



# European Conference on Complex Systems

Paris, 14-18 November 2005

## Program

## **Towards a science of complex systems**

Complex systems, as networks of interactive entities, are studied through a rapidly increasing mass of data in all domains. At the same time, these domains share a lot of new and fundamental theoretical questions. This situation is especially favourable for developing the new science of complex systems in an interdisciplinary way. The ECCS'05 is a step towards this new science.

There are two kinds of interdisciplinarity within complex systems. The first kind begins with a particular complex system and addresses a variety of questions coming from its particular domain and points of view. The second kind addresses issues that are fundamental to complex systems in general. The first kind leads to domain-specific interdisciplinary fields such as cognitive science. The new science of complex system belongs to the second kind of interdisciplinarity. It starts from fundamental open questions relevant to many domains, and searches for methods to deal with them.

These two kinds of interdisciplinarity are complementary and interdependent: any advance in one is valuable for the other. The science of complex systems will develop through a constantly renewed process of reconstructing data from models with a permanent interaction between the two kinds of interdisciplinarity. The reconstruction of the dynamics of complex systems presents a major challenge to modern science but it is becoming increasingly accessible through an accumulating mass of data, combined with the increasing power of computers, leading to theoretical advances in understanding.

This conference follows the one organized in Torino (Italy) in December 2004 with support from the coordination actions EXYSTENCE and ONCE-CS, funded by the Future and Emerging Technologies' unit of the European Commission. ECCS'05 benefits from the same support and is the first conference in an annual series organized by the new European Complex System Society (ECSS) and its Conference Steering Committee.

We hope that the participants will appreciate the beautiful venue of the conference this year, at the Cité Internationale Universitaire de Paris.

Our special thanks to the staff at CIUP for preparing the ground to this conference. We would also like to thank the sponsors of ECCS'05 for making it possible for all the participants to share their enthusiasm and ideas in the most constructive way.

The ECCS'05 Program Committee,  
The ECCS'05 Local Organization Committee,  
The ECSS Conference Steering Committee.

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# External Reviewers

This year, the Program Committee members were the main reviewers of all submitted papers. However, in some occasions, external reviewers were asked to review some papers, and we also want to thank here those following colleagues for their time

Gerard de Zeeuw, University of Amsterdam (Netherlands)  
Peter K. Allen, Columbia University (USA)  
Pierpaolo Andriani, advanced Institute of Management Research (UK),  
Jannis Kallinikos, LSE (UK)



# Program

Monday, November 14.

**08:00-09:00** : *Registration*

**09:00-09:50** : *Introduction*

*Michel Rocard*, Former French Prime Minister.

*Georges Haddad*, Director of the Higher Education Division, UNESCO.

**9:50-10:20** : *Coffee break* Espace Adenauer

**10:20-11:10** : *Invited Speaker 1* Espace Adenauer

**Chair:** Luca Cardelli

A panorama of the mathematical theory of dynamical systems,

*Jean-Christophe Yoccoz*

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**11:10-12:00** : *Invited Speaker 2* Espace Adenauer

**Chair:** Luca Cardelli

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*Giorgio Parisi*

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**12:00-13:30** : *Lunch*

**13:30-15:10** : *Complex Systems Methods 1* Maison de l'Argentine

**Chair:** Michel Morvan

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On stability of computations by cellular automata,

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Universality of Two Dimensional Sandpiles,

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*Giorgos Georgiadis, Lefteris Kirousis* **40**

Universal scaling of inter-node distances in complex networks,  
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Altruism 'For Free' using Tags,  
*David Hales* **44**

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**15:10-15:40 : Coffee break** Espace Adenauer

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**15:40-17:20 : Biological Modelling 2** Maison du Cambodge

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# Satellite Workshops

## 1. Engineering with Complexity and Emergence (ECE)

**Dates** : Tue 15 Nov. 14h30-19h, & Wed 16 Nov. 14h30-19h

**Organizers** : Ozalp Babaoglu, David Hales, Mark Jelasity, Alberto Montresor, Giovanna Di Marzo, and Franco Zambonelli

**Location** : Maison de l'Espace

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## 2. Emergent properties in natural and artificial dynamical systems (EPNADS)

**Dates** : Thu 17 Nov. 08h30-13h & 14h30-19h

**Organizers** : Michel Cotsaftis, Cyrille Bertelle, M.A. Aziz-Alaoui, Frederic Guinand, and Marc Rouff

**Location** : Maison Heinrich Heine

**Web site** : <http://www-lih.univ-lehavre.fr/~bertelle/epnads05.html>

The aim in this session is to study emergent properties arising through dynamical processes in various types of natural and artificial systems. The session is concerned with multidisciplinary approaches for getting representations of complex systems and using different methods to extract emergent structures. Equations formulation can lead to the study of emergent features such as self organization, opening on stability and robustness properties. Invariant techniques can express global emergent properties in dynamical and in temporal evolution systems. Artificial systems such as a distributed platform for simulation can be used to search emergent placement during simulation execution. Special attention is paid to population dynamics where global emergent properties can be detected.

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## 3. Embracing Complexity in Design

**Dates** : Thu 17 Nov. pm

**Organizers** : Jeff Johnson, Katerina Alexiou, and Theodore Zamenopoulos

**Location** : David Weill

**Web site** : [http://www.casa.ucl.ac.uk/ecid/eccs\\_workshop.html](http://www.casa.ucl.ac.uk/ecid/eccs_workshop.html)

In the UK we have an EPSRC funded research cluster called 'Embracing complexity in design'. We are the leaders of this cluster. It is part of a 4 million pound initiative called 'Designing for the twenty first century'. Our cluster is having many activities investigating the impact of complex systems science on the design process and the design of artificial systems. We believe that we can put together a workshop with high quality contributions covering a range of topics covering the area. Close

## 4. Semiotic Dynamics and Emergence of grammar

**Dates** : Fri 18 Nov. 08h30-13h & 14h30-19h

**Organizer** : Luc Steels

**Location** : Maison Heinrich Heine

The emergence of grammar remains one of the most challenging puzzles of cognitive science. The key question is how there could be true level formation, i.e. how a layer of syntactic and semantic categories and constructions could arise to establish form-meaning mappings. The goal of the workshop is to present either empirical examples of the emergence of new grammatical phenomena or to present computer/robotic simulations of specific examples where this happens. Attempts will also be made to look at level formation in other complex systems (biology, economics) and to see whether a generic theory of level formation is possible.

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## 5. Common trends in statistical physics, information theory, and combinatorial optimization

**Dates** : Thu 17 Nov. 08h30-13h & 14h30-19h

**Organizers** : Marc Mezard (Orsay), Andrea Pagnani (ISI), Martin Weigt (ISI), and Michele Leone (ISI)

**Location** : Maison du Mexique

**Web site** : <http://isiosf.isi.it/~cospico/satellite.htm>

The task of understanding and solving hard optimization problems is fundamental in many disciplines in natural as well as in engineering sciences. The problem has also a deep interest in itself as the basic issue of the complexity theory in theoretical computer science. Recently, it has been tackled successfully with methods coming from the statistical physics of disordered systems. This new perspective has brought some new insight into the intrinsic reasons for computational hardness. Stemming from these points, a new field of research is emerging which deals, broadly speaking, with constraint satisfaction networks in systems with many simple interacting variables. It includes some key problems appearing in error correcting codes, stochastic optimization algorithms, typical case complexity and phase transitions, constraint satisfaction, statistical physics of disordered systems, and statistical inference. Researchers with different backgrounds and affiliations, including probability, physics, computer science, statistics, electrical engineering, operation research, have started to realize that many of the central problems in their own fields have similar properties and in some cases similar techniques have been developed independently in these various fields. Examples of similar problems are the satisfiability problem in complexity theory, the spin glass problem in statistical physics, and the low density parity check codes for error correction. Examples of similar techniques are the message passing algorithms, mainly belief propagation, which is heavily used in inference, in error correction and in statistical physics. These are instances of complex interacting systems where emergent properties can be studied rather in detail, and have a potential strong impact for applications. Accordingly to this presentation, the meeting will gather scientists with different backgrounds, and focus on passing messages between disciplines, with a particular focus on the state of the art of European research.

## 6. Peer-to-peer data management in the Complex Systems perspective

**Dates** : Thu 17 Nov. 08h30-13h

**Organizers** : Giovanni Cortese, Stefano Leonardi, Friedhelm Meyer auf der Heide, and Christian Schindelhauer

**Location** : David Weill

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## 7. Complex Time-Delay Systems

**Dates** : Thu 17 Nov. 08h30-13h & 14h30-19h

**Organizers** : Fatihcan M. Atay

**Location** : Maison de l'Argentine

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## 8. Cities and regions as collective intelligence

**Dates** : Thu 17 Nov. 08h30-13h & 14h30-19h

**Organizers** : Denise Pumain, Danièle Bourcier, and Jean-Pierre Gaudin

**Location** : Honnorat

**Web site** : <http://complexsystems.lri.fr/contents/workshopCities.htm>

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## 9. Multi-Agents for Modeling Complex Systems

**Dates** : Fri 18 Nov. 08h30-13h & 14h30-19h

**Organizers** : Salima Hassas and Giovanna Di Marzo Serugendo

**Location** : Maison de l'Argentine

**Web site** : <http://liris.cnrs.fr/salima.hassas/MA4CS/>

The multi-agents systems (MAS) paradigm is more and more used as a tool for modeling, simulating or programming complex systems, in different disciplines: mechanics, economy, urbanism, sociology, biology, computer science, etc. Researchers from Complex Systems field, study systems that exhibit complexity as a phenomenon inherent to the system's nature. They naturally use the multi-agents paradigm as a tool for simulating or modeling such complex systems. MAS researchers focus on the study of communications languages, interaction protocols, agent architectures and MAS methodologies that facilitate the development of multiagent systems. MAS researchs are inspired by many

disciplines outside of AI, including biology, sociology, economics, organization and management science, complex systems, and philosophy. This Workshop is aimed to bring together researchers from the MAS field and the complex system field, in order to cross-fertilize research being developed in both fields, and come up with theories, tools, formal operational models and methodologies for MAS approaches dedicated to complex systems

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## **10. Industry facing the complexity**

**Dates** : Fri 18 Nov. 08h30-13h & 14h30-19h

**Organizers** : Michel Morvan, Paul Bourguine, Daniel Krob, Ralph Dum, Alain Krob and Dominique Luzeaux

**Location** : Honnorat

**Web site** : <http://complexsystems.lri.fr/contents/workshopIndustry.htm>

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## **11. Dynamical processes on complex networks**

**Dates** : Fri 18 Nov. 08h30-13h & 14h30-19h

**Organizers** : Alain Barrat and Marc Barthélemy

**Location** : Maison du Mexique

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## **12. Complex Chemical System Design**

**Dates** : Fri 18 Nov. 08h30-13h & 14h30-19h

**Organizers** : John McCaskill and Norman Packard

**Location** : David Weil

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## **13. Reverse modeling of biological regulatory networks: expectations and limitations**

**Dates** : Fri 18 Nov. 08h30-13h & 14h30-19h

**Organizers** : Florence d'Alché-Buc and François Képès

**Location** : Genopole Evry, (2 rue Gaston Crémieux, 91000 Evry)