

Una Introducción a los Sistemas Complejos

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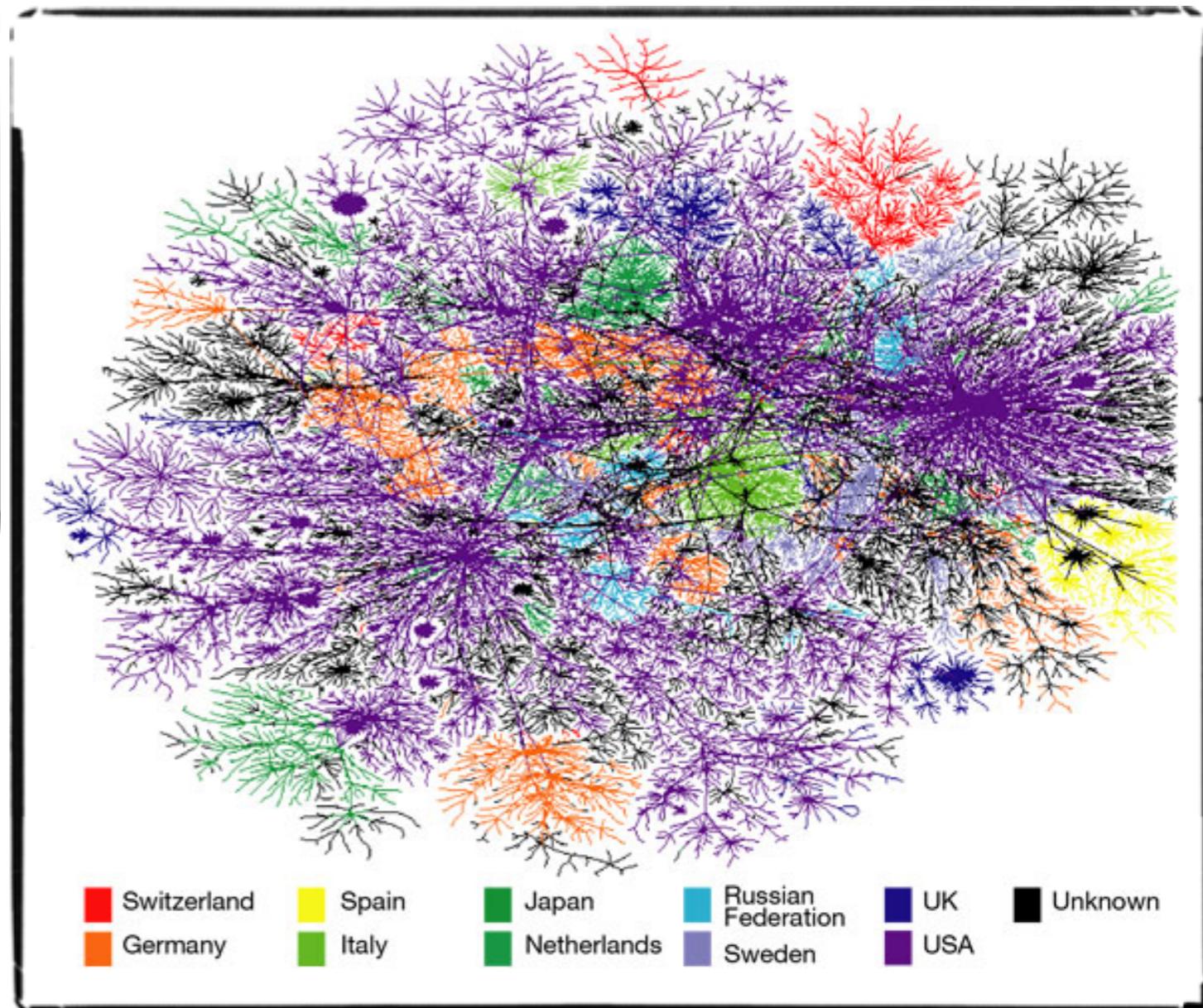
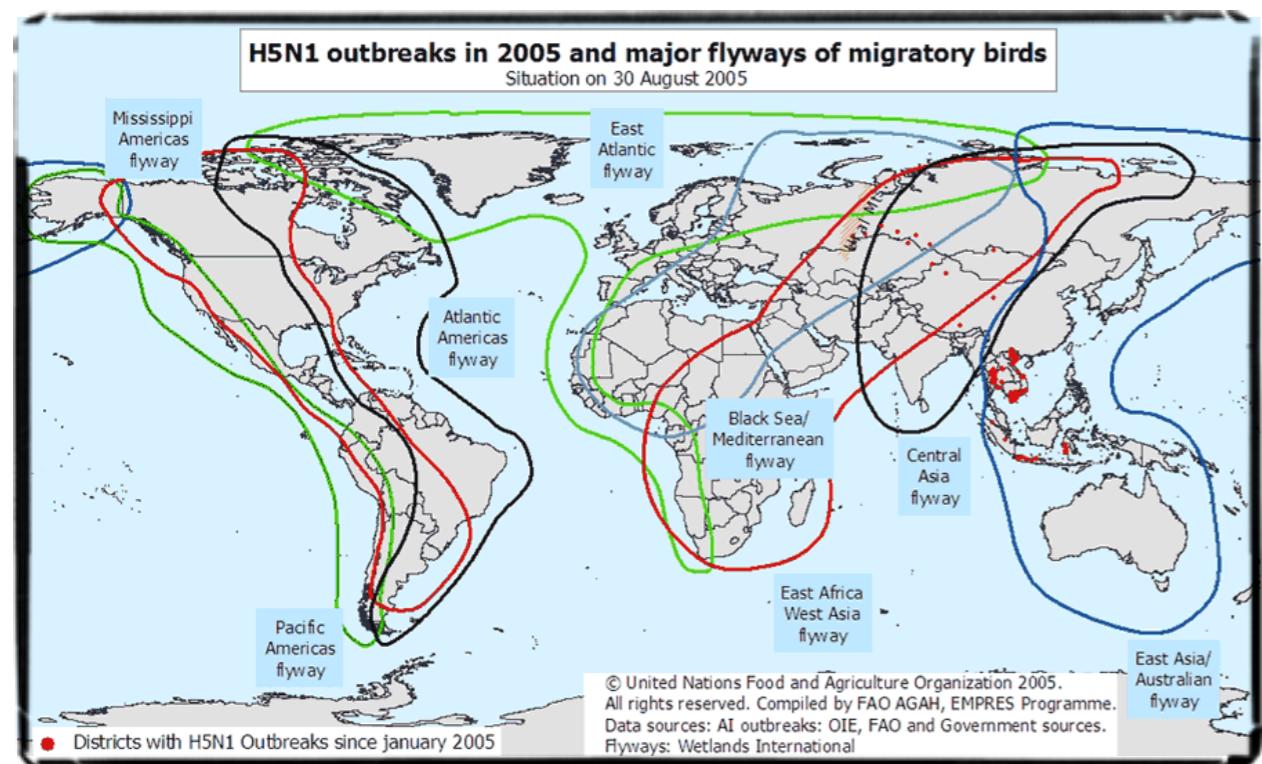
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15 de febrero de 2013, México, D.F.

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?

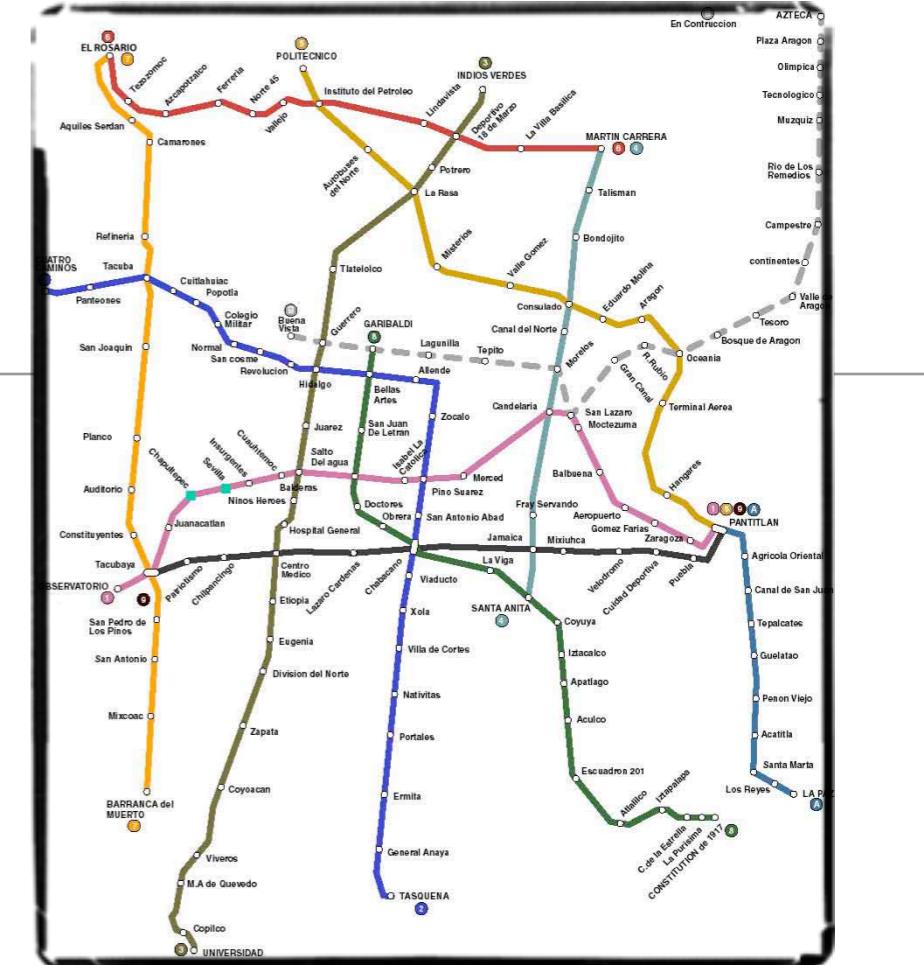
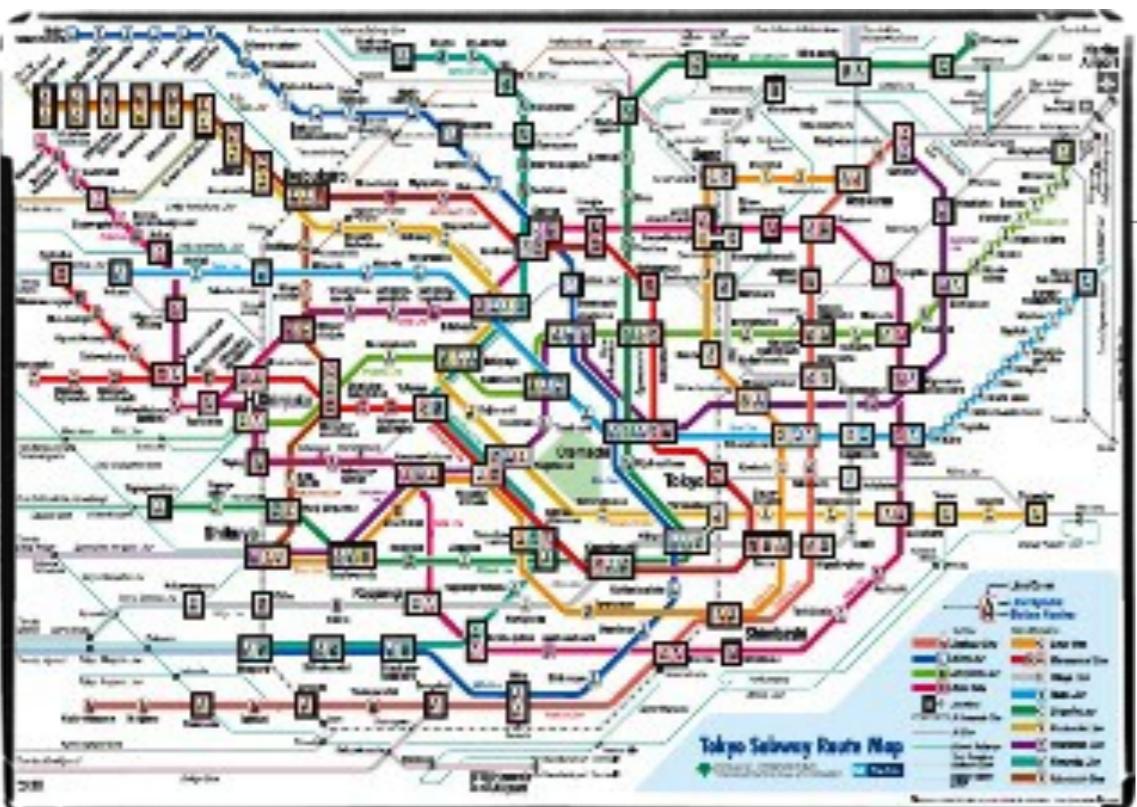
Algunas motivaciones



Non-trivial collective behaviour



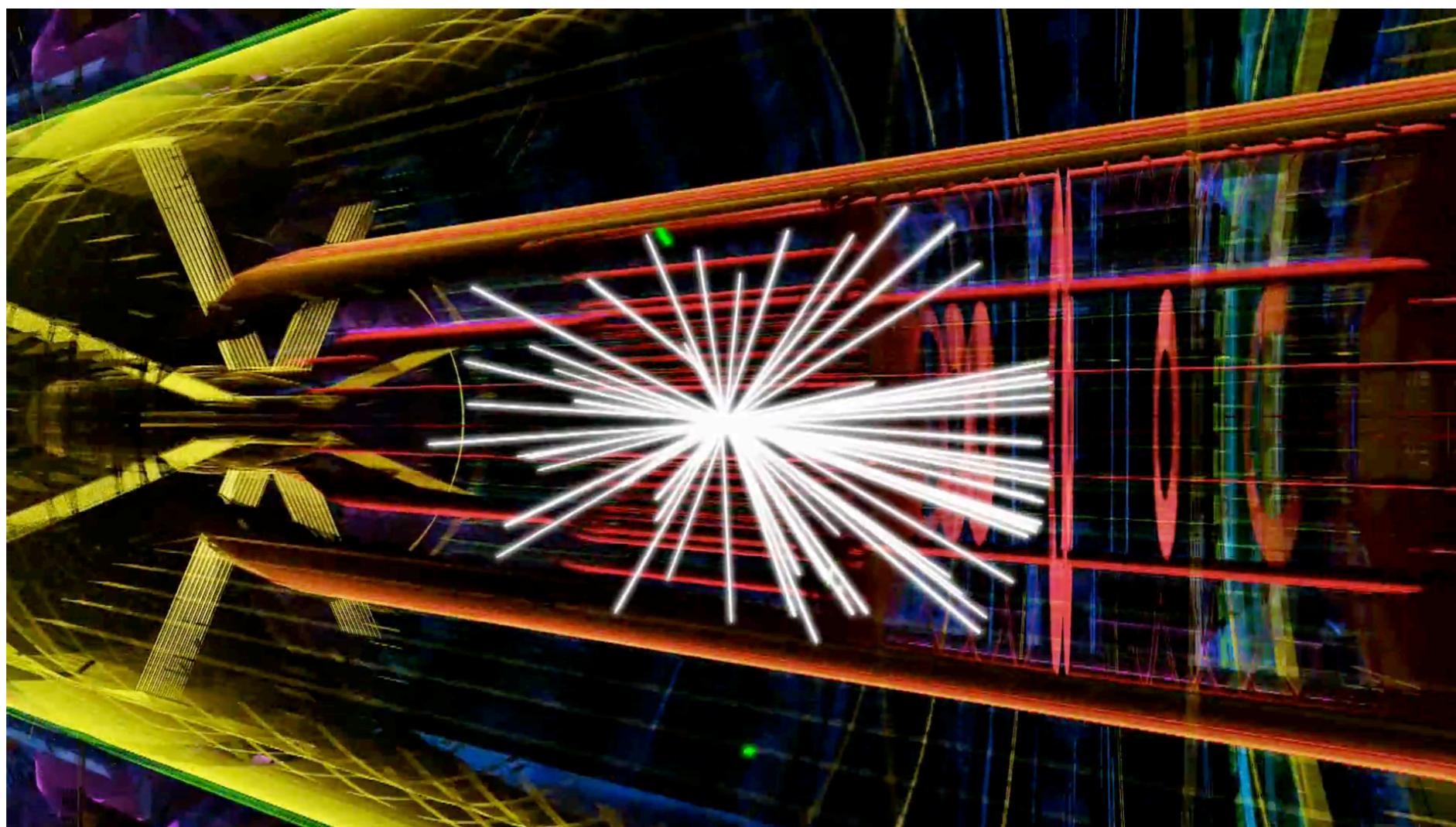
Public transport



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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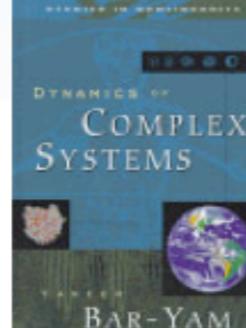
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Dynamics of Complex Systems Yaneer Bar-Yam



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.



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Book Summary | Sample Pages | Table of Contents | Preface

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Published by Wolfram Media (2002)
ISBN 1-57955-008-0

Melanie Mitchell

Complexity: A Guided Tour, 2009.



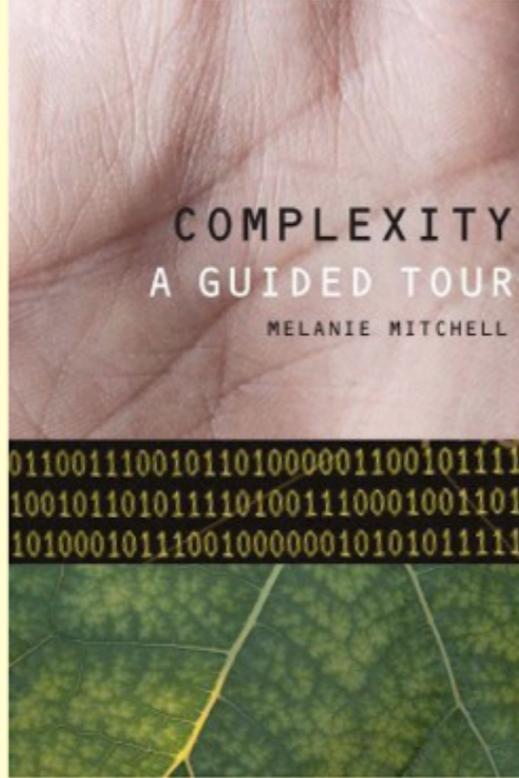
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Complexity: A Guided Tour

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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"An able a...

Wednesday, September 14, 2011 A A

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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).

¿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

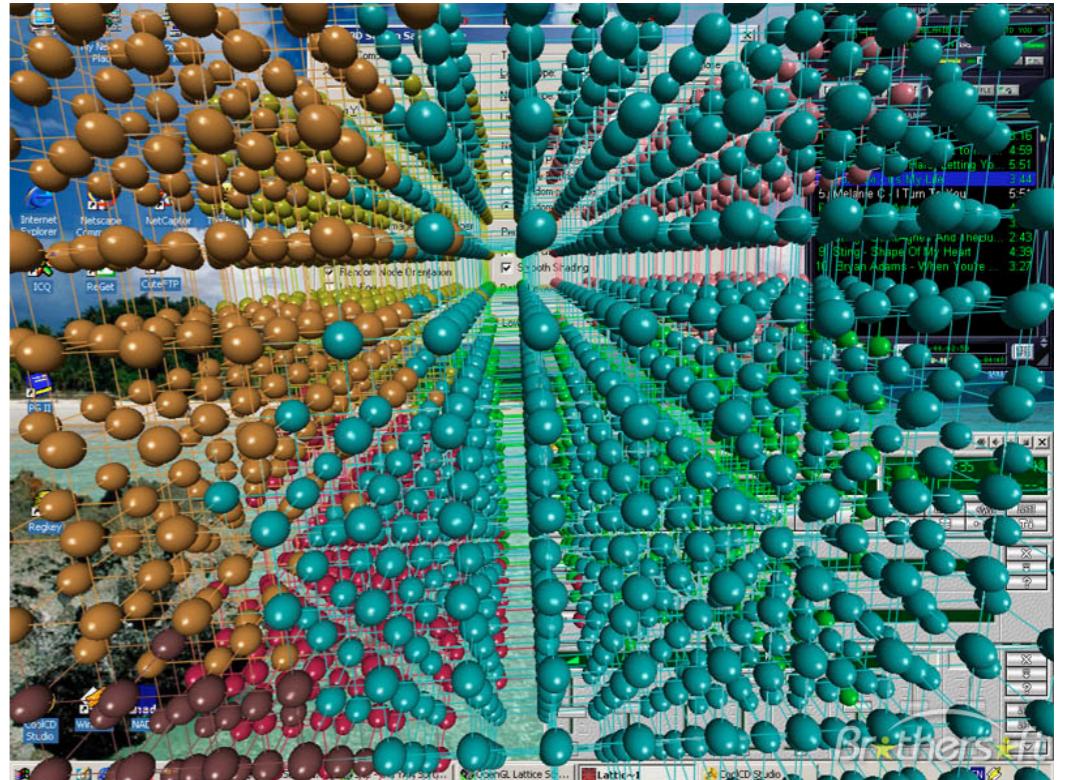
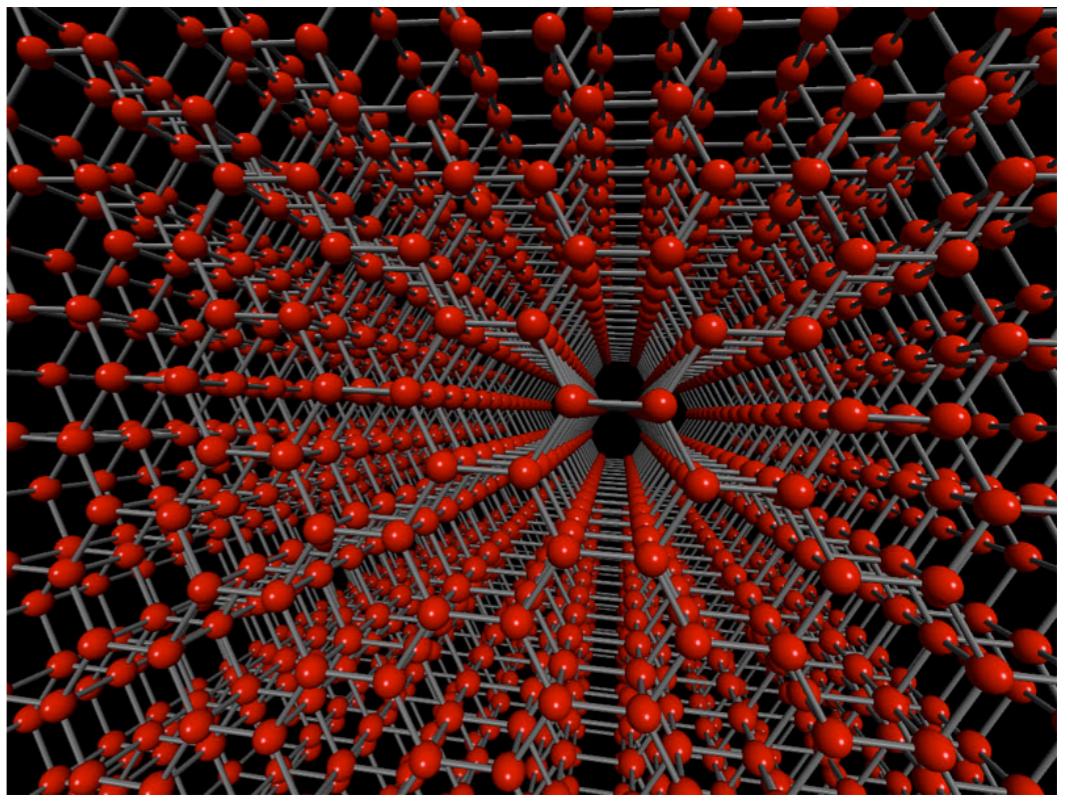
Software

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

Para ilustrar estos conceptos, rápidamente, nos apoyaremos en la *teoría de autómata celular*

¿Qué es un autómata 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-?)

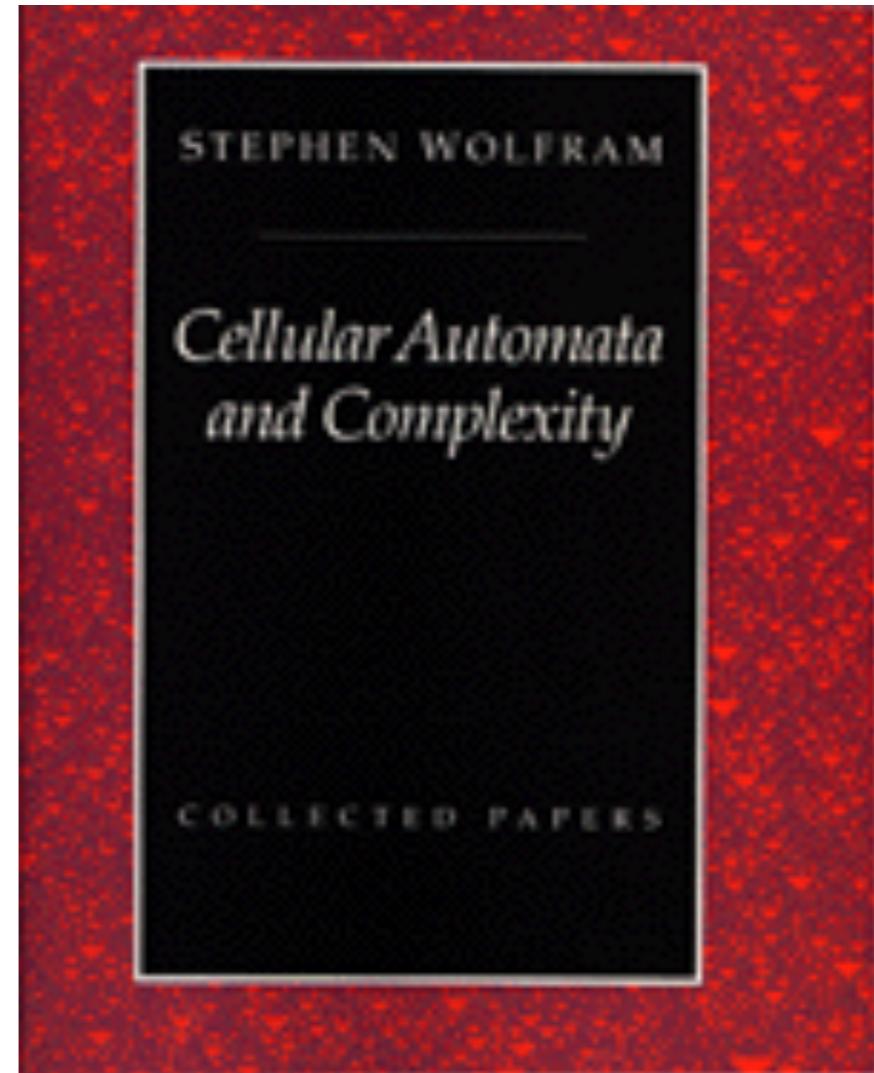
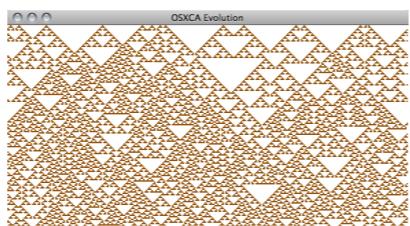


Stephen Wolfram's
A NEW KIND OF SCIENCE
The Crucial Experiment

How Do Simple Programs Behave?

2002

Complex systems are computationally universal!



complexity \Rightarrow { *uniform*
periodic
chaotic
complex

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

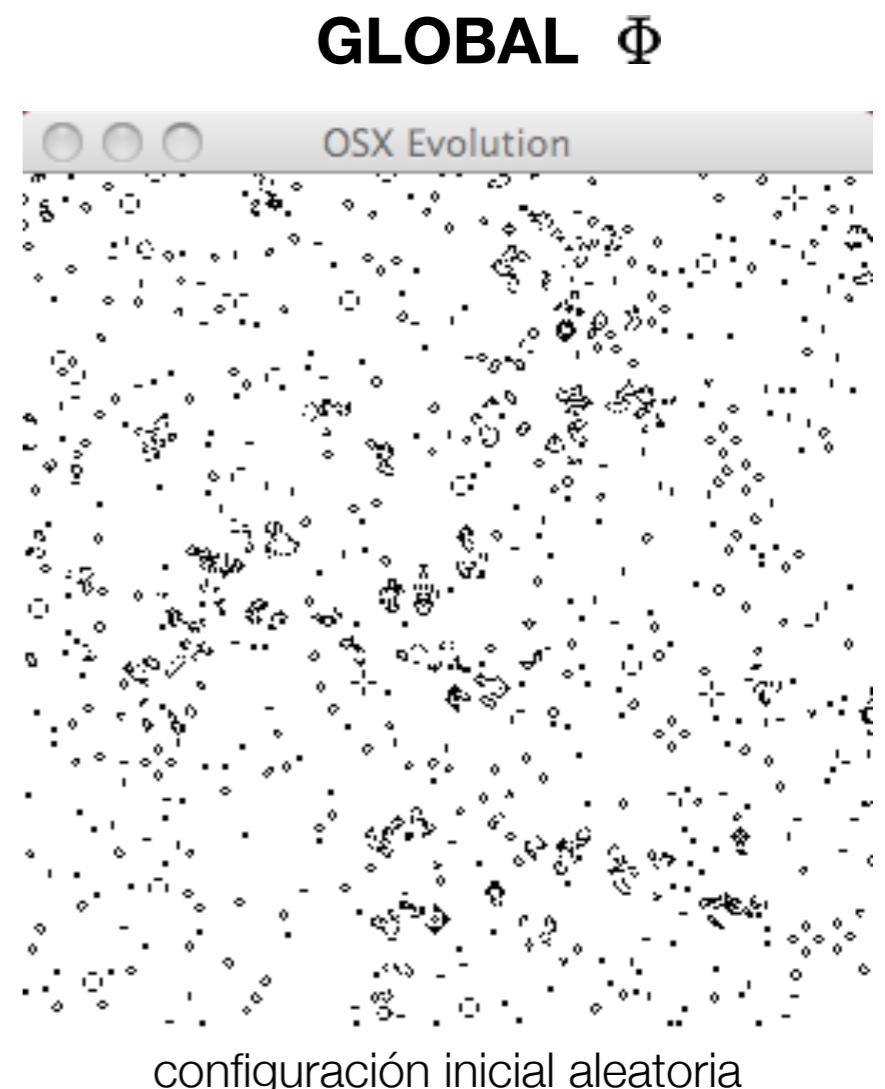
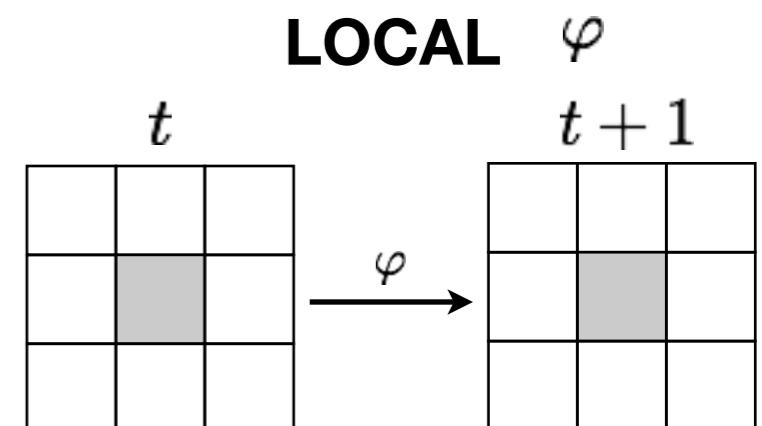
El autómata celular inventado por John Conway a finales de los 60's conocido como “*The Game of Life*”, es llamado así por su relación que tiene con la modelación de sistemas biológicos, tal como ecosistemas, incendios forestales, vida artificial, comportamientos colectivos de seres vivos, entre otros. 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:

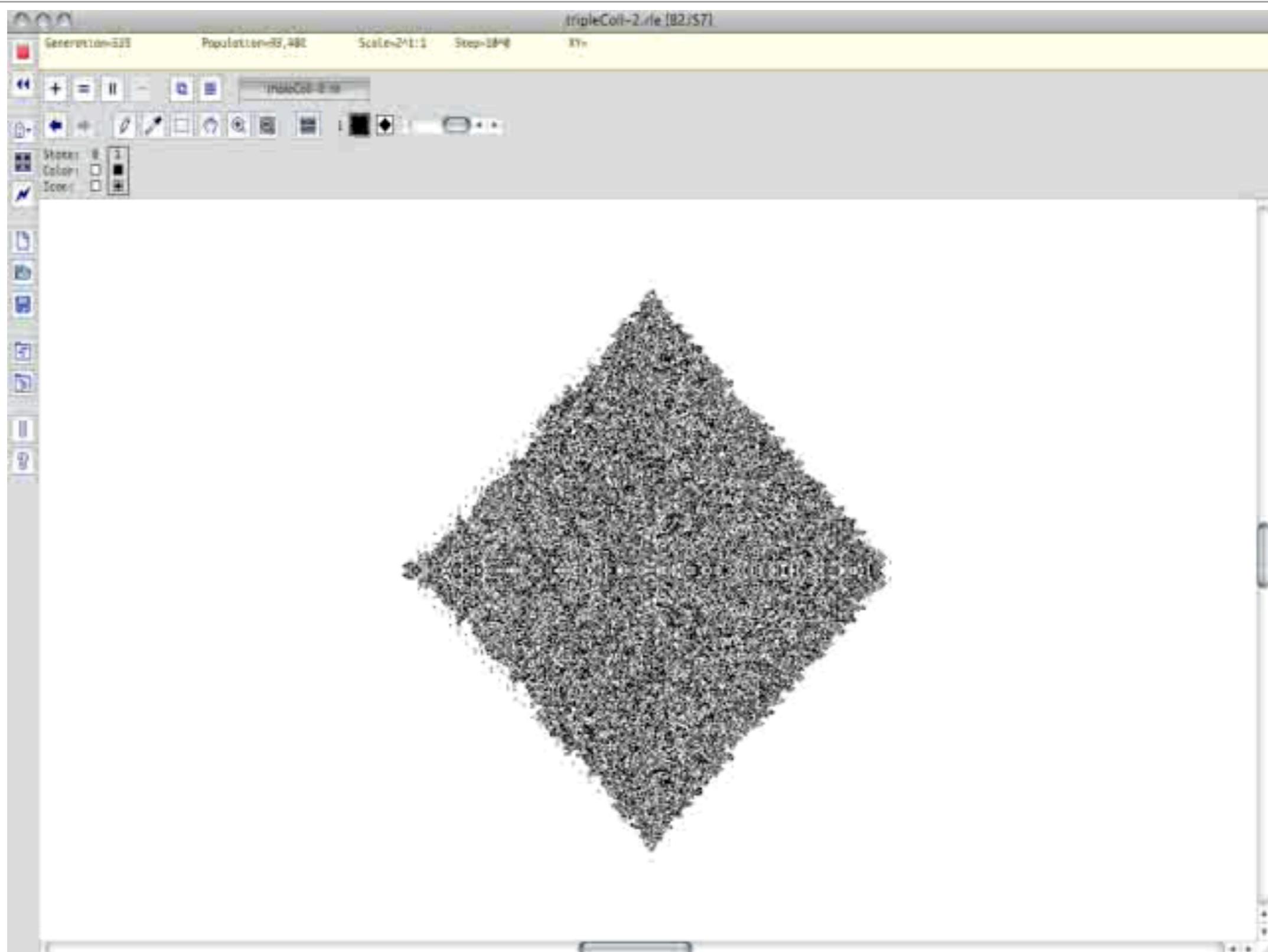
1. Una configuración c_i no debe desaparecer rápidamente.
2. Una configuración c_i debe crecer ilimitadamente.

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.

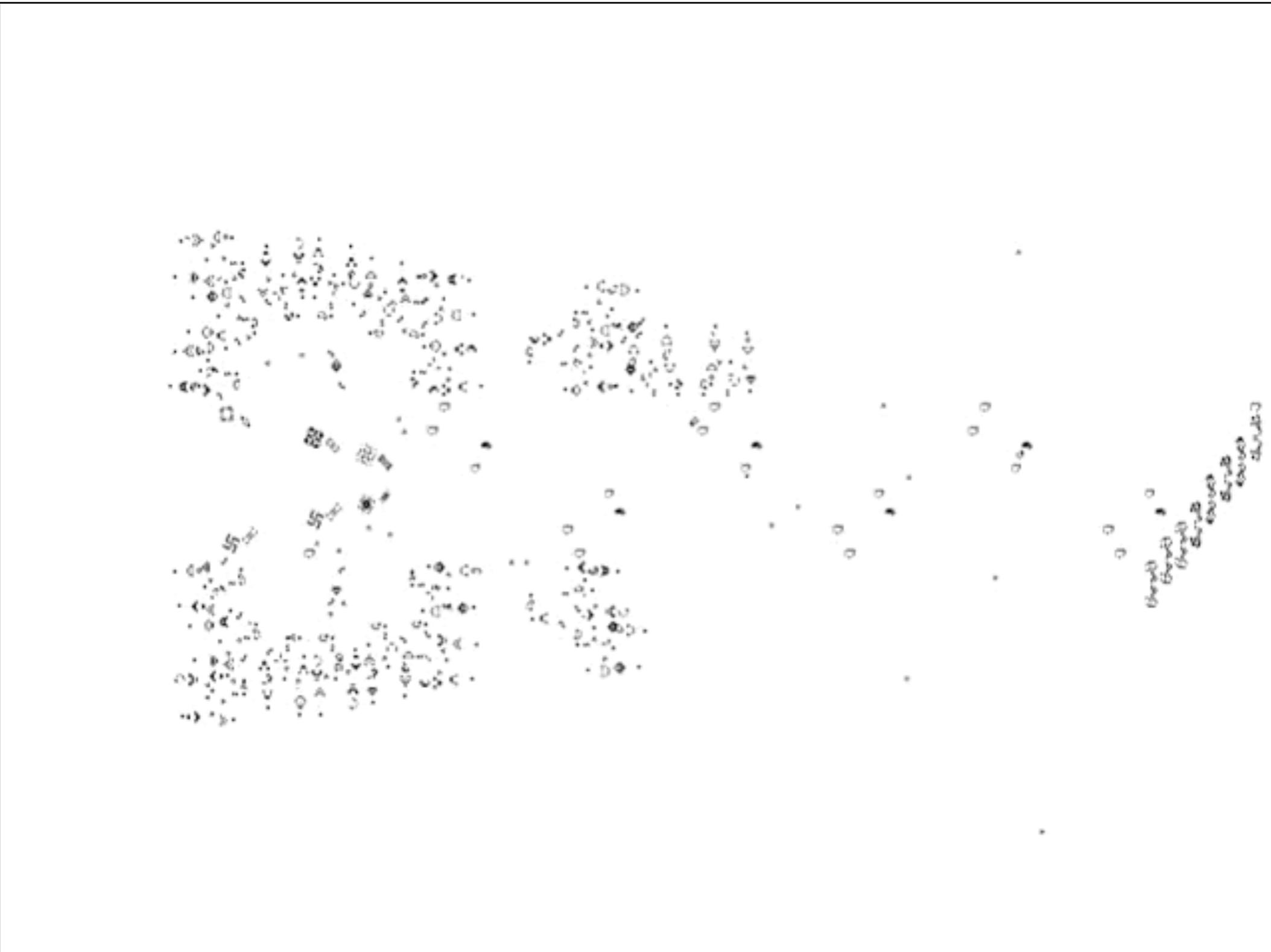
- (a) **Nacimiento.** Una célula muerta en el tiempo t llega a vivir en el tiempo $t + 1$ si tiene exactamente tres de sus vecinos vivos en el tiempo t .
- (b) **Muerte por sobre-población.** Si una célula vive en el tiempo t y tiene cuatro o mas de sus ocho vecinos vivos en el tiempo t , esta célula 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 .



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



Construcciones cada vez más complejas



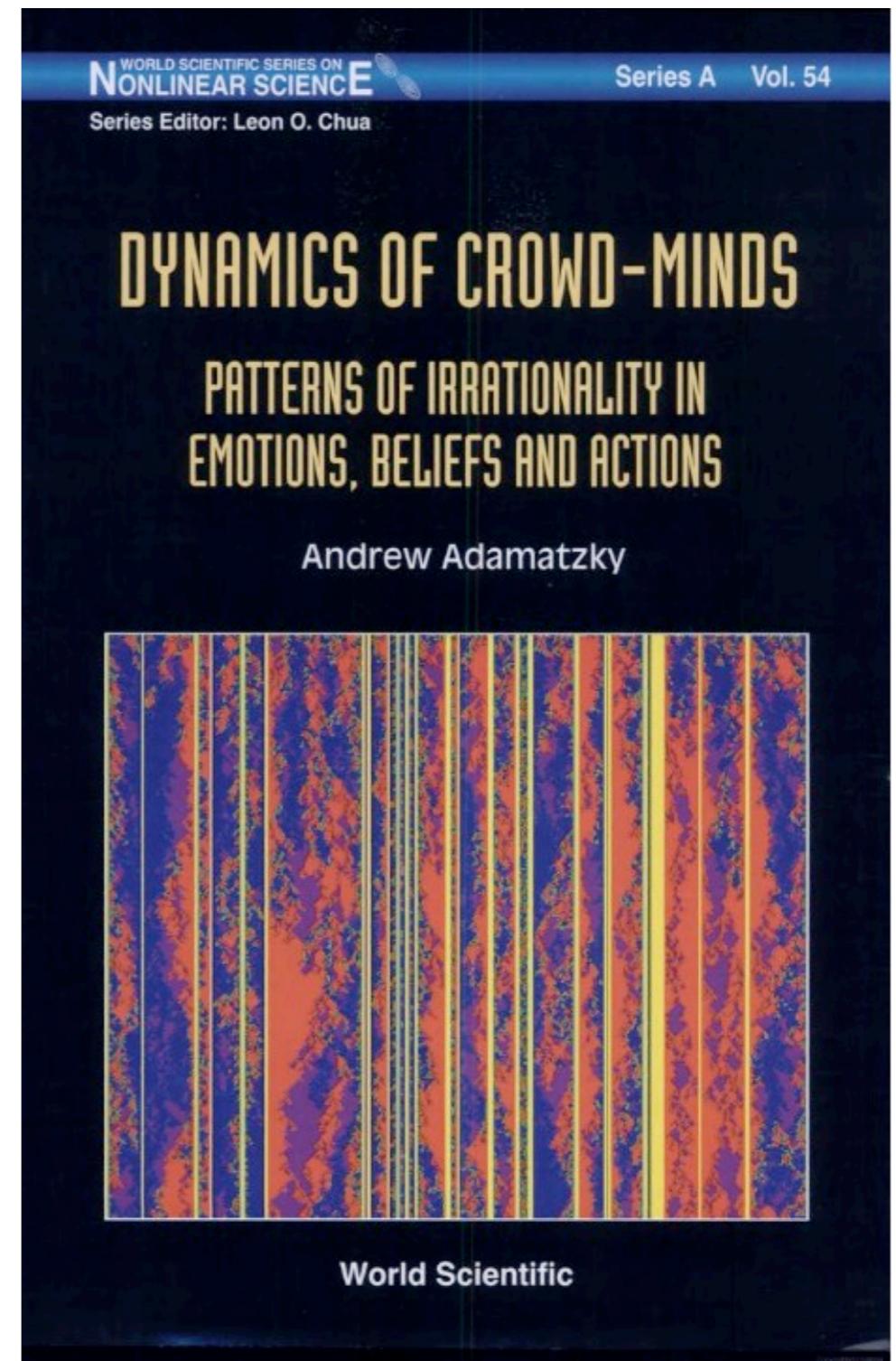
Complex systems applications

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.

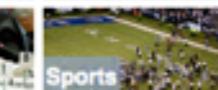
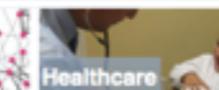
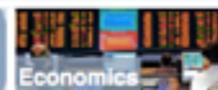
In the wake of these events, many people are asking what can be done to prevent such horror from recurring. I offer the following thoughts about the way forward:

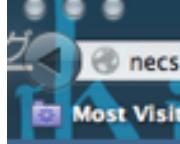
Simple statements to characterize a cause are inadequate. It is not sufficient to assert that the prevalence of guns is the sole cause, nor the perpetrator's mental instability, his social isolation, or his desire for infamy and media attention. We must realize that multiple factors create the conditions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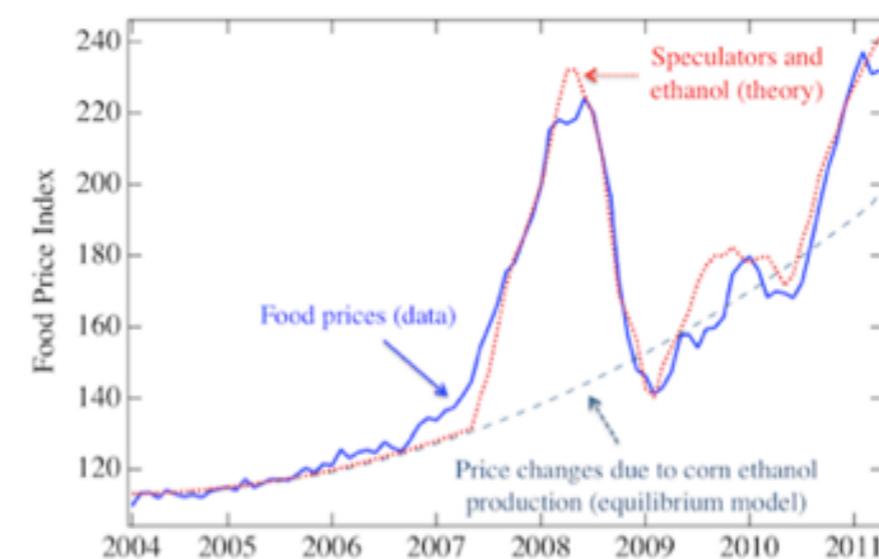
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Complex Systems

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

$$u_t + u_{xxxx} + uu_x = 0, \quad (6)$$

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

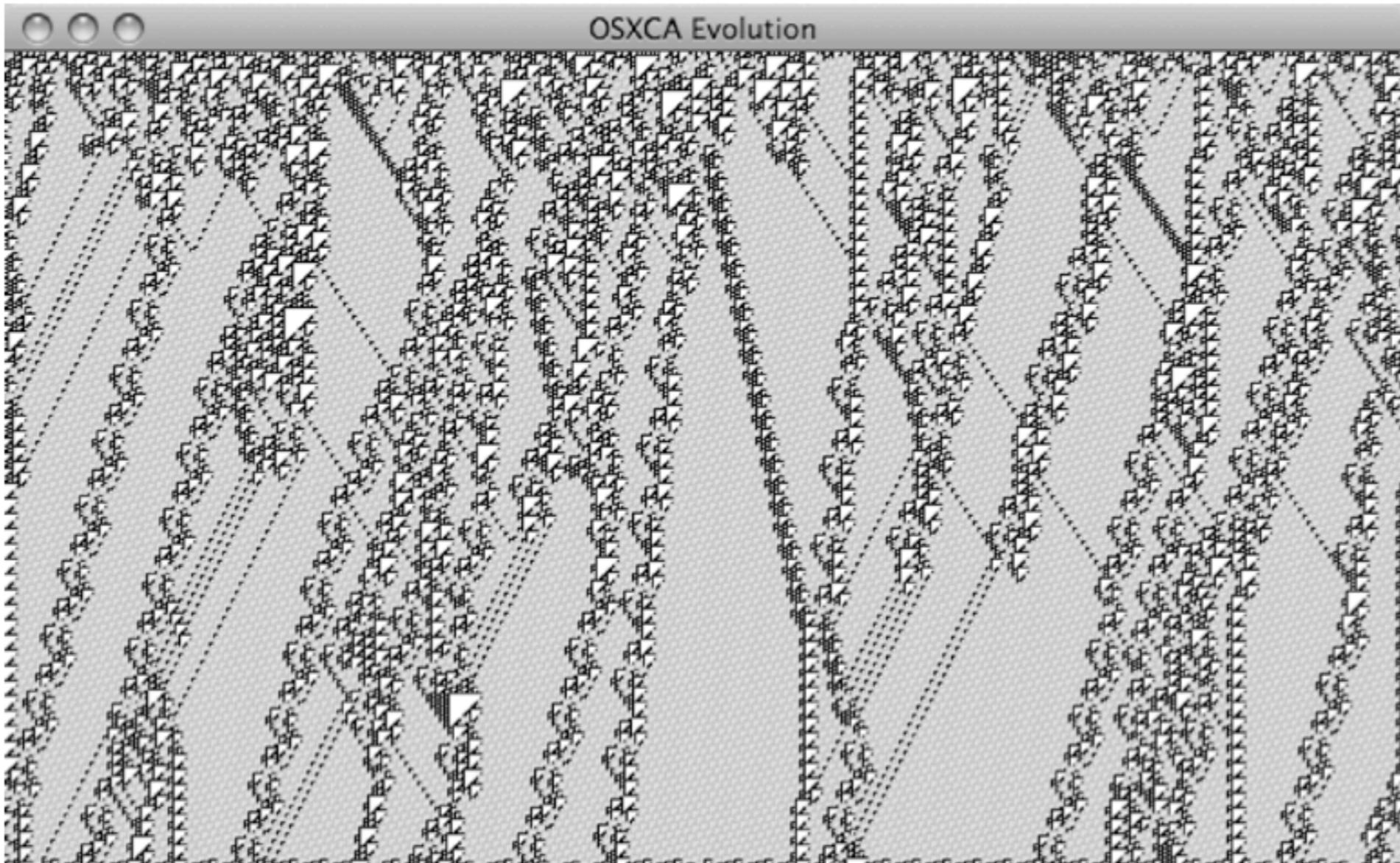


Figure 3. Random evolution in rule 110 on a ring of 644 cells to 375 generations. White cells represent state 0 and black cells state 1 starting on 50% of density. A filter is selected to get a better view of mobile self-localizations on its periodic background.

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.

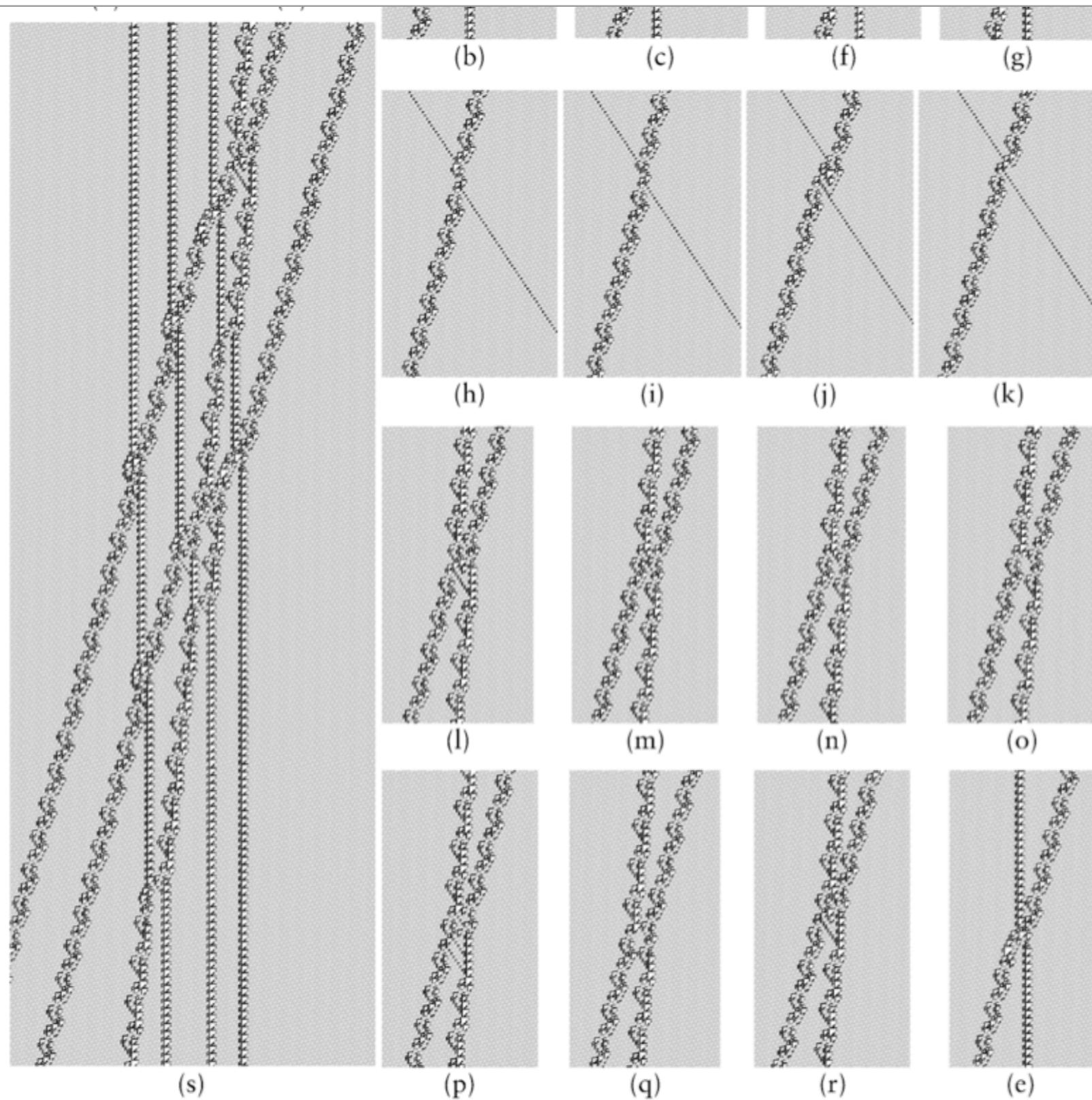
The notation proposed to codify initial conditions in rule 110 by phases is as follows:

$$\#_1 (\#_2, f_i - 1), \quad (8)$$

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

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

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

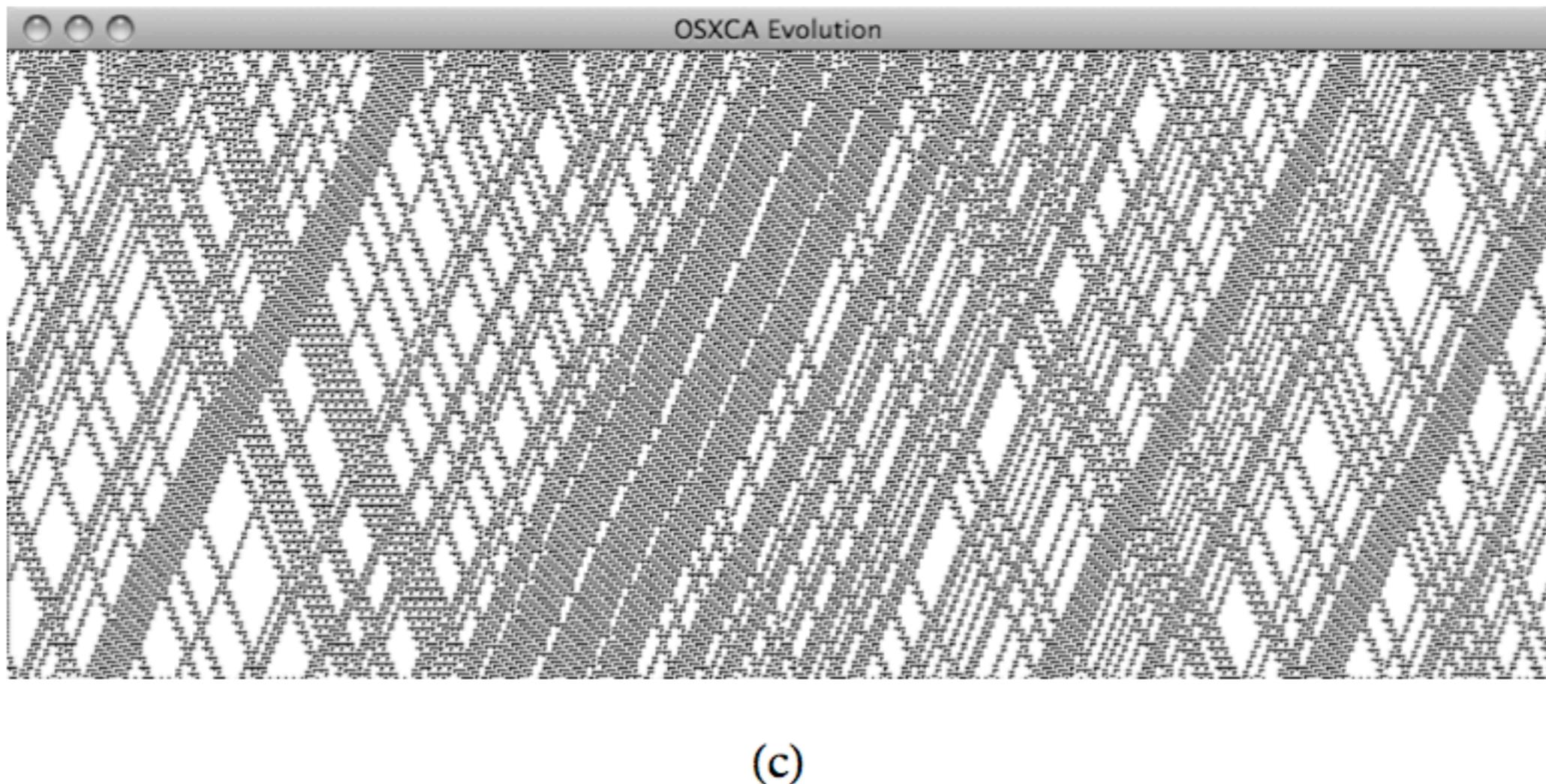


Figure 11. Typical snapshots of ECAM rule $\phi_{R9maj:4}$. (a) Starts with an initial density of 10%. (b) Presents an initial density of 80%. (c) Has an initial density of 50%. All evolutions are filtered for the best visualization of mobile self-localization interaction; the evolutions are on a ring 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=g+o>

Complex Systems Society

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

Complexity Research Expanding the Boundaries of Science

Santa Fe Institute, NM, USA

<http://www.santafe.edu/>

The screenshot shows the homepage of the Santa Fe Institute (SFI) website. At the top, there is a navigation bar with links to "Gmail - Inbox", "Home | Santa Fe Institute", and "www.santafe.edu". Below the bar, the SFI logo and the text "SANTA FE INSTITUTE" and "complexity research expanding the boundaries of science" are visible. A large banner image features a wall of stock market tickers and small scientific illustrations. To the right, a "SFI NEWS" section highlights a video titled "Video: Modeling the economy from the ground up" featuring Doyne Farmer. Below the news section, there is a search bar with "Search" and "GO" buttons. The footer contains links for "ABOUT", "RESEARCH", "EDUCATION", "EVENTS", "BUSINESS NETWORK", "SUPPORT SFI", and "OMIDYAR FELLOWSHIP". There are also sections for "THE PEOPLE", "2011-2012 RESEARCH FOCUS AREAS", and "SCIENCE EVENTS".

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

THE PEOPLE

Researchers and Staff
Governance
Visiting Appointments

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/>

The screenshot shows the homepage of the New England Complex Systems Institute (NECSI). The header features a banner with anime-style characters and the text "Gmail - Inbox - genarojm@..." and "New England Complex System". Below the header is a navigation bar with links to various websites like Free Board Games, Apple, Google Maps, YouTube, Wikipedia, Google, Wolfram MathWorld, Real Academia Espana, and Other Bookmarks. The main content area has a logo for NECSI and the tagline "solving problems of science and society". On the left, there's a sidebar with links for Research / Publications, Education (summer & winter school, executive education, professional programs, advanced training), Events and Conferences (upcoming events, iccs), Collaboration Opportunities (faculty fellows program, student fellows program, postdoc and student researchers program, guest lecturers), and About (about necsi, about complex systems, faculty, affiliates, researchers and staff, books and journals). The right side features a grid of nine thumbnail images with titles: "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", "* Movies Mobile App Released", "History: NECSI and the 2004 Red Sox Parade", "Causes of high food prices: speculators and ethanol production" (with a photo by Ed Yourdon), and "Link between food prices and riots" (with a photo by Nasser Nouri). At the bottom, there are sections for "Scientific Research and Applications" (with a list of topics) and "News" (with a news archive and several news items).

RESEARCH / PUBLICATIONS

EDUCATION

- summer & winter school
- executive education
- professional programs
- advanced training

EVENTS AND CONFERENCES

- upcoming events
- iccs

COLLABORATION OPPORTUNITIES

- faculty fellows program
- student fellows program
- postdoc and student researchers program
- guest lecturers

ABOUT

- about necsi
- about complex systems
- faculty
- affiliates
- researchers and staff
- books and journals

NEW ENGLAND COMPLEX SYSTEMS INSTITUTE
solving problems of science and society

[donate](#) [membership](#)

News

NECSI shows: (1) high food prices due to speculators and ethanol, (2) link between food prices and riots

Articles in aiCIO and Jyllands-Posten

NSF awards grant to Brandeis in partnership with NECSI

Market Instability: Why Flash Crashes Happen

NECSI President interviewed on climate and unrest

Prediction seminar by Yaneer Bar-Yam online

Twitter rising: from search to social media

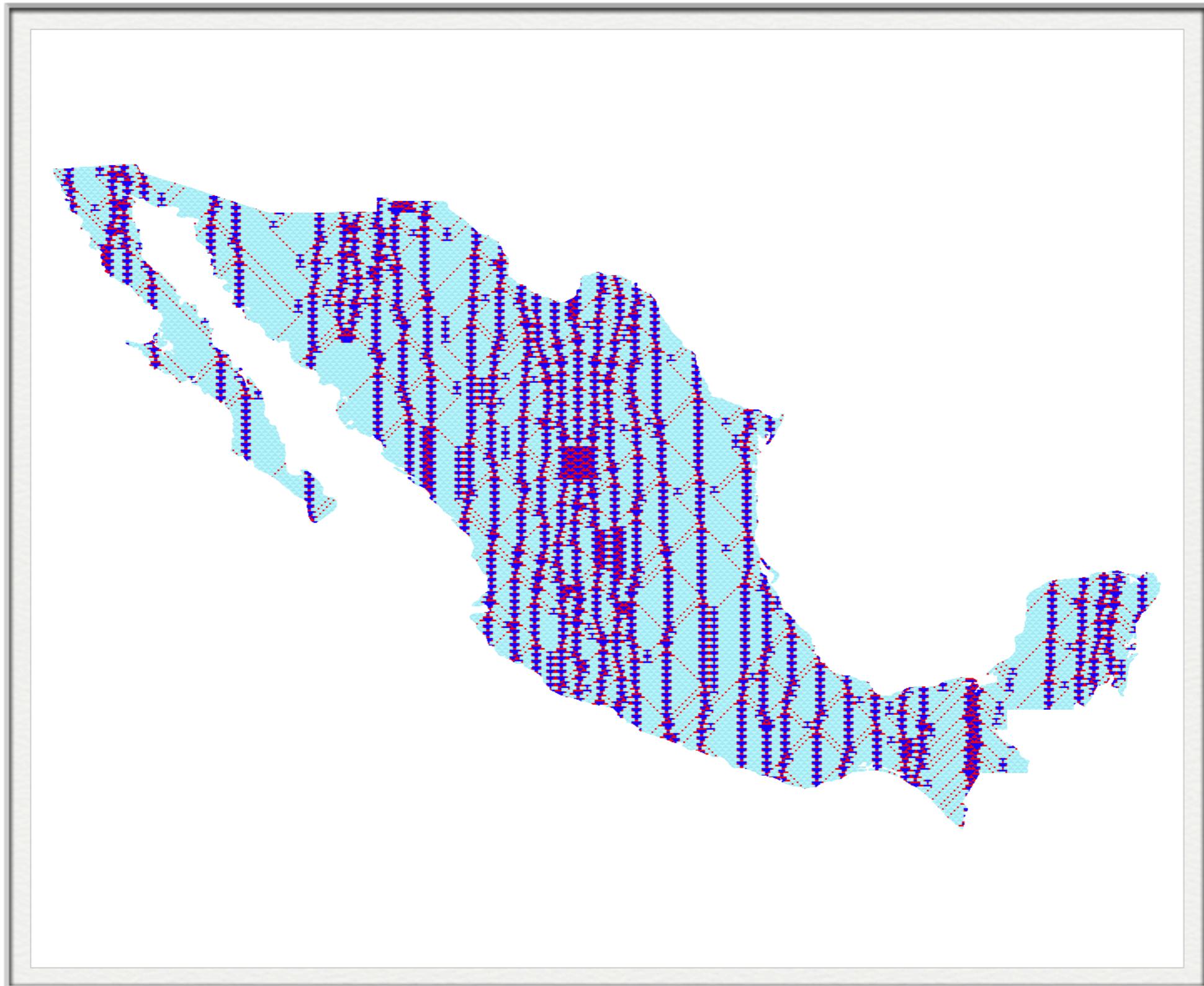
Scientific Research and Applications

- overview
- multiscale method
- networks
- evolution&ecology
- systems biology
- engineering
- development
- economics
- ethnic violence
- healthcare
- management
- education
- military conflict
- negotiation

L'institut des Systèmes Complexes – Paris Île-de-France (ISC-PIF)
Paris, France
<http://www.iscpif.fr/>



Some Mexican institutions starting studies about complex systems



Some Mexican institutions starting studies about complex systems

The screenshot shows a web browser window with the following details:

- Address Bar:** Gmail - Inbox - genarojm@... - Bienvenidos a la MDNLySC - www.nolineal.org.mx
- Toolbar:** Back, Forward, Stop, Home, Refresh, Address Bar, Bookmarks, Other Bookmarks, Font Size (+/-), Search.
- Page Content:**
 - Header:** DNL ySC Maestría en Dinámica No Lineal y Sistemas Complejos
 - Search Bar:** buscar...
 - Navigation Bar:** Maestría, Estudiantes, Servicios, Eventos, Contactar, WebLog, Acceso.
 - Sub-navigation:** Orígenes y Antecedentes, Personal, Líneas de Investigación, Documento Maestro, Artículos, Preguntas Frecuentes.
 - Presentación Section:** A large image of a fractal spiral.
 - Convocatoria de Ingreso a la maestría 2011:** Written by Fernando Ramírez Alatriste on Martes, 05 de Abril de 2011 13:47. It mentions the Universidad Autónoma de la Ciudad de México (UACM) convoking interested parties to apply for the Maestría en Dinámica no Lineal y Sistemas Complejos.
 - Right Sidebar (MDNLySC):** A sidebar with links to Maestría, Estudiantes, Servicios, Eventos, Contactar, WebLog, and Acceso.

Some Mexican institutions starting studies about complex systems

The screenshot shows a web browser window with the following details:

- Address Bar:** https://sites.google.com/site/uamxpecci/proyecto
- Toolbar:** Gmail - Inbox - genarojm@..., Proyecto - Programa de Estu..., +, Back, Forward, Stop, Home, Refresh, Bookmarks, Other Bookmarks.
- Page Content:**
 - Title:** Programa de Estudios sobre Complejidad, Cognición e Instituciones (PECCI). UAM-X
 - Navigation:** Navegación (orange bar) with links: Proyecto, Miembros, Complejidad, Cognición, Instituciones, Cooperación, Productos, Links, Foros y Eventos, Contacto.
 - Project Section:** Proyecto (orange bar) with four images: a spiral staircase, three spheres, a flight information board, and a person's face.
 - Text:** Definición del proyecto (Definition of the project) and a detailed description of the PECCI program.
 - Footer:** http://www.foto-gratis.es and a Translate button.

Some Mexican institutions starting studies about complex systems

The screenshot shows a web browser window with the following details:

- Address Bar:** transdisciplinario.cinvestav.mx/PlandeEstudios.aspx
- Title Bar:** Gmail - Seminario DCTS - ge X Plan de Estudios
- Toolbar:** Back, Forward, Stop, Home, Refresh, Bookmarks, Search.
- Page Header:** Portal del Programa Transdisciplinario, Buscar, 14 / 09 / 2011, Cinvestav logo.
- Left Sidebar (Menu):** Plan de Estudios, Inicio, Misión, Perfil de Egresados, **Plan de Estudios** (highlighted), Trabajo de Investigación, Obtención del Grado, Profesorado, Inscripción y Admisión, Eventos Académicos.
- Main Content Area:**
 - 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
- Right Sidebar:** TRABAJO DE INVESTIGACIÓN, Clases de proyectos para la tesis, 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).

Some Mexican institutions starting studies about complex systems

The screenshot shows a web browser window with the URL uncomp.uwe.ac.uk/LCCOMP/Principal.html in the address bar. The page header includes the LCCOMP logo, the text "Laboratorio de Ciencias de la Computación (LCCOMP)", and a "English" link. The main content area features several visual elements: a grid of numbers representing a cellular automaton evolution, a complex network diagram, and a pattern of green squares representing a Life-like cellular automaton. Below these images is a purple sidebar with Spanish text describing the figures. To the right is a large block of text providing an introduction to the laboratory's research interests.

LCCOMP

Laboratorio de Ciencias de la Computación
(LCCOMP)

English

La figura superior muestra la evolución de autómata celular reversible por bloques, la siguiente figura muestra un diagrama de ciclos (atractores), ambos en autómata celular 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*. Así mismo, se realizan estudios e investigaciones en *teoría de la computación y lenguajes, autómata celular, 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 ciclotrón (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 homepage of the Centro de Ciencias de la Complejidad (C3) website. At the top, there is a browser header with tabs for "Gmail - Inbox - genarojm@gmail.com" and "Centro de Ciencias de la Con...". Below the tabs, the URL "c3.fisica.unam.mx" is visible, along with standard browser controls like back, forward, and search.

The main navigation bar includes links for "Free Board Games", "Apple", "Google Maps", "YouTube", "Wikipedia", "Google", "Wolfram MathWorld", "Real Academia Española", and "Other Bookmarks". Below this is a secondary navigation bar with links for "En la Prensa", "Foro Científico", "Convocatorias", "Multimedia", "Intranet", "Reporta", "Enlaces", and "Contacto".

The logo of the Centro de Ciencias de la Complejidad (C3) is on the left, featuring three interlocking circles. To its right, the text "centro de ciencias de la complejidad" is displayed. Further right is the logo of the National Autonomous University of Mexico (UNAM).

A large central image is a reproduction of a section of the famous Mexican mural "The Epic of Mankind" by Diego Rivera, depicting a complex scene of industrial and social activity.

On the left side of the main content area, there is a sidebar with the heading "Incubadora de megaproyectos" and a list of links: "El C3", "Investigación", "Educación", "Seminarios", "Eventos", and "Vinculación".

On the right side, there are six sections, each with an image and a title:

- COMPLEJIDAD ECOLÓGICA**: An image of a bee on a flower.
- INTELIGENCIA COMPUTACIONAL**: An image of a brain scan.
- COMPLEJIDAD SOCIAL**: An image of a crowd of people.
- COMPLEJIDAD Y BIOLOGÍA CELULAR**: An image of cells under a microscope.
- COMPLEJIDAD Y SALUD PÚBLICA**: An image of a medical or laboratory setting.

At the bottom left, there is a button for "Eventos Próximos" and the date "12.09.2011". At the bottom center, there is information about the "Coloquio de Sistemas Complejos como Modelos de Computación (WCSCM2011)".

Some Mexican institutions starting studies about complex systems

The screenshot shows a web browser window with the following details:

- Address Bar:** Gmail - Inbox - genarojm@... - Bienvenido a ISCOM - www.i-s.com.mx
- Toolbar:** Back, Forward, Stop, Home, Refresh, Address Bar (www.i-s.com.mx), Bookmarks, History, Search.
- Bookmark Bar:** Free Board Games an..., Apple, Google Maps, YouTube, Wikipedia, Google, Wolfram MathWorld, Real Academia Española, Other Bookmarks.
- Volume Control:** A slider is set to 60.
- ISCOM Logo:** The logo is displayed with a red oval highlighting the 'S' and 'C' letters.
- Page Title:** ISCOM™ Integración de Sistemas Complejos
- Navigation Menu:** Home, Productos, Servicios, Contáctanos.
- Content Area:**
 - Bienvenido a ISCOM™:** Empresa orgullosamente mexicana. Includes an IBM logo and text: "ISCOM es una empresa asociada con IBM en su más alto rango. Iscom es una empresa mexicana privada que se especializa en la consultoría, comercialización, integración y soporte de sistemas y soluciones altamente confiables para procesos críticos de manejo de información garantizando la correcta interoperabilidad de los elementos que los conforman."
 - algunos proyectos:** Empresa orgullosamente mexicana. Includes two thumbnail images and descriptions:
 - Implementación del sistema de correo electrónico para clientes.**
 - Sistema de control, administración y operación Inmobiliaria.**

Some Mexican institutions starting studies about complex systems

The screenshot shows the homepage of the Red Complejidad, Ciencia y Sociedad website. The header features the text "Red Complejidad, Ciencia y Sociedad" and the logo "CCS". The main banner displays the text "Complejidad, Ciencia y Sociedad" and "Red Temática de Investigación". On the right side, there is a logo for CONACYT. The left sidebar contains links for "Plan de trabajo", "Congresos", and "Seminarios". The central content area includes a large image of a hexagonal grid, a section titled "NOTICIAS" with a thumbnail for "ESPAZIOS IBEROAMERICANOS", and a section titled "Versiones Impresas 2003-2010" featuring a thumbnail for "Atlas de la Ciencia Mexicana 2010". The footer includes the EULAKS logo.

Red Complejidad, Ciencia y Sociedad

www.red-ccs.org

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

Complejidad, Ciencia y Sociedad

Red Temática de Investigación

CONACYT

CONACYT

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 perspectiva

Seminarios

- » Seminario evaluación y perspectiva en CTI 2010

NOTICIAS

ESPAZIOS IBEROAMERICANOS

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

Atlas de la Ciencia Mexicana 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/>