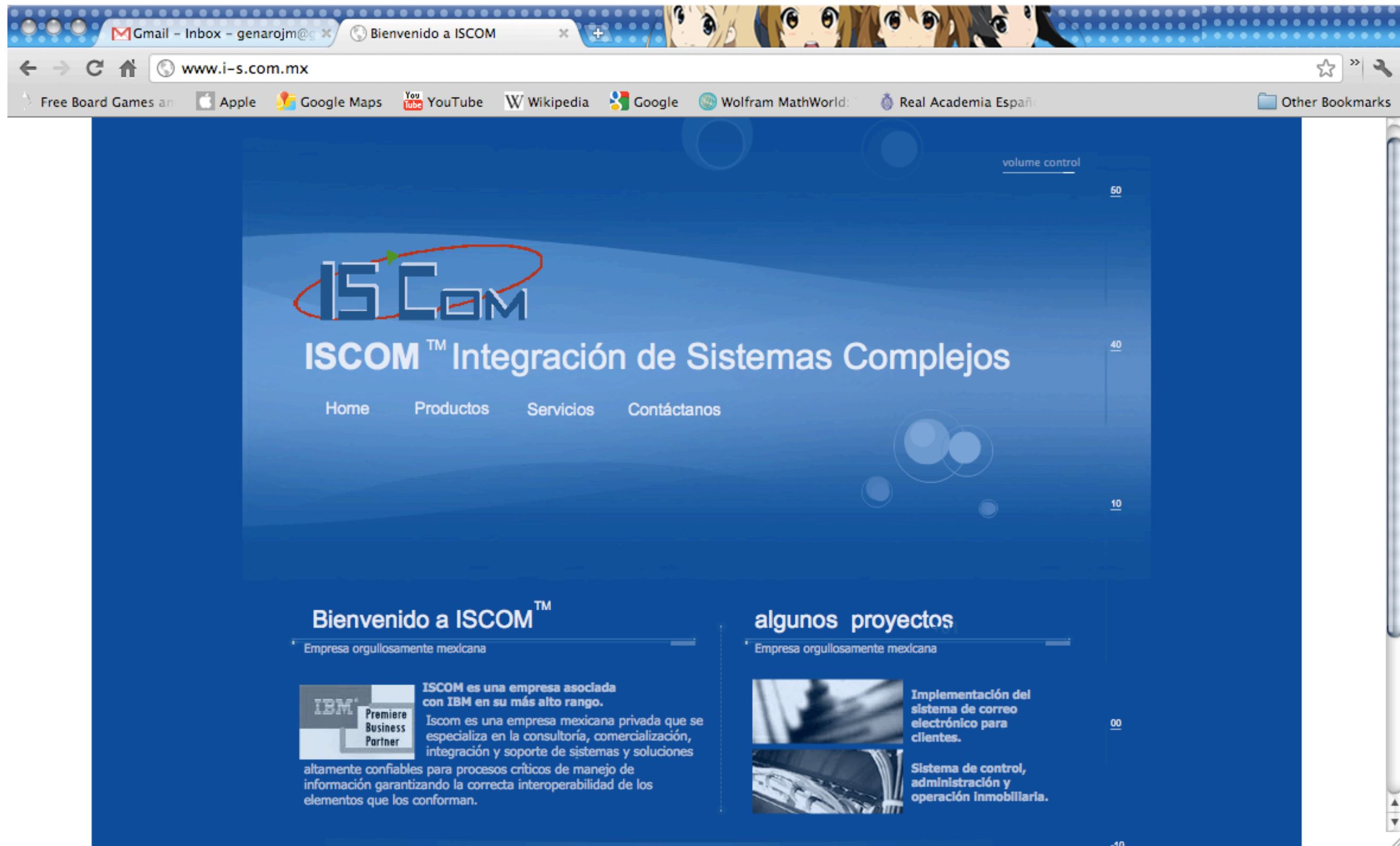
COMPLEJIDAD Y SALUD PUBLICA

Eventos Próximos

12.09.2011 ECCS'11 European

Coloquio de Sistemas Complejos como Modelos de Computación (WCSCM2011)

Some Mexican institutions starting studies about complex systems



Some Mexican institutions starting studies about complex systems

Red Complejidad, Ciencia y Sociedad

www.red-ccs.org

Most Visited - Wikipedia - YouTube - CAR... - 百度一下, 你就知道 - Google - Wolfram MathW... - Real Academia E... - Bookmarks

Complejidad, Ciencia y Sociedad

CONACYT

Red Temática de Investigación

Plan de trabajo

- » Presentación
- » Líneas temáticas
- » Comité académico
- » Acciones
- » Plan de trabajo 2010 resumen
- » Minutas

Congresos

- » Congreso Mayo 2011 Dilemas de la Innovación en México
- » Congreso Julio 2011 Evaluación y prospectiva

Seminarios

- » Seminario evaluación y perspectiva en CTI 2010

NOTICIAS

La presente publicación es resultado de un esfuerzo conjunto de la Secretaría General Iberoamericana (SEGIB) y la Comisión Económica para América Latina y el Caribe (CEPAL) y ha sido elaborada para la vigésima Cumbre Iberoamericana de Jefes de Estado y de Gobierno. [Ver trabajo](#)

Los trabajos que conforman este e-book son resultado de las reflexiones e intercambio de ideas y experiencias entre los participantes, algunos constituyen una continuidad y fortalecimiento de sus investigaciones, otros responden a inquietudes emergentes del programa de trabajo de la escuela de verano. [Ver e-book](#)

Volume 3, N1, 2011 publicación semestral de Innovación RICEC, revista electrónica arbitrada.

La revista electrónica del RICEC publica síntesis de trabajos, resultados de investigaciones relativos al desarrollo de la economía/sociedad del

Sobre los miembros

- » Atlas de la Ciencia Mexicana
- » Apropiación social del conocimiento e innovación
- » Centro de ciencias de la complejidad / C3
- » La Ciencia en tu escuela
- » Observatorio de Ciencia, Tecnología e Innovación

Atlas de la Ciencia Mexicana 2010

Versión Impresas 2003-2010

EULAKS

A complex systems research group emerge at IPN
(February 2013)

Center of Complex Systems IPN (CCSIPN)

<http://www.isc.escom.ipn.mx/sistemascomplejos/>

ESCOM, México D.F.

***Students are very welcome for research,
thesis, and terminal works. Please contact
to any CCSIPN member.***

FIN

¡Gracias por su atención!

Center of Complex Systems IPN (CCSIPN)

<http://www.isc.escom.ipn.mx/sistemascomplejos/>

Computer Science Laboratory (LCCOMP)

<http://uncomp.uwe.ac/LCCOMP/>