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# Properties of variational estimates of a mixture model for random graphs

Jean-Jacques Daudin, Alain Céliste, Steven Gazal, Stephane Robin

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# ECCS'10 LISBON

European Conference on Complex Systems

[eccs2010.eu](http://eccs2010.eu)



## PROGRAMME & ABSTRACTS



13-17 September 2010  
ISCTE-Lisbon University Institute





# **European Conference on Complex Systems '10**

Lisbon University Institute

September 13-17, 2010



# Introduction to the ECCS'10 Scientific Programme

ECCS'10 - European Conference on Complex Systems became, in the last few years, the main annual event in the domain of Complex Systems research. Following the very well succeeded conferences in Torino, Paris, Oxford, Dresden, Jerusalem and Warwick, the 2010 edition of ECCS will take place at the Lisbon University Institute, from 13 to 17 September.

The main plenary speakers will be **Christoph von der Malsburg, José Fernando Mendes, Didier Sornette, Henri Berestycki, Dirk Helbing, Rosaria Conte, João Fiadeiro and Carlo Ratti**, that will create the context for the scientific debates during the conference.

The ECCS'10 Scientific Programme includes more than 100 papers and 100 posters concerning a variety of research areas organized in the following tracks:

- Track A: Policy, Planning & Infrastructure - Policymaking; Design Processes; Environmental Decision Making; Management; Construction and Manufacturing; Energy and Sustainability; Urban Planning; Built Environment; Internet; Transport & Power Networks; Medical & Health Systems.
- Track B: Collective Human Behaviour and Society - Philosophy of Science; Economics & Finance; Sociology; Psychology; Game theory.
- Track C: Interacting Populations and Environment - Climate Change; Geography; Pollution; Demography; Ecology; Epidemiology.
- Track D: Complexity and Computer Science - Natural and Pervasive Computing; Global Computing Infrastructure; Swarms and Robot Teams; Mobile and Fleet Computing; Graphs and Neural Networks; Language and Cognition; Collaborative Human Computer Networks.
- Track E: From Molecules to Living Systems - Self-assembly & Self-organisation; Biochemistry, Cell Biology, Neuroscience; Systems Biology; Medicine & Physiology.
- Track F: Mathematics and Simulation - Mathematics; Theoretical Physics; Modelling; Theory of Simulation (both numerical mathematics and agent based); Network Theory.

A selected number of these papers will be published in several prestigious journals, such as “Advances in Complex System”, “The European Physical Journal B”, “International Journal of Agent Technologies and Systems”, “Theory in Biosciences”, “Foundations of Science”, “International Journal of General Systems”, “Real-World Economics Review”, “Emergence: Complexity & Organization (E:CO)”, and others.

Complementing the main conference tracks, ECCS’10 will include 12 Satellite Meetings with more than 100 presentations, concerning a variety of research domains such as emergence in geographical space, networks theory, socially intelligent ICT, biological systems, policy making and others.

Two special sessions will be featured this year: the Global Problems Panel Discussion, focusing on the impact of measures of policies on global change, and the [k]NO(w)BODY Workshop on Real Time Composition, an intensive workshop during the two days just before the conference, concerning experiments on the human processes of creativity, decision-making and group self-organization.

The ECCS’10 Organizing Committee would like to warmly thank the programme chair Tsou Sheung Tsun, together with all the Programme Committee members, Satellite Meetings organizers, and ECCS Steering Committee members, for ensuring that the 2010 edition of our conference meets the highest scientific standards.

Lisbon, September 2010

The ECCS’10 Organizing Committee

## **ECCS'10**

### **Conference Venue**

Lisbon University Institute, Building II, Lisbon, Portugal

### **Conference Organising Chair**

Jorge Louçã (Lisbon University Institute)

### **Conference Programme Chair**

Tsou Sheung Tsun (University of Oxford)

### **Complex Systems Society:**

Jeffrey Johnson (Open University, London; President of the CSS)

### **Conference Programme Committee members:**

Jeffrey Johnson (Open University, London)  
Arnaud Banos (CNRS; Université Paris I)  
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John Symons (University of Texas at El Paso)  
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Paul Verschure (Universitat Pompeu Fabra, Barcelona)  
Fatihcan Atay (Max Planck Institute, Leipzig)  
Ali Rana Atilgan (Sabancı Üniversitesi, Istanbul)

### **Complex Systems Society Conference Steering Committee members:**

Markus Kirkilionis (University of Warwick; Committee Chair)  
Fatihcan Atay (Max Planck Institute for Mathematics in the Sciences, Leipzig)  
Jürgen Jost (Max Planck Institute for Mathematics in the Sciences, Leipzig)  
Scott Kirkpatrick (The Hebrew University of Jerusalem)  
David Lane (University of Modena and Reggio Emilia)  
Andreas Lorincz (Hungarian Academy of Sciences)  
Denise Pumain (University Paris I Panthéon-Sorbonne)  
Felix Reed-Tsochas (University of Oxford)  
Eörs Szathmáry (Eötvös Loránd University, Budapest)  
Stephan Thurner (Medical University of Vienna)  
Paul Verschure (Universitat Pompeu Fabra, Barcelona)  
Riccardo Zecchina (ISI Foundation and Politecnico di Torino)  
Vittoria Colliza (ISI Foundation, Torino)

### **Organising Committee**

*Lisbon University Institute (IUL):*

Jorge Louçã, David Rodrigues, Elisabete Raimundo, Marie Mignot, Décio Telo, José Monteiro, Luis Miguel Serrano, Filipe Casal Ribeiro

*Doctoral Programme in Complexity Sciences (IUL/FCUL):*

Manuel Tânger, Rui Esteves, António Fonseca, Rita Margarido, Rui Dias, Rui Ligeiro, Nuno Caseiro, Sandra Barão, Alberto Murta, José Tomaz, José Loff, Laura Wise, Sérgio Bacelar, José Matos, Guilherme Statter, Hugo Mendes, José António Silva, Pedro Loureiro



Conference Supporters



Conference Sponsors



# ECCS'10 Schedule

	Sept. 11	Sept. 12	Sept. 13	Sept. 14	Sept. 15	Sept. 16	Sept. 17
8:00			Registration				
9:00			Welcome Address Christoph von der Malsburg	Henri Berestycki	Satellite Meetings	Satellite Meetings	Rosaria Conte
10:00			Coffee Break	Coffee Break	Coffee Break	Coffee Break	Coffee Break
11:00			Tracks A, B1, C	Tracks A, B2, C, E, F	Satellite Meetings	Satellite Meetings	Tracks B2, C, E, F
12:00			Lunch, Posters, Videos and Demos	Lunch, Posters, Videos and Demos	Lunch, Posters, Videos and Demos	Lunch, Posters, Videos and Demos	Lunch, Posters, Videos and Demos
13:00		[k]NO(w)BODY Workshop	Lunch, Posters, Videos and Demos	Lunch, Posters, Videos and Demos	Lunch, Posters, Videos and Demos	Lunch, Posters, Videos and Demos	Funding Session
14:00			Tracks A, B1, B2, D, F	Tracks A, B2, D, E, F	Satellite Meetings	Satellite Meetings	5 min break
15:00			Coffee Break	Coffee Break	Coffee Break	Coffee Break	João Fiadeiro
16:00			José Fernando Mendes	Dirk Helbing	Satellite Meetings	Satellite Meetings	Coffee Break
17:00			Didier Sornette Springer Complexity Lecture	Public Event - The Complexity of Global Change	Satellite Meetings	Satellite Meetings	Carlo Ratti
18:00		Registration	Welcome Drinks		Conference Dinner at Furnas do Guincho, Cascais		Closing Session
19:00							Closing Party A night at Fábrica do Braço de Prata



**European Conference on Complex Systems '10**

Lisbon University Institute

**SCIENTIFIC  
PROGRAMME**

September 13-17, 2010



<b>PLENARY SPEAKERS</b>	<b>1</b>
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JOSÉ FERNANDO MENDES 16:30-17:30 - Structural properties of complex networks	1
DIDIER SORNETTE 17:30-18:30 - Parallels Between Earthquake Prediction, Financial Crash Prediction and Epileptic Seizures Predictions	1
<b>SEPTEMBER 14</b>	<b>1</b>
HENRI BERESTYCKI 9:00-10:00 - TBA	1
DIRK HELBING 16:30-17:30 - The FuturICT crises relief project: Unleashing the power of information for a sustainable future	1
<b>SEPTEMBER 17</b>	<b>1</b>
ROSARIA CONTE 9:00-10:00 - Dynamics of (Il)legality	1
JOÃO FIADEIRO 15:30-17:00 - Anatomy of a Decision	1
CARLO RATTI 17:30-18:30 - Senseable Cities: Exploring Urban Future	1
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11:00-11:30 Healthcare Organizations as Complex Adaptive Systems: Lessons for Nurse Leaders	
11:30-12:00 Measuring Critical Infrastructures dependency by means of the Phase Synchronization	
12:00-12:30 A Multi-Agent System for the simulation of urban dynamics	
TRACK B1 - PHILOSOPHY OF SCIENCE	3
11:00-11:50 Complexity and Laws of Nature	
11:50-12:20 Structural Coherence of Knowledge Representations in Learning Science	
TRACK C - INTERACTING POPULATIONS AND ENVIRONMENT	3
11:00-11:45 Spatial sampling in HMRF mapping problems: Static and adaptive algorithms	
11:45-12:30 Population Dynamics on Complex Food Webs	
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14:00-14:30 Modeling the growth of distributed energy generation for a low carbon economy: Part I the approach	
14:30-15:00 Innovation policy modeling from a complex systems perspective	
15:00-15:30 Urban Built Form Grows Critical	
15:30-16:00 A Case Study in the Application of an Agent-Based Approach in the Formulation of Policies for UK Transport Emission Reduction	
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14:00-14:50 Complexity and Context-Dependency	
14:50-15:40 Models and representations of knowledge organization	

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14:45-15:15 On Positional Consumption and Technological Innovation – An Agent-Based Approach	
15:15-16:00 HedN Game, a Relational Framework for Network Based Cooperation	
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14:00-14:30 The Observatorium – The structure of news: topic monitoring in online media with mutual information	
14:30-15:15 The Web of Data is a Complex System - first insight into its multi-scale network properties	
15:15-15:45 Network synchronization interval and local Kolmogorov-Sinai entropy	
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14:45-15:15 Controlling the Bak-Tang-Wiesenfeld model	
15:15-16:00 Noisy Random Boolean Networks and Cell Differentiation	
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10:30-11:00 Rebuild vs. Renovate vs. Buy: Decision-making for the Enterprise Software Industry	
11:00-11:30 A complex adaptive system perspective on the periurban area: exploring transitions in urban-rural relationships	
11:30-12:00 Control as Learning Process in Human Complex Adaptive Systems: A few Remarks for Policy Making	
12:00-12:30 Sustainable Urban Design Experiments	
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11:15-11:45 Optimal Life Insurance, Consumption and Investment Decisions	
11:45-12:30 Compensations in the Shapley value and the compensation solutions for forest games	
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11:45-12:30 A stochastic model of social interaction in wild house mice	
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11:15-11:45 Extending the 'Life' Concept to Complex Systems	
11:45-12:30 Towards an Integrated Understanding of Protein Graph Characteristics for Protein Folding	
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11:45-12:30 The Unreasonable Effectiveness of Tree-Based Theory for Bond Percolation on Networks with Clustering	
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15:00-15:30 MAS approach to political prospection and alliance analysis	
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14:45-15:15 Labour mobility, industry evolution and social networks: a co-evolutionary model	
15:15-16:00 Schelling's segregation model for an open city: emergence of physical frontiers from a socio-spatial dynamics	
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15:00-15:30 Agent Based modelling of realistic molecules	

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11:00-11:45 Simulating Opinion Dynamics in Heterogeneous Communication Systems	
11:45-12:15 The determinants of network formation: a dynamic perspective	
12:15-12:45 Inferring Significance of Meeting Groups in Human Contact Networks	
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11:15-12:00 Ecotoxicity risks during influenza pandemic	
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10:30-11:15 Integrating Heterogeneous Gene Expression Data for Gene Regulatory Network Modelling	
11:15-11:45 Knockouts, Robustness and Cell Cycles	
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<b>SM 2 - HIGH THROUGHPUT HUMANITIES</b>	<b>12</b>
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<b>SM 3 - MODELLING THE NON-SEPARABILITY OF A VERY COMPLEX WORLD</b>	<b>14</b>
Organizers: Kirsty Kitto, Fabio Boschetti, and Peter Bruza	
<b>SM 4 - SCNET 2010 - SCIENCE OF COMPLEX NETWORKS</b>	<b>15</b>
Organizers: J.F.F. Mendes, G. Caldarelli, S.N. Dorogovtsev, A. V. Goltsev, M. Ostilli, F. Abreu	
<b>SM 5 - YOUNG RESEARCHERS SESSION AT ECCS'10</b>	<b>16</b>
Organizers: Andrea Apolloni, António Fonseca, David Rodrigues, Iain Kusel, Larisa Mihoreanu, and Martine J. Barons	
<b>SM 6 - COSI-ICT: SCIENCE OF COMPLEX SYSTEMS FOR SOCIALLY INTELLIGENT ICT</b>	<b>17</b>
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<b>SM 8 - EPNACS 2010 - EMERGENT PROPERTIES IN NATURAL AND ARTIFICIAL COMPLEX SYSTEMS</b>	<b>19</b>
Organizers: M.A. Aziz-Alaoui, Cyrille Bertelle, Gérard H.E. Duchamp, and Miguel A.F. Sanjuan	
<b>SM 9 - GRAPHICAL MODELS FOR REASONING ON BIOLOGICAL SYSTEMS: COMPUTATIONAL CHALLENGES</b>	<b>20</b>
Organizers: Nathalie Peyrard, Stéphane Robin, Régis Sabbadin, and Matthieu Vignes	
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Organizers: Sylvie Occelli, Yasmin Merali, Ferdinando Semboloni, Jeffrey Johnson, and Jorge Louçã	
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Organizers: Bruce Edmonds, David Hales, Mario Paolucci, Juliette Rouchier	
<b>SM 12 - ILACS - INTERNATIONAL LATINO AMERICA COMMITTEE OF THE COMPLEX SYSTEMS SOCIETY</b>	<b>23</b>
Organizers: Carla Taramasco, Andrés Véjar, and Jonás Carmona	



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JOÃO CARAÇA	35
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BRIAN CARTWRIGHT	35
Theme: Financial Stability	
ROBERT MEYERS	35
Theme: Technological Change and Sustainability	
JIM HALL	35
Theme: Climate Change	
DIDIER SORNETTE	35
Theme: Risk Assessment	

# Plenary speakers

## September 13

**Christoph von der Malsburg**

*9:30-10:30 - The Brain as Organizing Entity*

**José Fernando Mendes**

*16:30-17:30 - Structural properties of complex networks*

**Didier Sornette**

*17:30-18:30 - Parallels Between Earthquake Prediction, Financial Crash Prediction and Epileptic Seizures Predictions*

## September 14

**Henri Berestycki**

*9:00-10:00 - TBA*

**Dirk Helbing**

*16:30-17:30 - The FuturICT crises relief project: Unleashing the power of information for a sustainable future*

## September 17

**Rosaria Conte**

*9:00-10:00 - Dynamics of (Il)legality*

**João Fiadeiro**

*15:30-17:00 – Anatomy of a Decision*

**Carlo Ratti**

*17:30-18:30 - Senseable Cities: Exploring Urban Future*



# Tracks

September 13 morning - tracks A, B1 and C

## **Track A - Policy, Planning & Infrastructure**

Room: B103

***11:00-11:30 Healthcare Organizations as Complex Adaptive Systems: Lessons for Nurse Leaders***

Holly G. Johnson and Sergio Camorlinga

***11:30-12:00 Measuring Critical Infrastructures dependency by means of the Phase Synchronization***

Vincenzo Fioriti, Silvia Ruzzante, Elena Marchei, Alberto Tofani and Gregorio D'Agostino

***12:00-12:30 A Multi-Agent System for the simulation of urban dynamics***

Julien Perret , Florence Curie , Julien Gaffuri , and Anne Ruas

## **Track B1 - Philosophy of Science**

Room: C104

***11:00-11:50 Complexity and Laws of Nature***

John Symons

***11:50-12:20 Structural Coherence of Knowledge Representations in Learning Science***

Ismo T. Koponen and Maija Pehkonen

## **Track C - Interacting Populations and Environment**

Room: B203

***11:00-11:45 Spatial sampling in HMRF mapping problems: Static and adaptive algorithms***

Nathalie Peyrard, Régis Sabbadin, Daniel Spring, Ralph Mac Nally, and Barry Brook

***11:45-12:30 Population Dynamics on Complex Food Webs***

Gian Marco Palamara, Vinko Zlatic and Guido Caldarelli

## September 13 afternoon - tracks A, B1, B2, D and F

### Track A - Policy, Planning & Infrastructure

Room: B103

**14:00-14:30 Modeling the growth of distributed energy generation for a low carbon economy:  
Part I the approach**

Liz Varga

**14:30-15:00 Innovation policy modeling from a complex systems perspective**

Petra Ahrweiler

**15:00-15:30 Urban Built Form Grows Critical**

Romulo Krafta, Vinicius de Moraes Netto, Leonardo Lima

**15:30-16:00 A Case Study in the Application of an Agent-Based Approach in the Formulation of  
Policies for UK Transport Emission Reduction**

Araz Taeihagh and René Bañares-Alcántara

### Track B1 - Philosophy of Science

Room: C104

**14:00-14:50 Complexity and Context-Dependency**

Bruce Edmonds

**14:50-15:40 Models and representations of knowledge organization**

Olga Pombo

### Track B2 - Collective Human Behaviour and Society

Room: B204

**14:00-14:45 Power-Law Distributions in Scientific Publishing and Reviewers' Workload**

Ding-wei Huang

**14:45-15:15 On Positional Consumption and Technological Innovation – An Agent-Based  
Approach**

João Bernardino and Tanya Araújo

**15:15-16:00 HedN Game, a Relational Framework for Network Based Cooperation**

F. Delaplace and P. Lescanne

### Track D - Complexity and Computer Science

Room: B203

**14:00-14:30 The Observatorium – The structure of news: topic monitoring in online media with  
mutual information**

David Rodrigues

**14:30-15:15 The Web of Data is a Complex System - first insight into its multi-scale network  
properties**

Christophe Guéret, Shenghui Wang, and Stefan Schlobach

**15:15-15:45 Network synchronization interval and local Kolmogorov-Sinai entropy**

Acilina Caneco, Sara Fernandes, Clara Grácio, and J. Leonel Rocha

**Track F - Mathematics and Simulation**

Room: B204

**14:00-14:45 Beyond Lyapunov**

R. Vilela Mendes

**14:45-15:15 Controlling the Bak-Tang-Wiesenfeld model**

Daniel O. Cajueiro and Roberto F. S. Andrade

**15:15-16:00 Noisy Random Boolean Networks and Cell Differentiation**

Marco Villani, Roberto Serra, Alessia Barbieri, Andrea Roli, Stuart A. Kauffman, and Annamaria Colacci

**September 14 morning - tracks A, B2, C, E and F****Track A - Policy, Planning & Infrastructure**

Room: B103

**10:30-11:00 Rebuild vs. Renovate vs. Buy: Decision-making for the Enterprise Software Industry**

Paul Abraham, Srini Chari and Vishal Sikka

**11:00-11:30 A complex adaptive system perspective on the periurban area: exploring transitions in urban-rural relationships**

Ward Rauws, Gert de Roo

**11:30-12:00 Control as Learning Process in Human Complex Adaptive Systems: A few Remarks for Policy Making**

Simone Landini, Sylvie Occelli

**12:00-12:30 Sustainable Urban Design Experiments**

Matthew Cook

**Track B2 - Collective Human Behaviour and Society**

Room: B104

**10:30-11:15 Effective free energy for individual dynamics**

Sébastien Grauwin, Éric Bertin, and Pablo Jensen

**11:15-11:45 Optimal Life Insurance, Consumption and Investment Decisions**

I. Duarte, D. Pinheiro, A. A. Pinto and S. R. Pliska

**11:45-12:30 Compensations in the Shapley value and the compensation solutions for forest games**

Sylvain Béal, Eric Rémila, and Philippe Solal

## Track C - Interacting Populations and Environment

Room: B203

***10:30-11:15 Comparing large-scale computational approaches to epidemic modeling: agent based versus structured metapopulation models***

Marco Ajelli, Bruno Gonçalves, Duygu Balcan, Vittoria Colizza, Hao Hu, José J. Ramasco, Stefano Merler, Alessandro Vespignani

***11:15-11:45 Mixing patterns among epidemic groups***

Christel Kamp

***11:45-12:30 A stochastic model of social interaction in wild house mice***

Nicolas Perony, Barbara König, and Frank Schweitzer

## Track E - From Molecules to Living Systems

Room: C104

***10:30-11:15 A stochastic model of autocatalytic reaction networks***

Alessandro Filisetti, Roberto Serra, Marco Villani, Rudolf M. Fuchsli, Norman Packard, Stuart A. Kauffman, and Irene Poli

***11:15-11:45 Extending the 'Life' Concept to Complex Systems***

Jean Le Fur

***11:45-12:30 Towards an Integrated Understanding of Protein Graph Characteristics for Protein Folding***

Susan Khor

## Track F - Mathematics and Simulation

Room: B204

***10:30-11:15 Modeling of Demand in Housing Market through Multi-Agents Behavioral Modeling***

Maryam Esmaeili

***11:15-11:45 Possible thermodynamic structure underlying the laws of Zipf and Benford***

Carlo Altamirano and Alberto Robledo

***11:45-12:30 The Unreasonable Effectiveness of Tree-Based Theory for Bond Percolation on Networks with Clustering***

Sergey Melnik, Adam Hackett, Mason A. Porter, Peter J. Mucha, and James P. Gleeson

## September 14 afternoon - tracks A, B2, D, E and F

### Track A - Policy, Planning & Infrastructure

Room: B103

**14:00-14:30 Performance of Self-organizing Control in a Cellular Automaton Model of City Traffic**

Jacek Szklarski

**14:30-15:00 Design Complexity Management through Systematic Decomposition and Formulation**

Anas Alfaris, Afreen Siddiqi, Charbel Rizk, Olivier de Weck, Davor Svetinovic

**15:00-15:30 MAS approach to political prospection and alliance analysis**

A. N. Proto and C. Costea

### Track B2 - Collective Human Behaviour and Society

Room: B104

**14:00-14:45 Modeling Cognitive Dynamics: self-organization in crowd dynamics**

Armando Bazzani, Luca Cerboni, Bruno Giorgini, and Sandro Rambaldi

**14:45-15:15 Labour mobility, industry evolution and social networks: a co-evolutionary model**

Ricardo Mamede

**15:15-16:00 Schelling's segregation model for an open city: emergence of physical frontiers from a socio-spatial dynamics**

Laetitia Gauvin, Jean-Pierre Nadal, and Jean Vannimenus

### Track D - Complexity and Computer Science

Room: B203

**14:00-14:45 On Coverage Bounds of Unstructured Peer-to-Peer Networks**

Joydeep Chandra and Niloy Ganguly

**14:45-15:15 Context-Aware Agent-Based Modeling of Social Complex Systems**

Tarek Ben Mena, Narjès Bellamine Ben Saoud, Mohamed Ben Ahmed, and Bernard Pavard

**15:15-16:00 Modularity Measure of Networks With Overlapping Modules**

Anna Lázár, Dániel Ábel, and Tamás Vicsek

### Track E - From Molecules to Living Systems

Room: C104

**14:00-14:30 Water dynamics in the hydration shell of a protein**

J. Servantie, C. Atilgan, and A. R. Atilgan

**14:30-15:00 Increased specificity in a model with molecular frustration**

Andre M. Lindo and Fernao V. de Abreu

**15:00-15:30 Agent Based modelling of realistic molecules**

Sara Fortuna and Alessandro Troisi

**15:30-16:00 Evaluating Robustness of a Complex Multiscale Biochemical Model with an Algorithmic Model Reduction Technique**

Panayotis D. Kourdis and Dimitris A. Goussis



**Track F - Mathematics and Simulation**

Room: B204

**14:00-14:45 *How opinion dynamics generates group hierarchies***

F. Gargiulo, S. Huet

**14:45-15:15 *Parametric Resonance in Time-Dependent Networks of Hopf Oscillators***

Julio Rodriguez and Max-Olivier Hongler

**15:15-15:45 *Characterising Steady-State Topologies of SIS Dynamics on Adaptive Networks***

Stefan Wieland, Tomás Aquino, Andrea Parisi, and Ana Nunes

## September 17 morning - tracks B2, C, E and F

**Track B2 - Collective Human Behaviour and Society**

Room: B104

**10:30-11:00 *Cooperation in the International Relations System***

Matus Halas

**11:00-11:45 *Simulating Opinion Dynamics in Heterogeneous Communication Systems***

Walter Quattrociocchi, Rosaria Conte, and Elena Lodi

**11:45-12:15 *The determinants of network formation: a dynamic perspective***

Lorenzo Cassi and Anne Plunket

**12:15-12:45 *Inferring Significance of Meeting Groups in Human Contact Networks***

Eiko Yoneki and Dan Greenfield

**Track C - Interacting Populations and Environment**

Room: B203

**10:30-11:15 *Modeling Settlement Patterns in Real Territories***

Joaquim Carvalho, João Tojo and Rui Lopes

**11:15-12:00 *Ecotoxicity risks during influenza pandemic***

Andrew C. Singer, Vittoria Colizza, Heike Schmitt, Johanna Andrews, Duygu Balcan, Wei E. Huang, Virginie D. J. Keller, Alessandro Vespignani, Richard J. Williams,

**Track E - From Molecules to Living Systems**

Room: C104

**10:30-11:15 *Integrating Heterogeneous Gene Expression Data for Gene Regulatory Network Modelling***

Alina Sîrbu, Heather J. Ruskin, and Martin Crane

**11:15-11:45 *Knockouts, Robustness and Cell Cycles***

Gunnar Boldhaus, Nils Bertschinger, Johannes Rauh, Eckehard Olbrich and Konstantin Klemm, Eckehard Olbrich

**11:45-12:30 Estimation of time-variant risks by *Physarum polycephalum***

Bernd Meyer, Cedrick Ansorge and Toshiyuki Nakagaki

**Track F - Mathematics and Simulation**

Room: B204

**10:30-11:00 Using Wavelet Analysis to Disentangle the Different Movement Regimes of Foraging Animals**

Arnold Fertin and Vincent Fourcassié

**11:00-11:45 Statistical and spectral properties of self-organizing macromolecular systems**

Deniz Turgut, Ali Rana Atilgan, Canan Atilgan

**11:45-12:15 The soft consensus model: dynamics, complexity, and modularity**

Campanella, T. Araújo, and R. A. Marques Pereira



# Satellite Meetings

September 15

## **SM 1 - Emergence, Path dependence and Transitions in Geographical Space**

**Organisers:** *Denise Pumain, Arnaud Banos and Lidia Diappi*

September 15, room **B104** - [http://eccs2010.eu/sm\\_emergence](http://eccs2010.eu/sm_emergence)

**9:00 - 10:00 1<sup>st</sup> session**

Keynote: The Complexity of Structure, Strategy and Decision Making  
Peter Allen

**10:30 - 12:30 2<sup>nd</sup> session**

Dynamic of World cities' system through multinational firms' networks: Micro, meso and macro processes  
Celine Rozenblat, Daniele Ietri

Network Externality Induced Path Dependence in the IT sector  
Torsten Heinrich

Between Constraint and Noise, Emergence in an industrial system: Mulhouse 1746-1902  
Jean-Luc Mercier , Daniel M. Dubois, Isabelle Bernier, Michel Hau and Raymond Woessner

**14:00 - 16:00 3<sup>rd</sup> session**

Cascading Effects in Social Networks  
Jasmin Kominek, Jürgen Scheffran

Multiscale mobility networks and the large scale spreading of infectious diseases  
Duygu Balcan, Vittoria Colizza, Bruno Gonçalves, Hao Hu, José J. Ramasco, Alessandro Vespignani

From structure to dynamics: a multi-agent urban traffic simulation  
Pierrick Tranouez, Éric Daudé, Patrice Langlois

**16:30 - 18:30 4<sup>th</sup> session**

Keynote: Swarm intelligence to model spatial dynamics  
Cyrille Bertelle

Discussion:  
Social networks, emerging patterns and path dependence in geographical space

**SM 2 - High Throughput Humanities**

**Organisers: Maximilian Schich, Sune Lehmann, Riley Crane, and Gourab Ghoshal**

September 15, room **B103** - <http://hth.eccs2010.eu/> - [hth.eccs2010.eu@gmail.com](mailto:hth.eccs2010.eu@gmail.com)

**9:00 - 10:00 1<sup>st</sup> session**

9:00 - 9:15 Introduction  
9:15 - 10:00 Keynote: Leveraging online social networks for large-scale population demographics  
Alan Mislove

**10:30 - 12:30 2<sup>nd</sup> session**

10:30 - 11:00 Invited talk: The Network of Contemporary Musicians  
Juyong Park  
11:00 - 11:30 Invited talk: Mapping Flavour Space  
Sebastian Ahnert  
11:30 - 11:45 How Predictable: Mining Consumer Transaction Data to Explore Human Economic Trajectories  
Coco Krumme  
11:45 - 12:00 Urban Migration Patterns from Residential Street Directories  
Charles Loeffler  
12:00 - 12:15 Multi-relational social dynamics in a large-scale online game society  
Michael Szell, Renaud Lambiotte, and Stefan Thurner  
12:15 - 12:30 Complex Network Analysis on a Cloud Computing Architecture  
Lorenzo Zolesio, Vincenzo De Leo, Alessandro Chessa, Gianni Fenu, Michelangelo Puliga, and Luca Secchi

**14:00 - 16:00 3<sup>rd</sup> session**

- 14:00 - 14:30 Invited talk: Googling Social Interactions: Web Search Engine Based Social Network Construction  
Sang Hoon Lee
- 14:30 - 15:00 Invited talk: Generating Linguistic Networks Based on Large Corpora of Linguistic Data  
Alexander Mehler
- 15:00 - 15:15 Invited talk: A NeoGeo approach to classical resources  
Leif Isaksen, Elton Barker, and Eric C. Kansa
- 15:15 - 15:30 The Need to Categorize: A Comparative Look at Categorization in Wikipedia and the Universal Decimal Classification System  
Almila Akdag Salah, Cheng Gao, Krzysztof Suchecki and Andrea Scharnhorst
- 15:30 - 15:45 Image\_grid. The Big Metadata of Arachne. Context, Communication and Complexity of Big Data in Archaeology  
Paul Scheduling and Sebastian Cuy
- 15:45 - 16:00 A Mathematical Approach to the Study of the United States Code  
Daniel Martin Katz and Michael Bommarito

**16:30 - 18:30 4<sup>th</sup> session**

- 16:30 - 17:00 Invited talk: Networks of Internet mediated prostitution  
Luis EC Rocha, Fredrik Liljeros, and Petter Holme
- 17:00 - 17:30 Invited talk: How to read 1000000 Manga pages? – Visualizing patterns in games, comics, art, films, TV, animation, and print media  
Lev Manovich
- 17:30 - 17:45 Collective Emotional Behavior on Blogs: Data-Driven Modeling and Theoretical Survey  
Bosiljka Tadic, Marija Mitrovic and Georgios Paltoglou
- 17:45 - 18:00 Mind Economy: Modeling Influence in Communication Networks with Social Capital  
Alexy Khrabrov and George Cybenko
- 18:00 - 18:15 Attacks with Knives and Sharp Instruments // Quantitative Coding and the Witness to Atrocity  
Ben Miller
- 18:15 - 18:30 Information spreading on social networks  
Katalin Orosz, Andras Viscek, and Peter Pollner

### SM 3 - Modelling the non-separability of a very complex world

**Organizers: Kirsty Kitto, Fabio Boschetti, and Peter Bruza**

September 15, room **B203**

<http://www.per.marine.csiro.au/staff/Fabio.Boschetti/context.htm>

#### 9:00 - 10:00 1<sup>st</sup> session

9:00 - 9:10 Introduction  
 9:10 - 10:00 Invited Talk 1: Causal Decompositions of Spacetime  
 Jim Crutchfield

#### 10:30 - 12:30 2<sup>nd</sup> session

10:30 - 11:30 Invited Talk 2: Endogenous versus Exogenous Origins of Crises and Triumphs  
 Didier Sornette  
 11:30 - 12:00 Contributed Talk 1: Social tagging, guppy effect, and the role of interference  
 Riccardo Franco and Guido Zuccon  
 12:00 - 12:30 Contributed Talk 2: Syntactic Order for Free  
 Cedric Boeckx

#### 14:00 - 16:00 3<sup>rd</sup> session

14:00 - 15:00 Invited Talk 3  
 Michel Bitbol  
 15:00 - 15:30 Contributed Talk 3: Meaning in Context  
 Kirsty Kitto and Peter Bruza  
 15:30 - 16:00 Discussion Session: Is CSS 'complex' enough?  
 panel members to be announced  
 16:00 Close and invitation to further informal discussion

## SM 4 - SCNET 2010 - Science of Complex Networks

**Organizers:** *J.F.F. Mendes, G. Caldarelli, S.N. Dorogovtsev, A. V. Goltsev, M. Ostilli, F. Abreu*  
 September 15, room **B204** - <http://www2.fis.ua.pt/scn2010/scn.htm>

### 9:00 - 10:00 1<sup>st</sup> session

9:00 - 9:20	TBA Francisco Santos
9:20 - 9:40	TBA Z. Burda
9:40 - 10:00	TBA G. Caldarelli

### 10:30 - 12:30 2<sup>nd</sup> session

10:30 - 10:50	TBA S. Dorogovtsev
10:50 - 11:10	Ageing phenomena in non-equilibrium critical systems M. Henkel
11:10 - 11:30	TBA J. Pekka
11:30 - 11:50	An evolutionary network model for understanding economic dynamics Stefan Thurner
11:50 - 12:10	Network splitting due to cascading failures under stochastic intermittent flows Konstantinos Trantopoulos
12:10 - 12:30	How to Forget the Second Side of the Story: A New Method for the One-Mode Projection of Bipartite Graphs Katharina A. Zweig

### 14:00 - 16:00 3<sup>rd</sup> session

14:00 - 14:20	TA Meta-Model for Studying Collaboration Networks: Extension and Generalization of Guimerá et al.'s Team-Assembly-Based Model Haoxiang Xia
14:20 - 14:40	Simple 2D Cellular Automata in Natural Geohazard Simulation Maja Adamska-Szatko
14:40 - 15:00	Trade, Conflict and Sentiments: Multi-relational Organization of Large-scale Social Networks Michael Szell
15:00 - 15:20	Reaching Consensus through Distributed Probabilistic Polling Moez Draief
15:20 - 15:40	Long-term community evolution in an animal society N. Perony
15:40 - 16:00	Generating random graphs with multifractals Gergely Palla



**16:30 - 18:30 4<sup>th</sup> session**

16:30 - 16:50	The unreasonable effectiveness of tree-based theory for clustered networks Sergey Melnik
16:50 - 17:10	Stability of Boolean Dynamics Fakhteh Ghanbarnejad
17:10 - 17:30	TBA A. Scala
17:30 - 18:30	Discussion

**SM 5 - Young Researchers Session at ECCS'10**

**Organizers: Andrea Apolloni, António Fonseca, David Rodrigues, Iain Kusel, Larisa Mihoreanu, and Martine J. Barons**

September 15, room **B202** - <http://phd.eccs2010.eu>

**9:00 - 10:00 1<sup>st</sup> session**

9:00 - 10:00	Keynote: TINA: mapping the science for scholars and decision-makers David Chavalarias
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**10:30 - 12:30 2<sup>nd</sup> session**

10:30 - 10:45	Evolution of social norms in a dynamic scale free network Sérgio Bacelar
10:45 - 11:00	Maintenance of sexual reproduction in a world of structured resources Yixian Song
11:00 - 11:15	Formulation of Transport Emission Reduction Policies: A Case Study in the Application of Network Analysis Araz Taeihagh, Zun Wangand, René Bañares-Alcántara
11:15 - 11:30	A tool for relations detection José António Silva
11:30 - 11:45	Exploring the Dynamics of Economic Networks using Agent-Based Modeling Fabien Held
11:45 - 12:00	Modelling fleet behaviour with rule-based fuzzy cognitive maps Laura Wise, Sérgio A. Carvalho, Alberto G. Murta, João P. Carvalho
12:00 - 12:15	A Dynamic Approach to Spatio-temporal Collaborative Filtering Sofia Torrão, Francisco Restivo

**14:00 - 16:00 3<sup>rd</sup> session**

14:00 - 15:00	Keynote: Assembling the superset of 4 critical research areas in Complexity: Evolution, Self-Organization, Cognition, Network Topology Vitorino Ramos
15:00 - 15:15	A Framework for Hypernetwork Modelling and Analysis José Loff

- 15:15 - 15:30 Modeling for a Tardean Quantitative Sociology  
Sebastien Grauwin
- 15:30 - 15:45 Predicting patient outcomes: artificial neural network analysis of a complex intervention for back pain  
Martine Barons
- 15:45 - 16:00 Network characteristics of news text sources  
Manuel Tânger

**16:30 - 18:30 4<sup>th</sup> session**

- 16:30 - 16:45 The emergence of linear sequencing in children: A continuity account and a formal model  
Iain Kusel
- 16:45 - 17:00 Demo
- 17:00 - 17:15 Dynamic Bayesian analysis of protein signalling connectivity reveals heterogeneity within single breast cancer subtype  
Steven Hill, Yiling Lu, Jennifer Molina, Gordon B. Mills, Sach Mukherjee
- 17:15 - 18:15 Keynote: Experiments In Swarm Robotics  
Anders Lyhne Christensen

**SM 6 - COSI-ICT: science of COMplex Systems for socially Intelligent ICT**

**Organizers: Jeffrey Johnson and the ASSYST team**

September 15, room **B201** - <http://eccs2010.eu/cosi-ict>

Programme TBA.

## September 16

### SM 7 - Dynamics on and of Complex Networks IV

**Organizers: Monojit Choudhury, Niloy Ganguly, Animesh Mukherjee, and Fernando Peruani**

September 16, room **B104** - <http://users.isi.it/%7Edoocn/>

#### 9:00 - 10:00 1<sup>st</sup> session - Internet

- 9:00 - 9:30 Web traffic: analysis of navigation data and modeling at single user level  
José Ramasco
- 9:30 - 10:00 The metric properties of the Internet  
Marian Boguna

#### 10:30 - 12:30 2<sup>nd</sup> session - Social / Communication Network

- 10:30 - 11:00 Complex systems science : dreams of universality, reality of interdisciplinarity  
Pablo Jensen
- 11:00 - 11:30 TBA  
Victor Eguiluz
- 11:30 - 12:00 Temporal correlations and spreading dynamics in communication networks  
Jari Saramaki
- 12:00 - 12:30 Information cascades in mobile-phone data  
Fernando Peruani

#### 14:00 - 16:00 3<sup>rd</sup> session - Internet / Social Network

- 14:00 - 14:30 Coverage-maximization in networks under resource constraints  
Subrata Nandi
- 14:30 - 15:00 Relying on statistical properties for measuring evolving complex networks: case studies  
Fabien Tarissan
- 15:00 - 15:30 Analysis of face-to-face behavioral networks from wearable sensors  
Ciro Cattuto
- 15:30 - 16:00 Statistics of human movements: from mobility networks to urban polycentric structure  
Marc Barthélemy

**16:30 - 18:30 4<sup>th</sup> session - Agent**

16:30 - 17:00	Collective dynamics of memory webs Petter Holme
17:00 - 17:30	An agent-based approach to sociality in wild house mice Nicolas Perony
17:30 - 18:00	Patterns of cooperation: fairness and coordination in networks of interacting agents Anne-Ly Do
18:30 - 19:00	Closing Ceremony

**SM 8 - EPNACS 2010 - Emergent Properties in Natural and Artificial Complex Systems**

**Organizers:** *M.A. Aziz-Alaoui, Cyrille Bertelle, Gérard H.E. Duchamp, and Miguel A.F. Sanjuan*  
September 16, room **B103** - <http://www-lih.univ-lehavre.fr/~bertelle/epnacs2010/>

**9:00 - 10:00 1<sup>st</sup> session**

9:00	Meeting opening
9:35	Minority Game: Mesoscopic Explanation of Macroscopic Observables in Herd Regime Karol Wawrzyniak and Wojciech Wislicki

**10:30 - 12:30 2<sup>nd</sup> session**

10:30 - 11:00	Detection of Synchronization Phenomena in Networks of Hindmarsh-Rose neuronal Models Nathalie Corson, Stefan Balev, and M. A. Aziz-Alaoui
11:00 - 11:30	Collaboration and Competition in Boids Simulation with Predation Antoine Dutot, Damien Olivier and Guilhelm Savin
11:30 - 12:00	Modeling Urban Dynamics Complexity with Swarm Intelligence Processes Rawan Ghnemat, Cyrille Bertelle and Gérard H.E. Duchamp
12:00 - 12:30	Segregation in social dilemmas Roger Waldeck

**14:00 - 16:00 3<sup>rd</sup> session**

GraphStream workshop, Part 1 : a java library for dynamical complex networks, concepts and introduction  
Damien Olivier, Yoann Pigné, Antoine Dutot, Guilhelm Savin

**16:30 - 18:30 4<sup>th</sup> session**

GraphStream workshop, Part 2 : : a java library for dynamical complex networks, applications and practical lab  
Frédéric Guinand, Antoine Dutot, Yoann Pigné, Guilhelm Savin

## SM 9 - Graphical models for reasoning on biological systems: computational challenges

*Organizers: Nathalie Peyrard, Stéphane Robin, Régis Sabbadin, and Matthieu Vignes*

September 16, room **B203** - <http://mia.toulouse.inra.fr/graph.mod.biol>

### 9:00 - 10:00 1<sup>st</sup> session

- 9:00 - 9:15            Introducing the meeting  
 9:15 - 10:00        Invited Speaker: Approximate Bayesian Computation (ABC) to Learn the Structure and Dynamics of Complex Systems  
 Michael Stumpf

### 10:30 - 12:30 2<sup>nd</sup> session

- 10:30 - 11:00        Properties of variational estimates of a mixture model for random graphs  
 Jean-Jacques Daudin, Alain Celisse, Steven Gazal, and Stéphane Robin  
 11:00 - 11:30        Extended Bayesian scores for reconstructing gene regulatory networks  
 Jimmy Vandel, Brigitte Mangin, Matthieu Vignes, and Simon de Givry  
 11:30 - 12:00        A Graphical Method for Reducing and Relating Models in Systems Biology  
 Steven Gay, Sylvain Soliman and François Fages

### 14:00 - 16:00 3<sup>rd</sup> session

- 14:00 - 14:45        Invited Speaker: Ecological applications of spatial point process theory - examples of spatial complexity  
 Janine Illian  
 14:45 - 15:05        Solving Adaptive Sampling Problems in Graphical Models using Markov Decision Processes  
 Mathieu Bonneau, Nathalie Peyrard, and Régis Sabbadin  
 15:05 - 15:25        Spatiotemporal modeling of a spread of Apple Scab  
 Rémi Crété, Valérie Caffier, Frédérique Didelot, Besnik Pumo and Pierre Santagostini  
 15:25 - 15:55        Hybrid parameter learning using Dirichlet distributions for modelling the dynamics of multi-scale phenomena occurring in food processes  
 Cédric Baudrit, Pierre-Henri Wuillemin, and Nathalie Perrot  
 15:55 - 16:00        Wrap up

## SM 10 - Policy making in complex adaptive systems

*Organizers: Sylvie Occelli, Yasmin Merali, Ferdinando Semboloni, Jeffrey Johnson, and Jorge Louçã*

September 16, room **B202** - [http://eccs2010.eu/sm\\_policy](http://eccs2010.eu/sm_policy)

### 9:00 - 10:00 1<sup>st</sup> session

- |              |   |
|--------------|---|
| 9:00 - 9:05  | Opening<br>Jeffrey Johnson and the ASSYST team                      |
| 9:05 - 9:30  | Managing Networks of Social Innovators<br>David Lane                |
| 9:30 - 10:00 | Co-evolutionary Dynamics Change Policy Making<br>Eve Mitleton-Kelly |

### 10:30 - 12:30 2<sup>nd</sup> session

- |               |   |
|---------------|---|
| 10:30 - 11:00 | Intervention and Policy Making in Complex Socio-Economic and Technical Systems<br>Peter Allen             |
| 11:00 - 11:30 | Policy Making for Smart Grids<br>Liz Varga  |
| 11:30 - 12:00 | Managing green politics of the crisis times: from revealed problems to complex solutions<br>Carmen Costea |
| 12:00 - 12:30 | University Spin-Offs and lessons learned from Audax<br>José Paulo Esperança                               |
| 12:30 - 13:00 | Policy and Design of Complex Systems<br>Jeffrey Johnson   |

### 14:00 - 16:00 3<sup>rd</sup> session

- |               |  |
|---------------|--|
| 14:00 - 14:30 | Planning without a plan. Evolution and emergent strategies in the Florence metropolitan area<br>Ferdinando Semboloni |
| 14:30 - 15:00 | Exploring the role of ICT in urban planning policy: some political and ethical considerations<br>Matthew Cook        |
| 15:00 - 15:30 | Epiwork IP project: a first year balance<br>Daniela Paolotti   |
| 15:30 - 16:00 | Agent-based Self-Determination for Policy-oriented Infrastructure Management<br>Jeremy Pitt                          |

### 16:30 - 17:30 BOF session and general discussion

## **SM 11 - SCIVE'10 - Social Complexity of Informal Value Exchange**

**Organizers:** *Bruce Edmonds, David Hales, Mario Paolucci, Juliette Rouchier*

September 16, room **B204** - <http://cfpm.org/scive/>

### **9:00 - 10:00 1<sup>st</sup> session**

Invited speaker: Informal Hawala/Hundi Systems of Value Transfer  
Roger Ballard

### **10:30 - 12:30 2<sup>nd</sup> session**

Network Externalities in Hawala Exchanges

Anamaria Berea

Obligation, trust and information in an Agent-Based Model of the Hawala System of International Value Exchange

Bruce Edmonds

Prices as conventions in an agent based model of growing economies

Sarah Wolf, Antoine Mandel, Steffen Furst, and Carlo Jaeger

### **14:00 - 16:00 3<sup>rd</sup> session**

Invited speaker: Social Dynamics and ICT

Rosaria Conte

Evolving informal cooperatives for a risky activity when networks matter

Victorien Barbet, Renaud Bourles, and Juliette Rouchier

Emergence of Money on a Network Topology

Mario Paolucci

Towards a Financial Commons?

David Hales

### **16:30 - 18:30 4<sup>th</sup> session**

Discussion - future projects and directions

## **SM 12 - ILACS - International Latino America Committee of the Complex Systems Society**

**Organizers: Carla Taramasco, Andrés Véjar, and Jonás Carmona**

September 16, room B201 - <http://ilacs.csregistry.org/Satellite+Meeting+2010>

### **15:00 - 16:00 1<sup>st</sup> session**

- 15:00 - 15:15 A introduction about the ILACS  
Carla Taramasco, Andrés Véjar, Jonás Carmona
- 15:15 - 16:00 Follow that cell! In toto reconstruction of early zebrafish development  
Miguel Luengo

### **16:30 - 18:30 2<sup>nd</sup> session**

- 16:30 - 17:10 Action potential initiation: a complex dynamical process?  
Jonathan Platkiewicz
- 17:10 - 17:50 Transition to aggregation in bacterial colonies: myxobacteria mutants as self-propelled rods  
Fernando Peruani
- 17:50 - 18:30 Workshop of the committee - in Spanish  
Carla Taramasco, Andrés Véjar, Jonás Carmona





# Posters and Demos

September 13 - tracks A, C, and E

## **Track A: Policy, Planning & Infrastructure**

P1 - The importance of mid-level feedback to foster motivation in a multi-agent system

Paolo Battino Viterbo and Valentina Barsotti

P2 - Formulation of Transport Emission Reduction Policies: A Case Study in the Application of Network Analysis

Araz Taeihagh, Zun Wang and René Bañares-Alcántara

P3 - Hospital Refurbishment to provide resilience in changing climatic conditions: a complexity challenge

Pam Garthwaite and Claudia Eckert

P4 - Modelling the Impact of Women Empowerment on the Eradication of Poverty using Concepts and Tools of Complexity Science

Isaac Lunywere

P5 - Vulnerability Assessment of Multi-layer Infrastructure Networks

Konstantinos Trantopoulos, Andreas Vögeli and Wolfgang Kröger

P6 - Hospital Refurbishment to provide resilience in changing climatic conditions: a complexity challenge

Pam Garthwaite and Claudia Eckert

P7 - Traffic Simulation with Focus on Pedal-Bicycles

Jelena Vasic and Heather J. Ruskin

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D52 - A unified theory for geographic parthenogenesis and sexual reproduction  
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P69 - The Ambivalent Role of IFN- $\gamma$  in Immunology – a Matter of Feedback  
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P72 - A unified theory for geographic parthenogenesis and sexual reproduction  
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P73 - Optimal vaccine allocation and vulnerability  
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P9 - A Complex Systems Approach to Production Management in the Automotive Industry

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Fabian Held

P11 - Chaotic behaviour in innovation dynamics: Impact on managerial decision

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P28 - A tool for relations detection

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P77 - Gene regulation in time and space: a model of the interdependence between genome structure and gene network dynamics

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P78 - Receptor cross-talk in angiogenesis: Mapping environmental cues to cell phenotype in a stochastic, Boolean signaling network model

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P79 - Processing of complex environmental cues in circadian systems composed of two-oscillators

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P80 - Modelling the miRNA - mRNA network

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# Special sessions

## [k]NO(w)BODY Workshop

11 September 2010, 14:00-19:00 and 12 September 2010, 13:00-17:30. Room TBA.  
<http://eccs2010.eu/knowbody>

### **Presentation and Coordination of Experiments**

*João Fiadeiro*

## Public Session on Global Problems

14 September 2010, 17:30-19:30. Room TBA.  
[http://lora.maths.warwick.ac.uk/groups/global/wiki/ff903/Concept\\_for\\_ECCS'10\\_Global\\_Problems\\_Panel\\_Discussion.html](http://lora.maths.warwick.ac.uk/groups/global/wiki/ff903/Concept_for_ECCS'10_Global_Problems_Panel_Discussion.html)

Panel:

**Markus Kirkilionis**

*Concept and Introduction*

**João Caraça**

*Theme: Economics*

**Brian Cartwright**

*Theme: Financial Stability*

**Robert Meyers**

*Theme: Technological Change and Sustainability*

**Jim Hall**

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**Didier Sornette**

*Theme: Risk Assessment*



**European Conference on Complex Systems '10**

Lisbon University Institute

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# Track A

## Policy, Planning & Infrastructure

### **Healthcare Organizations as Complex Adaptive Systems: Lessons for Nurse Leaders**

*Holly G. Johnson and Sergio Camorlinga*

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**Abstract:** We live in an age where we have the ability to connect instantaneously with friends and family around the globe via telephone, internet, or web camera. Pre-school children are able to perform electronic tasks that baby boomers find impossible. Healthcare information and communication technology (ICT) is underutilized in Canada and around the world, although the technology and need exist to improve continuity of care, safety, affordability, efficiency, and reliability. Public and private healthcare organizations have begun the work of making electronic medical records (EMR's) available to most Canadians over the next decade with the goal of "bring[ing] Canada's paper-based healthcare system into the 21st century" (Canada Health Infoway, 2008). Nurse leaders face enormous impediments to technology implementation, including costs, education and training, compatibility of systems, patient and provider attitudes, and organizational complexity. Nurses, as the largest professional sector within healthcare worldwide, have the opportunity to lead healthcare ICT implementation projects in an effort to circumvent barriers. Complexity makes up one of the largest challenges for nurses and nurse leaders in healthcare, but using complexity concepts in a metaphorical way is helpful in easing the quest for absolute control, which can result in suppression of innovation. The components of complexity science applicable to healthcare are valuable in understanding and embracing the inevitable and necessary change, complexity, tension and paradox that accompany leadership and nursing. Using complexity science, nurse leaders can draw knowledge from the masses by creating the conditions in which complexity thrives and innovation emerges. Utilizing the theoretical underpinnings of complexity science and complex adaptive systems, an overview of the nurse leader's role in ICT implementation is examined.

### **Measuring Critical Infrastructures dependency by means of the Phase Synchronization**

*Vincenzo Fioriti, Silvia Ruzzante, Elena Marchei, Alberto Tofani, Gregorio D'Agostino*

vincenzo.fioriti@enea.it

**Abstract:** A major problem of Critical Infrastructures (ICT, Internet, power networks and so on) is the quantification of inter-dependencies. In the last years some methodologies have been devised to cope with this issue relying on qualitative procedures or topological metrics. All these approaches have their own drawbacks; moreover, data and information are lacking or are very difficult to collect even off-line. However, sometimes,

high quality data (i.e. the time series) are available. In these cases it is possible to use the Phase Synchronization, based on the Hilbert phase extraction (previously used to analyze meteorological, biological, financial signals) in order to quantify the dependency between the ICT and the Power System. In this paper, we introduce the methodology, assess the feasibility of the tool, compare it with the standard linear cross-correlation, by applying the Phase Synchronization and the cross-correlation to time series derived from some Power System and ICT System. Results prove that Phase Synchronization outperforms cross-correlation.

## **A Multi-Agent System for the simulation of urban dynamics**

*Julien Perret, Florence Curie, Julien Gaffuri, Anne Ruas*

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**Abstract:** Simulating the evolution of cities suggests the ability to understand and model the laws governing urban dynamics. The approach presented in this paper uses a multi-agent system to model the self-organising properties of urban systems. The proposed multi-agent system is a hierarchy of topographic agents (e.g. buildings, roads, rivers or urban blocks) that are built, modified, merged, split, restructured and destroyed over time. Each agent's behaviour is controlled by a set of constraints and associated actions. In the proposed system, only topographic objects are taken into account, assuming a certain independence between society and the urban form (morphology) as well as a delay between the action of the society on the urban form and the feedback of the latter to the former.

## **Modeling the growth of distributed energy generation for a low carbon economy: Part I the approach**

*Liz Varga*

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**Abstract:** There are many challenges facing the UK power industry, including the anticipated exhaustion of local coal and gas resources over the next 50+ years and statutory reductions requiring significant carbon emission cuts. This is in the context of a privatized market, with the National Grid as the transmission company, regulated by Ofgem which also has responsibility for the sustainability and security of energy supply. There is also a growing diversity of products that generate energy from renewable sources or reduce demand for energy whilst not worsening living or economical standards. These products generally exploit developing technologies, such as photovoltaics, and are often linked to energy services such as the provision of information to the consumer with the potential for intervention to reduce energy use or increase energy efficiency. This paper seeks to establish the framework for a basic agent-based model which describes the growth and dynamics of an electricity market in which the demand for energy can be managed largely from renewable sources.

## **Innovation policy modeling from a complex systems perspective**

*Petra Ahrweiler*

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**Abstract:** This paper will outline a coherent framework for researching innovation in complex social systems. Complexity perspectives are highly relevant to innovation policy modeling. After a short introduction to innovation as a topic for research, the currently widely applied use of computational network analysis to investigate collaborative innovation arrangements will be discussed focusing on structural properties of these configurations. To include procedural and dynamic features of innovation, a systemic perspective will be confirmed for social systems to connect agent-based modeling to the emerging integrated research program.

## **Urban Built Form Grows Critical**

*Romulo Krafta, Vinicius de Moraes Netto, Leonardo Lima*

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**Abstract:** Our paper suggests that changes of the inner urban built form could be explained as a result of a process of self-organized criticality. Similar to the general behaviour of such kind of a system, urban built form grows discretely up to a point in which new additions could occur both in the boundaries and in inner areas. Once reached this critical point, the urban system stays around it, combining outer and inner growth. While outer growth is quantitative and does not modify the system's structure, inner growth is qualitative as well as quantitative and can transform urban centrality. Replacement of old structures by new ones always occurs with

extraordinary capital concentration, developing new polarization inside the urban fabric. The hypothesis is tested through the comparative evolution of different land, built form and location values within a period of continuous urban growth. Comparative indicator values are obtained by simplified simulation

## **A Case Study in the Application of an Agent-Based Approach in the Formulation of Policies for UK Transport Emission Reduction**

***Araz Taeihagh and René Bañares-Alcántara***

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**Abstract:** The increased complexity in our socio-economical systems requires the development of new tools to support a better understanding of the intricacies involved in addressing problems associated with such systems. We believe that by introducing a systematic approach for exploring alternative policies we can improve the decomposition of these problems, decrease the required time for analysis and formulate more effective policies. A case in policy formulation and analysis in the transport sector for achieving CO2 emission targets in the UK is presented; this solution is based on a previously proposed framework (Taeihagh et al., 2009a). The results obtained from the analysis of policy measures and their relations are used in the formulation of policy alternatives (packages and clusters) through the application of agent-based modelling. The results have the potential to further promote the use of computational approaches in the formulation of policies through the development of software systems that can support the design of policies for different sectors and geographical scopes.

## **Rebuild vs. Renovate vs. Buy: Decision-making for the Enterprise Software Industry**

***Paul Abraham, Srini Chari, Vishal Sikka***

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**Abstract:** SAP has a large multi-national software development organization with many diverse products for the complex enterprise systems market. These complex systems and the products that support them are in a constant state of upgrade either through renovation or rebuild or replacement. Of late, the target markets, and supporting technologies, change every couple of years, exponentially increasing the complexity, and necessitating a way of recalibrating that keeps pace with new realities. SAP, with a mature understanding of functional, software and technical relationships, has used a comprehensive financial decision-making approach to evaluate these strategies. However, a variety of factors, including external market forces, rapid technology innovation, and others require a more flexible decision making approach. This short paper explains our approach that augments SAP's current approaches, in a way that can be understood, proven and adopted by management and developers alike. Specific recommendations for practice are provided.

## **A complex adaptive system perspective on the peri-urban area: exploring transitions in urban-rural relationships**

***Ward Rauws, Gert de Roo***

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**Abstract:** The peri-urban area represents a changeable zone within the urban-rural continuum with a mixture of land-uses, where high dynamics can be found. Currently spatial planners and policymakers are not fully equipped to anticipate properly to these dense dynamics. In order to enhance our understanding of peri-urban development processes a complex adaptive system perspective is suggested. This perspective incorporates the idea that peri-urban developments emerge through a mix of processes. This mix consists out of various interacting contextual and case-specific processes and is assumed to evolve in a non-linear way. In addition, transition is presented as a helpful conceptualisation of non-linear change for peri-urban planning. Illustrated by several case studies of European urban regions, insights that may support our understanding of the mechanisms behind peri-urban developments are discussed. Finally resulting in possible implications for planning practices in the peri-urban area.

## Control as a Learning Process in Human Complex Adaptive Systems: Some Remarks for Policy Making

*Simone Landini, Sylvie Occelli*

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**Abstract:** Although the notion of control is constitutive to the very concept of CAS, its full potential as far as human organizations are concerned has yet to be realized. A claim is made that such an investigation would be substantial in supporting innovative policy making, where also as a result of ICT progress and societal changes, main changes are occurring. This paper aims to provide a contribution in this respect. An approach is proposed in which the two main meanings of control, that of checking the outcome of behaviors and implementing decisions for effective actions are extended to consider the learning process by which Human Complex Adaptive Systems undertake control activity. To elucidate the approach a conceptual framework is outlined and its main components discussed.

## Sustainable Urban Design Experiments

*Matthew Cook*

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**Abstract:** In many instances complex system scientists interested in the development of sustainable urban environments have neither the mandate nor the funding to undertake or take part in urban design experiments. However, this paper suggests that many opportunities for complex system scientists to undertake such experiments may arise in future as concepts which draw on ideas from complexity science are integrated within urban planning policy frames. A number of these concepts are explored, relational geography, socio-ecological systems and the multi-level perspective on socio-technical transitions to sustainability. As these concepts reconfigure urban planning policy frames, complex systems scientists may be able to work with and build upon new power relations leading to their subsequent enrolment in planning communities. Phronetic planning research and explicatory research may usefully complement complexity science in these endeavours.

## Performance of Self-organizing Control in a Cellular Automaton Model of City Traffic

*Szklarski, J.*

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**Abstract:** With use of a city traffic model based on cellular automaton, we analyze performance of the self-controlling strategy proposed by Lammer and Helbing [2008]. We consider a regular, lattice-like road network in which traffic control is realized at intersections with two conflicting streams. Four distinct scenarios are studied and it is shown that a) in the deterministic case the self-controlling strategy always quickly converges to the best fixed-cycle switching periods; and b) in the non-deterministic/irregular network case, this strategy gives better results than the solution based on fixed cycles.

## Design Complexity Management through Systematic Decomposition and Formulation

*Anas Alfaris, Afreen Siddiqi, Charbel Rizk, Olivier de Weck, Davor Svetinovic*

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**Abstract:** Designing a large-scale complex system, such as a city of the future, with a focus on sustainability requires a systematic approach towards integrated design of all sub-systems. Domains such as buildings, transportation, energy and water management are all coupled. Designing each one in isolation can lead to sub-optimality where sustainability is achieved in one aspect but at the expense of other aspects. A methodology comprised of systematic multi-level decomposition and multi-domain parameter dependency formulation is introduced for addressing design problems of complex sustainable systems. The application of the methodology for the design of a new urban development, Masdar city in Abu Dhabi, with over 220 of different form and behavior parameter sets is shown.

## MAS approach to political propection and alliance analysis

*Araceli N. Proto and Carmen Costea*

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**Abstract:** The generalization of the Lotka-Volterra model (GLVM), to the N agents case is used in this contribution. The model is applied to model party alliances before election processes, as well as to prospect the final horizons of different candidates in Argentinian future elections which will take place on October 2011. The parameters of the model are setting using public polls. Romanian polls are used to validate the ansatz about the meaning of the parameters considering the available data, as this election results are known.

### Posters and Demos

- 1 - "The importance of mid-level feedback to foster motivation in a multi-agent system", by Paolo Battino Viterbo and Valentina Barsotti
- 2 - "Formulation of Transport Emission Reduction Policies: A Case Study in the Application of Network Analysis", by Araz Taeihagh, Zun Wang and René Bañares-Alcántara
- 3 - "Hospital Refurbishment to provide resilience in changing climatic conditions: a complexity challenge", by Pam Garthwaite and Claudia Eckert
- 4 - "Modelling the Impact of Women Empowerment on the Eradication of Poverty using Concets and Tools of Complexity Science", by Isaac Lunywere.
- 5 - "Vulnerability Assessment of Multi-layer Infrastructure Networks", by Konstantinos Trantopoulos, Andreas Vögeli and Wolfgang Kröger
- 6 - "Hospital Refurbishment to provide resilience in changing climatic conditions: a complexity challenge", by Pam Garthwaite and Claudia Eckert
- 7 - "Traffic Simulation with Focus on Pedal-Bicycles", by Jelena Vasic and Heather J. Ruskin
- 8 - "Urban Land as a Critical System", by Daniel Vasata, Pavel Exner and Petr Seba
- 9 - "A Complex Systems Approach to Production Management in the Automotive Industry", by Vasco Teles and Francisco Restivo
- 10 - "Evaluating Agent-Based Models of Business Relationships & Networks as Complex Adaptive Systems", Fabian Held
- 11 - "Chaotic behaviour in innovation dynamics: Impact on managerial decision", Annick Castiaux
- 12 - "Disentangling the Complex Conceptual History of Mental Models and Actions by Big Data Analysis", by Reschke and Carl Henning
- 13 - "Concentration", by Christophe Bruchansky





# Track B1

## Philosophy of Science

### **Complexity and Context-Dependency**

***Bruce Edmonds***

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**Abstract:** It is argued that given the “anti-anthropomorphic” principle, that the universe is not structured for our benefit, that modelling trade-offs will necessarily mean that many of our models will be context-specific. The context heuristic, that divides the processing into rich, fuzzy context-recognition and crisp, conscious reasoning and learning is outlined. The consequences of accepting the impact of this human heuristic in the light of the necessity of accepting context-specificity in our modelling of complex systems is examined. In particular the development of “islands” or related model clusters rather than over-arching laws and theories. It is suggested that by accepting and dealing with context (rather than ignoring it) we can push the boundaries of science a little further.

### **Structural Coherence of Knowledge Representations in Learning Science**

***Ismo Koponen, Maija Pehkonen***

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**Abstract:** Knowledge structures are often represented in form of networks or maps of concepts. The recent philosophy of science as well as the educational research has pointed out that the organization and coherence of such knowledge representations are very closely related to knowledge production, acquisition and knowledge processing. In this paper we use network theory and structural characteristics of networks - like the clustering and cyclicity - to characterize the structural coherence of knowledge representation used by teacher students in learning physics. The results suggests that the clustering is related to tendency of learners to use triangular (transitive) schemes in organizing knowledge.



# Track B2

## Collective Human Behaviour and Society

### Effective free energy for individual dynamics

*Sébastien Grauwin, Eric Bertin and Pablo Jensen*

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**Abstract:** Physics and economics are two disciplines which share the common challenge of linking microscopic and macroscopic behaviors. However, while physics is based on collective dynamics, economics is based on individual choices. This conceptual difference, which we enlightened in a recent paper, is one of the main obstacles one has to overcome in order to characterize analytically economic models. In this paper, we build both on statistical mechanics and the game theory notion of Potential Function to introduce a rigorous generalization of the physicist's free energy, which includes individual dynamics. Our approach pave the way to analytical treatments of a wide range of socio-economic models and might bring new insights into them. As first examples, we derive solutions for a congestion model and a residential segregation model.

### Compensations in the Shapley value and the compensation solutions for forest games

*S. Béal, E. Rémila, P. Solal*

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**Abstract:** We consider an alternative expression of the Shapley value that reveals a system of compensations: each player receives an equal share of the worth of each coalition he belongs to, and has to compensate an equal share of the worth of any coalition he does not belong to. We give an interpretation in terms of formation of the grand coalition according to an ordering of the players and define the corresponding compensation vector. Then, we generalize this idea to cooperative games with a communication graph. Afterwards, we consider forest graphs and extend the compensation vector by considering all rooted spanning trees of the graph (Demange \cite{d04}) instead of orderings of the players. The associated allocation rule, called the compensation solution, is characterized by component efficiency and relative fairness. The latter axiom takes into account the relative position of a player with respect to his component.

## **Power-law distributions in scientific publishing and reviewers' workload**

***Ding-wei Huang***

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**Abstract:** We analyze the publications in a scientific journal (Chinese Journal of Physics) over the past two decades. We study the productivity and collaboration of Chinese scientists. On average, each author publishes two papers; and each paper lists four coauthors. However, these numbers are highly biased and not representative for the majority of scientists. The productivity distribution can be described by a power law; while the collaboration distribution has an exponential tail. We obtain analytical formulation to address the correlations between productivity and collaboration. We expect that the results are valid for scientific publishing in general. Based on these observations, we also comment on the distribution of reviewer's workload.

## **HedN Game, a Relational Framework for Network Based Cooperation**

***Franck Delaplace, Pierre Lescanne***

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**Abstract:** The paper proposes a new framework for cooperative games, providing a theoretic tool to study the behavior of players during cooperative network formation. It is based on mathematical relations. Here cooperation is defined as a supportive partnerships represented by a directed network between players (aka hedonic relation). We examine in a specific context, modeled by abstract games how a change of supports induces a modification of strategic interactions between players. Two levels of description are considered: the first one describes the support network formation whereas the second one models the strategic interactions between players. Both are described in a unified formalism, namely CP~game. Stability conditions are stated, emphasizing the connection between these two levels. We also stress the interaction between updates of supports and their impact on the evolution of the context.

## **On Positional Consumption and Technological Innovation – an Agent-based Approach**

***João Bernardino and Tânia Araújo***

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**Abstract:** Positional behavior is a source of external costs and arguably sets limits to wellbeing. Remedies against this market failure are defended by some authors and rejected by others, with one of the issues primarily discussed being the role that positional consumption may have in generating technological innovation. We aim to contribute to the understanding of this process by developing a representative agent-based model. We observe a plausible structure of the dynamics behind the process of generation of technological innovation by positional consumption, and obtain results on the influence of some key factors over the pace of innovation.

## **Labour mobility, industry evolution and social networks: a co-evolutionary model**

***Ricardo Mamede***

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**Abstract:** This paper presents a model that was built in order to analyse the interdependencies between labour market dynamics and the evolution of industries' structure, in situations where interpersonal links among workers influence individuals' job decisions. The model was inspired by the case of industries that rely heavily on highly skilled labour and in which problems of incomplete information abound. The causal mechanisms here proposed, based on the co-evolution of the population of firms, the labour market and the social networks among its heterogeneous learning workers, constitute an alternative explanation for a number of well-known regularities of industry evolution and of labour mobility, being arguably more suitable to the analysis of those industries than the formal models available in the literature.

## **Modeling cognitive dynamics: self-organization in crowd dynamics**

***Armando Bazzani, Luca Cerboni, Bruno Giorgini, Sandro Rambaldi***

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**Abstract:** Both in animal societies and human crowds many collective behaviors are observed that emerge as self-organized states from microscopic dynamics. Models of crowd dynamics have been proposed to describe individual interactions by means of physical-like forces that allowed to simulate collective behaviors like the spontaneous lane formation in bidirectional flows or the flux oscillations at bottlenecks. However these models do not explicitly consider individual cognitive behaviors which result from behavioral strategies and information based interactions. In this paper we propose a crowd dynamical model that introduces a cognitive dynamics to allow individual to choose between two different possibilities. The model considers the existence of two different strategies that could be applied by individuals according to the information received from the environment: a cooperative and a selfish strategy. We discuss the formation of self-organized states and the transition to a "panic dynamics" by means of simulation in a simple example.

## Cooperation in the International Relations System

*Matus Halas*

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**Abstract:** Model of the international relations system proposed here uses 63 original Axelrod's strategies in the Prisoner's Dilemma game environment. Occurrence of actors' dyadic interactions is determined with help of distance between players as well as their power. Possibility to build mutual trust based upon history of the previous interactions, and also the small chance of both kinds of noise - misimplementation and misperception - are included. Results suggest that several strategies besides the well-known TFT can win the contest even in the absence of any noise, and also that large generosity level is successful in case of (dis)trust emergence possibility together with noise presence. It seems that if it is formalized properly, international relations system favors generous cooperation. Causes of war should be maybe sought out at lower levels of analysis than the most popular systemic one. However, in noiseless environment TFT remains most successful.

## Schelling's segregation model for an open city: emergence of physical frontiers from a socio-spatial dynamics

*L. Gauvin, J.-P. Nadal, J. Vannimenus*

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**Abstract:** In the 70's Schelling introduced a multi-agent model to describe the segregation dynamics that may occur with individuals having only weak preferences for 'similar' neighbors. Recently variants of this model have been discussed, in particular, with emphasis on the links with statistical physics models. Whereas these models consider a fixed number of agents moving on a lattice, here we present a version allowing agents to enter and leave the lattice. The density of agents is controlled by a parameter which can be viewed as measuring the attractiveness of the city-lattice. We show that this model is directly related to a physical model usually describing alloys, the Blume Emery Griffiths (BEG) model at zero temperature, with kinetic constraints. These constraints lead to a new variety of "phases" whose main features are frontiers between clusters of different agents. We study the model analytically and numerically. In some regimes, we notice the emergence of socio-spatial segregation actualized by physical frontiers, being actually vacant regions. (arXiv:1002.3758v1 [physics.soc-ph])

## Simulating Opinion Dynamics in Heterogeneous Communication Systems

*Walter Quattrociocchi, Rosaria Conte, Elena Lodi*

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**Abstract:** This paper explores opinion dynamics by means of multi-agent based simulations when agents are exposed to different sources of information varying both the contents and the perceived reliability of the messages spread. Agents' internal opinion is updated either by accessing one of the information sources, namely media and experts, or by exchanging information with one another. They are also endowed with cognitive mechanisms to accept, reject or partially consider the acquired information. In this paper, the impact of reliable sources and peer-to-peer communication on the quality of information will be explored. After having shortly presented the hypotheses and the model, the simulation design will be specified and results will be discussed with respect to the hypotheses. Some considerations and ideas for future studies will conclude the paper.

## The determinants of network formation: a dynamic perspective

*Lorenzo CASSI and Anne PLUNKET*

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**Abstract:** This paper investigates the dynamics of network formation in genomics patenting in France (1986-2007) and it tests the respective role of cumulative mechanisms (e.g. closure) and actor strategies (e.g. filling a structural hole) in determining the evolution of inventor networks. To do that, we consider and analyse four types of co-inventor links. Taking two individual inventors as our focal point, four categories of links are distinguished: (1) a link bridging two components; (2) a link determining the creation of a new component; (3) a pendant to an existing component; or (4) an intra-component link. Besides usual network, geographical and technological aspects, our analysis also considers how the applicant's strategies in terms of cumulative and bridging affect the inventor's link formation.

## Optimal Life Insurance, Consumption and Investment Decisions

*I. Duarte, D. Pinheiro, A. A. Pinto, S. R. Pliska*

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**Abstract:** We describe an extension to Merton's famous continuous time model of optimal consumption and investment, in the spirit of previous works by Pliska and Ye, to allow for a wage earner to have a random lifetime and to use a portion of the income to purchase life insurance in order to provide for his estate, while investing his savings in a financial market composed by one risk-free security and an arbitrary number of risky securities whose diffusive term is given by a multi-dimensional Brownian motion. The wage earner's problem is then to find the optimal consumption, investment, and insurance purchase decisions in order to maximize expected utility of his family consumption, of the size of the estate in the event of premature death, and of his total wealth at the time of retirement. Dynamic programming methods are used to obtain explicit solutions for the case of discounted constant relative risk aversion utility functions and some economically relevant results are obtained.

## Inferring Significance of Meeting Groups in Human Contact Networks

*Eiko Yoneki and Dan Greenfield*

**Abstract:** The structure of human contact networks in the real world is time dependent and it is a complex task to describe its dynamics. This paper aims to identify dynamics of meeting groups in human connectivity traces, where meeting groups are expected to be a group interacting among the nodes in physical space. Thus, we define 'meeting group' differently from 'community'. We exploit statistical approach that provides quantitative attributes to uncover meeting groups. We identify the power law behavior of meetings that is important for supporting to understanding dynamics of information flow between meeting groups and building group oriented communication protocol.

## Posters and Demos

- 14 - "Scale-free characteristics of co-occurrence network in keywords: stem-cell case", by Sang-Jin Ahn and Sang-il Kim
- 15 - "Opinion Model Meets Reality: Empirical Confirmation Using Statistical Data", by Sven Banisch and Tanya Araújo
- 16 - "Emergence of collective action under coordination dilemmas", by Francisco C. Santos, Brian Skyrms, Max O. Souza and Jorge M. Pacheco
- 18 - "Group decision-making: comparison of the two models based on a phase transition approach", by Tatiana Bouzdine-Chameeva
- 19 - "Risk-Identification and Strategic Foresight based on History, Management and Complex Systems Perspectives - The Example of the Bio-Pharmaceutical Industry", by Carl Henning Reschke
- 20 - "Population structure induces a symmetry breaking favoring the emergence of cooperation", by Flavio Pinheiro, Francisco C. Santos and Jorge M. Pacheco
- 21 - "Birth and Death Systems with 2D Spatial Diffusion: Applications to Population and Economic Dynamics", by Pedro de Mendonca and Ellak Somfai
- 22 - "Opinion Dynamics", by Anthony Woolcock, Colm Connaughton and Yasmin Merali

- 23 - "Bounded confidence model: addressed information maintain diversity of opinions", by Krzysztof Malarz and Krzysztof Kulakowski
- 24 - "Influence of emotions on the length of Internet discussions", by J. A. Holyst, A. Chmiel, J. Sienkiewicz, M. Thelwall, G. Paltoglou and K. Buckley, A. Kappas
- 25 - "Evolutionary dynamics of cooperation when individual fitness derives from group decisions taken in the past", by João A. Moreira, Flávio L. Pinheiro, Ana Nunes and Jorge M. Pacheco
- 26 - "Developing Cybercultura as a complex communication strategy", by Jorge A. González
- 27 - "A meta-population model with two sub-populations", by Andrea Apolloni, Chiara Poletto, Jose Javier Ramasco, Pablo Jensen and Vittoria Colizza
- 28 - "A tool for relations detection", by José António Silva
- 29 - "Complex systems science : dreams of universality, reality of interdisciplinarity", by Sebastian Grauwin, Guillaume Beslon, Eric Fleury, Sara Franceschelli, Celine Robardet, Jean-Baptiste Rouquier and Pablo Jensen
- 30 - "Statistical properties of population density of Japan", by Hiroto Kuninaka
- 31 - "Social influence model of language competition", by Wojciech Borkowski and Andrzej Nowak
- 32 - "Dynamics of quality negotiations", by Andrzej Nowak, Karolina Lisiecka, Katarzyna Samson and Michal Ziembowicz
- 33 - "Evolutionary dynamics of multiplayer social dilemmas in bigraph structured populations", by Jorge Peña, Yannick Rochat and Henri Volken
- 34 - "Mapping hashtag networks on Twitter", I. Amaral, J. Silva, S. Lanceros-Mendez and H. Sousa
- 35 - "IT Governance process: a network evaluation approach", by José Tomaz
- 36 - "Empirical evidence for a persistent fear-factor in stock markets", by Emeric Balogh, Zoltán Nédá, Bálint Zs. Nagy and Ingve Simonsen
- 37 - "Dynamic Hierarchical Structure of Currencies in Artificial International Money Market", by Masanori Tsujino and Takashi Hashimoto
- 38 - "In Search of Organizational Fitness: The Linkage of Organizational Design Parameters to Emerging Structural Configuration", by José V. Matos
- 39 - "Does Consensus Increase Egalitarianism in Social Choice?", by Dorota Marciniak and Josep Freixas
- 40 - "A Study on Financial Data using Random Matrix Theory and Information Theory methods", by José Salgado and José Matos
- 41 - "The complexity and structure of science and technology innovation networks in the biotechnology sectors of the European countries", by Dong Hee Lee and Duk Hee Lee
- 42 - "The global food system and environmental change: The potential of a dynamic network theory perspective", by Rita Margarido
- 43 - "Creative economy & creative communities-feasible option during crisis time. Challenges and opportunities for Romania", by Marta-Christina Suci, Mina Ivanovici, Klaus Bruno Schebesch and Vasile Goldis
- 44 - "Evolution of social norms in a dynamic scale free network", by Sérgio Bacerlar
- 45 - "Using interactive computer visualization of complex phenomena for Teaching Negotiation. Demonstration of an Attractor Software Platform", by Wieslaw Bartkowski
- 105 - "Modeling Financial Markets", by Pedro Loureiro





# Track C

## Interacting Populations and Environment

### **Spatial sampling in HMRF mapping problems: Static and adaptive algorithms**

***Nathalie Peyrard and Régis Sabbadin and Daniel Spring and Ralph Mac Nally and Barry Brook***

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**Abstract:** In many environmental management problems, the construction of occurrence maps of species of interest is a prerequisite to their management. However, this task is difficult since observations are often imperfect and costly. There is a lack of methodological tools for designing efficient spatial sampling strategies. We developed original model-based static and adaptive sampling methods dedicated to the construction of occurrence maps. We adopt the classical image analysis probabilistic framework of Hidden Markov Random Fields and we express the sampling strategy as the solution of an optimisation problem. Resolution is intractable and we propose heuristic approaches to derive approximately optimal solutions both for static and adaptive sampling. An empirical comparison, on simulated data, of the adaptive and static HMRF-based sampling methods with random sampling and adaptive cluster sampling, shows that in most cases the adaptive sampling approach, when possible, provides a restored map of better accuracy than the other approaches.

### **Mixing patterns among epidemic groups**

***Christel Kamp***

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**Abstract:** Epidemic modelling has a long tradition in facilitating an understanding of the spread of infectious agents with direct impact on public health. Recent modelling approaches have specifically improved our understanding of the connections between transmission network topology and epidemic spread: Host populations are not generally well mixed and show heterogeneous and dynamic contact behaviour. This results in a broad range of epidemic patterns regarding both speed and width of epidemic expansion. However, there is also a mutual influence between transmission network structure, mixing between susceptible and infected hosts

and the epidemic process: epidemic control gets more difficult if infected hosts mix well within the susceptible population. We present a new mathematical framework which allows for a study of mixing patterns between susceptible and infected hosts in populations with very general structural features. While clustering of infected hosts is a qualitatively well known phenomenon our approach allows for its quantification and puts it in relation to the hosts' overall contact behaviour. It shows that different degrees of assortativity emerge depending on the transmission network structure and epidemic stage. The method's use is demonstrated for synthetic populations. It can however easily be transferred to more realistic settings in which information about mixing patterns of epidemic groups is vital for improved epidemic control.

## Population Dynamics on Complex Food Webs

*Gian Marco Palamara, Vinko Zlatic, Guido Caldarelli*

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**Abstract:** In this work we analyze the topological and dynamical properties of a simple model of complex food webs, namely the niche model. We describe the system as an oriented weighted graph and we assign a Lotka-Volterra population dynamics on the structure created by the niche model. After this we introduce ""predators"" and ""prey"" weighted graphs from which we underline patterns of competition among species. We measure topological properties of such graphs comparing simulated food webs with real data. We find that, using a combination of projections weights as competition kernel in the Lotka-Volterra equations, the stability of food webs decreases with its complexity (measured as the average degree of the web)

## Comparing large-scale computational approaches to epidemic modeling: agent based versus structured metapopulation models

*Marco Ajelli, Bruno Gonçalves, Duygu Balcan, Vittoria Colizza, Hao Hu, José J. Ramasco, Stefano Merler, Alessandro Vespignani*

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**Abstract:** Recent years have witnessed with increased frequency the use of large-scale computational models for the realistic simulations of epidemic outbreaks. Methodologies adapt to the scale of interest and range from very detailed agent-based models to spatially structured metapopulation models. One major issue thus concerns to which extent the epidemic evolution found by different modeling approaches may differ and depend on the different approximations and assumptions used. We provide for the first time a side by side comparison of the results obtained with a stochastic agent based model and a structured metapopulation stochastic model for the evolution of a baseline pandemic event in Italy, a large and geographically heterogeneous European country. The Agent Based model is based on the explicit representation of the Italian population through highly detailed data on the socio-demographic structure. The metapopulation simulations use the GLobal Epidemic and Mobility (GLEaM) model, based on high resolution census data worldwide, and integrating airline travel flow data with short range human mobility patterns at the global scale. The model also considers age structure data for Italy. GLEaM and the Agent Based models are synchronized in their initial conditions by using the same disease parameterization, and by defining the same importation of infectious cases from International travel. The results obtained show that both models provide epidemic patterns that are in very good agreement at the granularity levels accessible by both approaches, with differences in peak timing of the order of few days. The relative difference of the epidemic size depend on the  $R_0$  considered and the metapopulation model consistently yields a larger incidence with respect to the agent based model, as expected due to the differences in the structure in the intra-population contact pattern of the approaches. The age breakdown analysis shows that similar attack rates are obtained for the younger age classes. The good agreement between the two modeling approaches is very important in the definition of the tradeoff between data availability and the information provided by the models. The presented results thus define the possibility of hybrid models combining the agent based and the metapopulation approaches according to the available data and computational resources.

## A stochastic model of social interaction in wild house mice

*Nicolas Perony, Barbara König, Frank Schweitzer*

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**Abstract:** We investigate to what extent the interaction dynamics of a population of wild house mouse (*Mus musculus domesticus*) in their environment can be explained by a simple stochastic model. We use a Markov chain model to describe the transitions of mice in a discrete space of nestboxes, and implement a multi-agent simulation of the model. We find that some important features of our behavioural dataset can be reproduced

using this simplified stochastic representation, and discuss the improvements that could be made to our model in order to increase the accuracy of its predictions. Our findings have implications for the understanding of the complexity underlying social behaviour in the animal kingdom and the cognitive requirements of such behaviour.

## Modeling Settlement Patterns in Real Territories

*Joaquim Carvalho, Rui Lopes, João Tojo*

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**Abstract:** This paper describes an agent based model of the spreading of a population over a territory. The model aims at reproducing a distribution of settlements with statistical and spatial characteristics similar to a historically produced pattern. The model operates on a representation of a real territory, taking into account hydrography and relief. The two main goals are to obtain a rank size distribution of the size of settlements which corresponds to a power law (also known as the Zipf Law of settlements) and to place the settlements in the territory in patterns that are close to the real ones, in zones where settlement was the result of a long historical process. The goal of the project was to demonstrate that a set of relatively simple rules could produce a complex pattern, similar to the result of a long and complex historical process. So it is an assumed reductionist approach. Our conclusions show that a simple territorial logic, taking into account the quality of land, accessibility, population growth and migration preferences could reproduce Zipf distributions and interesting patterns of agent flow among the settlements created. However, achieving spatial patterns closer to the historical record needs an extra dimension involving field of sight. The best results were achieved by creating an artificial population which chooses to create settlements in places where a wide field of view exists of quality territory.

## Ecotoxicity risks during influenza pandemic

*Andrew C. Singer, Vittoria Colizza, Heike Schmitt, Johanna Andrews, Duygu Balcan, Wei E. Huang, Virginie D. J. Keller, Alessandro Vespignani, Richard J. Williams*

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**Abstract:** The global public health community has closely monitored the unfolding of the 2009-10 influenza pandemic to best mitigate its impact on society. However, little attention has been given to the impact that our response to a pandemic might have on the environment. Antiviral and antimicrobial drugs prescribed to treat influenza and influenza-associated complications are poorly metabolized in vivo; once ingested, they are subsequently excreted into wastewater in a biologically-active form. Here we use a global spatially structured epidemic model to simulate the quantities of drugs used during an influenza pandemic under different conditions. We couple this model to a wastewater and river flow model, to project drug concentrations in wastewater treatment plants (WWTPs) and receiving rivers in the Thames basin in Southern England. Ecotoxicologic modeling shows that projected concentrations of antibiotics in WWTPs and receiving rivers would not exceed toxicity thresholds in the case of a mild pandemic, as observed with the current H1N1 pandemic. However, at the peak of a moderate or severe pandemic, the mean antibiotic usage could increase by 13% and 252% as compared to inter-pandemic periods, respectively. Nearly one-third of the microbial community in 70% of the WWTPs in the Thames basin are projected to be growth-inhibited during a severe pandemic, and preliminary empirical evidence signals the potential disruption of bacterial biofilms upon exposure to WWTP-relevant concentrations of Tamiflu. Between 5 to 40% of the length of the Thames River receiving WWTP effluent is projected to exceed thresholds for microbial growth-inhibition from antibiotics. Projections indicate no ecotoxicologic risk for a situation consistent with the 2009-10 H1N1 influenza pandemic. However, a more severe pandemic might result in reduced WWTP efficacy, resulting in the release of partly untreated sewage into receiving rivers, leading to eutrophication, fish kill, and contamination of drinking water abstraction points.

## Posters and Demos

- 46 - "Ageing and quality of life – new responses from the real estate sector", by Fátima Loureiro de Matos
- 47 - "Age-dependent immune response and antigenic drift in influenza", by Andrea Parisi, Ana Nunes, Gabriela Gomes
- 48 - "Modelling complex systems with cellular automata", by Alexandre Makarovitsch, Jean-Pierre Foll and Pierre Chauvet
- 49 - "The precipitation and temperature regime over Turkey as a result of climate change", by Hamza Altinsoy, Alperen Yuncu and Levent Kurnaz

- 50 - "Impacts of the increasing climate variability to the Andorran Winter Tourism", by M. Pons, C. Pérez, B. Sureda, M. Rosas-Casals and E. Jover
- 51 - "The Effects of Climate Change on the Production of the crops in Turkey", Hamza Altinsoy, Cihat Kurt, Rumeysa Mus and Levent Kurnaz
- 52 - "A unified theory for geographic parthenogenesis and sexual reproduction", by Yixian Song, Stefan Scheu and Barbara Drossel

# Track D

## Complexity and Computer Science

### **The Observatorium – The structure of news: topic monitoring in online media with mutual information**

*David Rodrigues*

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**Abstract:** Large, real time text classification systems are becoming a popular topic. We present a method for automatically extracting correlated news from online media using a dynamic similarity graph and use the variation of information as a measure to identify topics, lifespan and key terms. The presented method has the advantage of requiring no human intervention or training and having no pre-assigned categories because they emerge from the dynamics of the generated network.

### **Network synchronization interval and local Kolmogorov-Sinai entropy**

*Acilina Caneco, Sara Fernandes, Clara Grácio and J. Leonel Rocha*

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**Abstract:** The synchronization of a network depends essentially on the connection topology of the network and on the behavior in the local nodes. In this work we fix the connection topology and express the network synchronization interval in terms of the local Kolmogorov-Sinai entropy, for piecewise linear expanding maps with the essential spectrum of the transfer operator being the unit disk. As a consequence the amplitude of the synchronization interval decreases as the local Kolmogorov-Sinai entropy increases.

## The Web of Data as a Complex System

*Christophe Gueret, Shenghui Wang and Stefan Schlobach*

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**Abstract:** The Web of Data (WoD) is an internet-based network consisting of data-resources and their semantic relations. It has recently taken flight now combines over a hundred of interlinked data-sources containing already more than 15 Billion edges. A consequence of this recent success is that a paradigm shift is currently taking place: could the Web of Data until now still be studied, searched and maintained like a classical data-base, it has now turned into a Complex System, and needs to be studied as such. In this paper we introduce the Web of Data as a challenging object of study and provide initial results on two of network scales: the pure data-layer, and the global connection between graphs. In this analysis we can show that the "official" abstract representation of the WoD does not fit the real distribution we can derive from the lower scale. However, as interesting as these results are, bigger challenges await in form of the highly dynamic character of the WoD, and the typed, and implicit, character of the edges which is, to the best of our knowledge, hitherto unstudied.

## On Coverage Bounds of Unstructured Peer-to-Peer Networks

*Joydeep Chandra, Niloy Ganguly*

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**Abstract:** In this paper, we develop methods to estimate the network coverage of a TTL-bound query packet undergoing flooding on an unstructured p2p network. The estimation based on the degree distribution of the networks, reveals that the presence of certain edges, that we name as cross and back edges, reduces the coverage of the peers in p2p networks and also generate a large number of redundant messages, thus wasting precious bandwidth. We therefore develop models to estimate the back/cross edge probabilities and the network coverage of the peers in the presence of these back and cross edges. Extensive simulation is done on random, power-law and Gnutella networks to verify the correctness of the model. The results highlight the fact that for real p2p networks, which are large but finite, the percentage of back/cross edges can increase enormously with increasing distance from a source node, thus leading to huge traffic redundancy.

## Context-Aware Agent-Based Modeling of Social Complex Systems

*Tarek Ben Mena, Narjès Bellamine-Ben Saoud, Mohamed Ben Ahmed, Bernard Pavard*

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**Abstract:** In this paper, we present a modelling social complex systems with Multi-Context-Aware Agent Systems (MCAAS). MCAAS are Multi-Agent Systems where some or all agents are context-aware. Context-Aware Agent (CAA) can adapt their behavior according to context with all its dimensions : physical, social, emotional, cultural, etc. We propose also a platform for CAA deployment and we use this platform for the development of an emergency rescue simulator based on CAA.

## Modularity Measure of Networks With Overlapping Modules

*Anna Lazar, Danel Abel, Tamas Vicsek*

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**Abstract:** In this paper we introduce a non-fuzzy measure which has been designed to rank the partitions of a network's nodes into overlapping communities. Such a measure can be useful for both quantifying clusters detected by various methods and during finding the overlapping community-structure by optimization methods. The theoretical problem referring to the separation of overlapping modules is discussed, and an example for possible applications is given as well.

## Posters and Demos

- 53 - "Complex Adaptive Robotics in Logistics Systems - SystemC as an Appropriate Approach for Modeling (CARLS)?", by M.Hülsmann and R.Colmorn
- 54 - "Closed-Loop Coding-Decoding Procedures as Technological Base of the Living and Organized Complex Systems", by Dobilas Kirvelis
- 55 - "Complex engineering systems design: from mapping requirements to system optimization", by Ivo Ferreira

- 56 - "Second-Order Assortative Mixing in Networks", by Shi Zhou, Ingemar J. Cox and Lars K. Hansen
- 57 - "Bipartite Graphs for Densification in Social Networks", by Szymon Chojnacki and Mieczyslaw Klopotek
- 58 - "Towards Community Detection Problem Formalization", by Mohammed Haddad, Belkacem Serrour and Hamamache Kheddouci
- 59 - "Joint Attention Realized in a Robot with Intentional Agency", S. Nagataki, M. Shibata, T. Konno, T. Hashimoto and H. Hattori
- 60 - "Multi-Objective Swarm Optimization for Grid Scheduling", by María Arsuaga-Ríos, Miguel A. Vega-Rodríguez and Francisco Prieto-Castrillo
- 61 - "Common e-mail statistical features and priority task model of short-time dynamics in work groups", Satoko Itaya, Naoki Yoshinaga, Peter Davis, Rie Tanaka, Taku Konishi, Shinichi Doi and Keiji Yamada
- 62 - "Describing Mental States and Bodily Behaviors", by S. Hirose and N. Nagataki
- 63 - "Dynamic Adaptation to Available Nodes on Open Cloud Computing", by Rui Esteves
- 64 - "Aging in a Language Change Model", by Gareth Baxter
- 65 - "Network characteristics of news text sources", by Manuel Tânger





# Track E

## From Molecules to Living Systems

### Extending the 'Life' Concept to Complex Systems

*Jean Le Fur*

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**Abstract:** There is still no consensus definition of complex systems (CS). This article explores, as a heuristic approach, the possibility of considering CS as a general category, 'living things'. Living organisms would be considered a specialized class of 'living things'. The main features of the proposal are presented. Concepts associated with "life" are then explored in the context of CS: birth, death and lifespan, adaptation, ontogeny and growth, reproduction... Thereafter, a refutation approach is used to test the proposed classification against a set of diverse systems, including a vertebrate, a breaking wave and an idea. The results of this analysis are then used to generate a definition of CS, given the proposal, and within the background of cybernetics, complex adaptive systems and biology. The definition of CS as 'living things' appears to be a useful heuristic approach, opening up new lines of research for improving the definition of CS.

### A stochastic model of autocatalytic reaction networks

*Alessandro Filisetti, Roberto Serra, Marco Villani, Rudolf M. Fuchslin, Norman Packard, Stuart A. Kauffman, Irene Poli*

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**Abstract:** Autocatalytic networks are widespread in nature, but they are difficult to create or to reproduce in laboratory. There are however several models of coupled reactions which describe a phase transition to an autocatalytic cycle when a certain level of heterogeneity in the composition of the chemical soup is reached, so it is interesting to understand why these phenomena are not easily achieved in the laboratory. For this purpose we introduce here a model, inspired by a previous one by Kauffman, tailored for the study of such properties. In particular, we take into account the stochastic nature of the dynamics of interacting molecules, in the case of a well stirred tank reactor. We describe the model and we analyse its behaviour under different circumstances. In particular, the onset of an autocatalytic set is studied as the feed is varied, and its stability is analysed.

## Towards an Integrated Understanding of Protein Graph Characteristics for Protein Folding

*Susan Khor*

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**Abstract:** The principles underlying protein folding remains one of Nature's puzzles with important practical consequences for mankind. An approach that has gathered momentum since the late 1990's, looks at protein hetero-polymers and their folding process through the lens of complex network analysis. As a result, there is now a body of empirical studies describing common topological characteristics of proteins and linking topological characteristics to protein folding. In general, protein folding is a self-sufficient kinetic process making its way through a very large conformation space towards a unique native state in biological time. As such, it can be viewed as a very efficient local search process. In this paper, we use a model to test whether the suggested explanations for the various observed topological characteristics of proteins make sense from a local search perspective. We hope to understand in an integrated way, the influences structural characteristics of proteins have on protein folding.

## Integrating Heterogeneous Gene Expression Data for Gene Regulatory Network Modelling

*Alina Sîrbu, Heather J. Ruskin and Martin Crane*

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**Abstract:** Gene regulatory networks are complex biological systems that have a large impact on protein levels, so that discovering network interactions is a major objective of Systems Biology. Quantitative GRN models have been inferred, to date, from time series measurements of gene expression, but at small scale, and with limited application to real data. Time series experiments are typically short, (number of time points of the order of 10), while regulatory networks can be very large, (containing hundreds of genes). This creates an under-determination problem, which negatively influences the results of any inferential algorithm. Presented here is an integrative approach to model inference, which has not been previously discussed, to the authors' knowledge. Multi-platform heterogeneous expression time series are used to infer the same model, and results are shown to be more robust to noise and parameter perturbation. Additionally, a wavelet analysis shows these models display limited noise over-fitting within the individual datasets.

## Knockouts, Robustness and Cell Cycles

*Gunnar Boldhaus and Nils Bertschinger and Johannes Rau and Eckehard Olbrich and Konstantin Klemm*

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**Abstract:** The response to a knockout of a node is a characteristic feature of a networked dynamical system. Knockout resilience in the dynamics of the remaining nodes is a sign of robustness. Here we study the effect of knockouts for binary state sequences and their implementations in terms of Boolean threshold networks. Beside random sequences with biologically plausible constraints, we analyze the cell cycle sequence of the species *Saccharomyces cerevisiae* and the Boolean networks implementing it. Comparing with an appropriate null model we do not find evidence that the yeast wildtype network is optimized for high knockout resilience. Our notion of knockout resilience weakly correlates with the size of the basin of attraction, which has also been considered a measure of robustness.

## Estimation of time-variant risks by the slime mold *Physarum polycephalum*

*Bernd Meyer, Cedrick Ansorge, and Toshiyuki Nakagaki*

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**Abstract:** Self-organized mechanisms are widely used in nature to achieve flexible, adaptive control and decision-making. It has recently been shown that noise can play a crucial functional role in such systems. Essentially, noise can enable a self-organized system to reliably adapt to short-term changes in the environment while maintaining a generally stable behavior. This is fundamental in biological systems because they must strike a delicate balance between stable and flexible behavior. We investigate the question how noise influences the decision-making of the true slime mold *Physarum polycephalum*, an important model species for the

investigation of computational abilities in simple organisms. We propose a simple biological experiment to investigate the reaction of *P. polycephalum* to time-variant risk factors. We present a stochastic extension of an established mathematical model for *P. polycephalum* to analyze this experiment. It predicts that noise can enable *P. polycephalum* to correctly assess time-variant risk factors, while the corresponding noise-free system fails to do so. Importantly, our analysis holds interest beyond the study of *P. polycephalum*. In conjunction with earlier work it demonstrates that the influence of noise on self-organized decision-making is not tied to a specific self-organized mechanism or its physical realization. Rather it is a general property of the underlying process dynamics, which appears to be universal across a wide range of systems. Our study thus provides further evidence that stochastic resonance is a fundamental component of the decision-making in self-organized macroscopic groups and organisms.

## Water dynamics in the hydration shell of a protein

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**Abstract:** We study the dynamics of hydration water/protein association in folded proteins, using lysozyme and myoglobin as examples. Extensive molecular dynamics simulations are performed to identify underlying mechanisms of the dynamical transition that corresponds to the onset of amplified atomic fluctuations in proteins. The number of water molecules within a cutoff distance of each residue scales linearly with protein depth index and is not affected by the local dynamics of the backbone. Keeping track of the water molecules within the cutoff sphere, we observe an effective residence time, scaling inversely with depth index at physiological temperatures while the diffusive escape is highly reduced below the transition. A depth independent orientational memory loss is obtained for the average dipole vector of the water molecules within the sphere when the protein is functional. While below the transition temperature the solvent is in a glassy state, acting as a solid crust around the protein inhibiting any large scale conformational fluctuations. At the transition, most of the hydration shell unfreezes and water molecules collectively make the protein more flexible, slowly relaxing matter.

## Increased specificity in a model with molecular frustration

*André M. Lindo and Fernaldo V. de Abreu*

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**Abstract:** In this article we explore a molecular frustration mechanism for specificity amplification. We show that this mechanism can be seen as a more general form of a kinetic proofreading mechanism, with an interesting new property, namely the ability to tune the specificity amplification by changing the reactants concentrations. This contrasts with the classical kinetic proofreading mechanism in which specificity is a function of only the reaction rate constants involved in a chemical pathway.

## Agent Based modelling of realistic molecules

*Sara Fortuna and Alessandro Troisi*

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**Abstract:** In this paper we extend our previously developed agent-based (AB) model to the study of a realistic system. We study the 2D self-assembly of rigid organic molecules on a surface, comparing the AB results with Monte Carlo (MC) and MC simulated annealing, a technique traditionally used to solve the global minimisation problem. The AB algorithm is able to give a lower energy configuration in the same simulation time than both the MC simulation techniques.

## Evaluating Robustness of a Complex Multiscale Biochemical Model with an Algorithmic Model Reduction Technique

*P.D. Kourdis and D.A. Goussis*

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**Abstract:** Complex mathematical models characterized by a wide range of time scales are considered. When the fast time scales are of dissipative nature and are much faster than the rest, the solution quickly relaxes on a manifold and evolves with the slow scales. Interested in the long-term evolution, the full mathematical model can then be divided in two parts; one part relating to the fast scales and identifying the manifold and another

part that relating to the slow scales and describing the slow evolution on the manifold. On this basis, the significance of the various components in the model can be assessed, by examining their contribution to the fast and slow parts. Perturbations to the components contributing to the fast (slow) part will produce an immediate (gradual) effect. These ideas will be applied for the evaluation of the robustness of a model describing the glycolysis pathway.

## Posters and Demos

- 66 - "Modelling Complex Epigenetic Changes", by Ruskin Heather J. , Perrin Dimitri, Raghavan Karthika and Goasmat Francois
- 67 - "Systemic Processes of Evolutionary Knowledge Organization in Pharmaceuticals", by Carl Henning Reschke
- 68 - "A theoretical approach to identify indispensable proteins of the Type III secretion systems of Salmonella enterica serovar Typhimurium strain LT2", by Chandrajit Lahiri and Radhakrishnan Sabarinathan
- 69 - "The Ambivalent Role of IFN- $\gamma$  in Immunology – a Matter of Feedback", by Andreas Heitger and Birgit Jürgens
- 70 - "Modeling the Operator of Schizophrenic Behavior Within the Mechanism of Societal Operators", by Dallas F. Bell, Jr.
- 71 - "Role of Regulatory Mechanisms in Pathogen Persistence", by Katherine Wendelsdorf, Josep Bassaganya-Riera, Raquel Hontecillas, Stephen Eubank, and Madhav Marathe  
Katherine Wendelsdorf, Josep Bassaganya-Riera, Raquel Hontecillas, Stephen Eubank, and Madhav Marathe
- 72 - "A unified theory for geographic parthenogenesis and sexual reproduction", by Yixian Song, Stefan Scheu and Barbara Drossel
- 73 - "Optimal vaccine allocation and vulnerability", by Andrea Apolloni, Bryan Lewis, Chris Barrett, Madhav Marathe, Stephen Eubank and Jangzuo Chen
- 74 - "Stochastic modeling of infectious diseases", by Ganna Rozhnova and Ana Nunes
- 75 - "The mathematical structures of the brain. Category Theory in neural science", by Jaime Gómez Ramírez, Ricardo Sanz and Manuel Bedia
- 76 - "Sparseness in model gene regulatory networks", by Marcin Zagórski
- 77 - "Gene regulation in time and space: a model of the interdependence between genome structure and gene network dynamics", by Thimo Rohlf, Ivan Junier and Francois Kepes
- 78 - "Receptor cross-talk in angiogenesis: Mapping environmental cues to cell phenotype in a stochastic, Boolean signaling network model", by Thimo Rohlf and Amy L. Bauer
- 79 - "Processing of complex environmental cues in circadian systems composed of two-oscillators", by Daniel Santa Cruz Damineli and Andreas Bohn
- 80 - "Modelling the miRNA - mRNA network", by Göker Arpag, Ayse Erzan and Pradeep Kumar Mohanty
- 81 - "Dynamic Bayesian analysis of protein signalling connectivity reveals heterogeneity within single breast cancer subtype", by Steven M. Hill, Yiling Lu, Jennifer Molina, Gordon B. Mills and Sach Mukherjee

# Track F

## Mathematics and Simulation

### **Beyond Lyapunov**

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**Abstract:** Ergodic parameters like the Lyapunov and the conditional exponents are global functions of the invariant measure, but the invariant measure itself contains more information. A more complete characterization of the dynamics by new families of ergodic parameters is discussed, as well as their relation to the dynamical Rényi entropies and measures of self-organization. A generalization of the Pesin formula is derived which holds under some weak correlation conditions.

### **Controlling the Bak-Tang-Wiesenfeld model**

*D. O. Cajueiro and R. F. S. Andrade*

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**Abstract:** Self-organized criticality is a characteristic of eternally driven systems that organize themselves without fine parameter tuning. The issue considered here is that the process of self-organization of such systems generates events with no characteristic size being very costly to society. In order to deal with this problem, focusing mainly on the direct Dhar model, we have recently shown that an external control can be used to reduce the size of avalanches in systems exhibiting self organized criticality. Here, we explore the problem of controlling self-organized criticality on the undirect Bak-Tang-Wiesenfeld (BTW) model.

### **Noisy Random Boolean Networks and Cell Differentiation**

*Marco Villani, Roberto Serra, Alessia Barbieri, Andrea Roli, Stuart A. Kauffman and Annamaria Colacci*

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**Abstract:** We propose a modification of the Random Boolean Network model where noise is allowed, in such a way that in its asymptotic state the system can visit several attractors of the deterministic dynamics. The notion of Threshold Ergodic Sets (TES) is introduced, and it is proposed that they represent cell types. The degree of differentiation of a cell is related to the number of attractors which belong to its TES, and it is shown that this leads to a meaningful description of cell differentiation. By coupling the threshold, which is related to the level of

noise, to mutations which may interfere with the control mechanisms of the cell, a description of the the process of cell transformation, from normal to malignant, is provided. This description, albeit abstract, is consistent with several known experimental facts.

## **Modeling of Demand in Housing Market through Multi-Agents Behavioral Modeling**

**Maryam Esmaeili, A. Vancheri, P. Giordano**

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**Abstract:** Housing is a key component of the economy of every country. Having a model which is able to predict the housing market in a few years could be very valuable for different disciplines such as economists, social scientist, geographies, etc. For having such a model first we need to predict the housing mobility patterns to make the demand in housing market. In this paper a decision making system using fuzzy type-2 system has been developed to model the housing relocation in Lugano in some years. In this model the agents are the households which are able to evaluate their housing status and if they were not satisfied they decide to change their house. Every agent is identified by his socio-economic characteristics, the time he lives in the system and the position of his house. In every step of the simulation, the agent observes the features of his house and the environment and compare it with his socio-economic features and if they were matched he will be satisfied by his house and if not he will decide to change his place. Through this process we will model the house relocation reasons, then these reasons will be used in the model the shape the agents' selection regarding new house selection. In the proposed hierarchical structure, the motivations of an agent are modeled in the first stages of the hierarchy through modeling of agent's dissatisfaction. Using Kano model, dissatisfaction process has been modeled by a knowledge-base system. The strengths of the attributes of an available product in firing the rules of the knowledge-base system of the agent are computed and interpreted as motivations of the agent to do an action (selection). After computing the motivations of selecting a new house for every agent, the matching level between the agent's needs and the attributes of a new house is computed by a fuzzy type-2 inference system. Higher matching level means higher probability in selecting a new product. This approach has been used in house selection to make demands in housing market.

## **Generalized thermodynamics underlying the laws of Zipf and Benford**

**Carlo Altamirano and Alberto Robledo**

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**Abstract:** We show that the laws of Zipf and Benford, obeyed by scores of numerical data generated by many and diverse kinds of natural phenomena and human activity are the focal expressions of a generalized thermodynamic structure. This structure is obtained from a deformed type of statistical mechanics that arises when configurational phase space is incompletely visited in a strict way. We consider a generalized version of Benford's law for data expressed in full and not by the first digit. The inverse functional of this expression is identified with Zipf's law; but it naturally, and quantitatively, reproduces the bends or tails observed in real data for small and large rank. Thermodynamically, our version of Benford's law expresses a Legendre transform between two entropy (or Massieu) potentials, while Zipf's law is merely the expression that relates the corresponding partition functions. Remarkably, we find that the entire problem is analogous to the transition to chaos via intermittency exhibited by low-dimensional nonlinear maps. Our results also explain the generic form of the degree distribution of scale-free networks.

## **Parametric Resonance in Time-Dependent Networks of Hopf Oscillators**

**Julio Rodriguez and Max-Olivier Hongler**

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**Abstract:** We study a collection of limit cycle oscillators with different frequencies interacting via networks. With static networks, our specific class of models produces a frequency learning mechanism leading the collection of oscillators to ultimately adopt a single consensual frequency which, once reached, subsists even if interactions are switched off (i.e. interactions produce a plastic deformation of the dynamics). The consensual state is asymptotically reached independent of the networks' topologies. However, the topologies affect the convergence rate. For time-dependent networks, new dynamical patterns may emerge. These produce a time-dependent spectrum of the Laplacian matrices describing the algebraic connectivities. For time-dependent circulant networks, we are able to show that linear stability analysis in the vicinity of the stationary consensual

state produces Hill type equations (i.e a second-order linear ODEs with oscillating parameters), thus offering the possibility of destabilization via parametric resonance phenomena.

## Characterising Steady-State Topologies of SIS Dynamics on Adaptive Networks

*Stefan Wieland, Tomas Aquino, Andrea Parisi, Ana Nunes*

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**Abstract:** Disease awareness in epidemiology can be modelled with adaptive contact networks, where the interplay of disease dynamics and network alteration often adds new phases to the standard models (Gross 2006; Shaw 2008) and, in stochastic simulations, lets network topology settle down to a steady state that can be static (in the frozen phase) or dynamic (in the endemic phase). In the simple endemic phase of the SIS model, this steady state does not depend on the initial network topology, but only on the disease and rewiring parameters and on the link density of the network, which is conserved. We give an analytic description of the structure of this co-evolving network of infection through its steady-state degree distribution.

## Using wavelet analysis to disentangle the different movement regimes of foraging animals

*Arnold FERTIN and Vincent Fourcassié*

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**Abstract:** When foraging in their environment a lot of animals adopt an intermittent search strategy composed of various movement regimes. To understand the functional significance of these regimes their identification is required. We used a method based on Continuous Wavelet Transform (CWT) to highlight these regimes. CWT is a mathematical tool which achieves a time-scale (or time-frequency) analysis of signals and which is especially appropriate to process the transient and non-stationarity properties of the signals generated by intermittent phenomena. This tool was applied to the acceleration component of the movement of foraging individuals of the ant species *Odontomachus hastatus*. It turned out to be an excellent method for identifying in a totally unsupervised manner the different kinematic regimes in the ants' movement, constituting a first step for the understanding of their functional significance.

## The Unreasonable Effectiveness of Tree-Based Theory for Bond Percolation on Networks with Clustering

*Sergey Melnik, Adam Hackett, Mason A. Porter, Peter J. Mucha, and James P. Gleeson*

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**Abstract:** We demonstrate that a tree-based theory for bond percolation yields extremely accurate results for several networks with high levels of clustering. We find that such a theory works well as long as the mean intervertex distance  $\ell$  is sufficiently small---i.e., as long as it is close to the value of  $\ell$  in a random network with negligible clustering and the same degree-degree correlations. We confirm this hypothesis numerically using real-world networks from various domains and on several classes of synthetic clustered networks.

## Statistical and Spectral Properties of Self-Organizing Macromolecular Systems

*Deniz Turgut, Ali Rana Atilgan, Canan Atilgan*

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**Abstract:** The characteristics of networks derived from spatial self-organizing systems exemplified by residue networks and macroscopic simulation of block copolymers are studied. We introduce network models inspired by three dimensional crystal structures to approximate these systems. A linear relation between degree and second degree correlations is derived. This relation is used along with the spectral properties to characterize the resulting networks. It is found that networks originating from three dimensional lattices, especially close packed structures, are more successful in capturing the essential properties of networks based on protein structures and micelles.



## How opinion dynamics generates group hierarchies

**F. Gargiulo, S. Huet**

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**Abstract:** We recently proposed a model coupling the evolution of the opinions of the individual with the local network topology. The opinion dynamics is based on the Bounded Confidence model. The social networks is based on a group concept where each individual is totally connected to the members of its group and is linked to the individuals of the other groups with a given probability. During a time step, the individual has to decide between discussing with a member of its own network and applying the opinion dynamics, or moving groups because it has an opinion far from the average opinion of its own group. One of the main results we obtained is that the group sizes, starting from an homogenous situation can be strongly heterogeneous at the equilibrium state. This kind of heterogeneity can be identified in many real networks. In this paper we present the complete set of behaviours that this complex model can exhibit, at group level. In particular we will focus on the mechanisms that lead to the stability of the groups and the appearance of heterogeneity in sizes.

## The soft consensus model: dynamics, complexity, and modularity

**G. Campanella, T. V. de Araújo, and R. A. Marques Pereira**

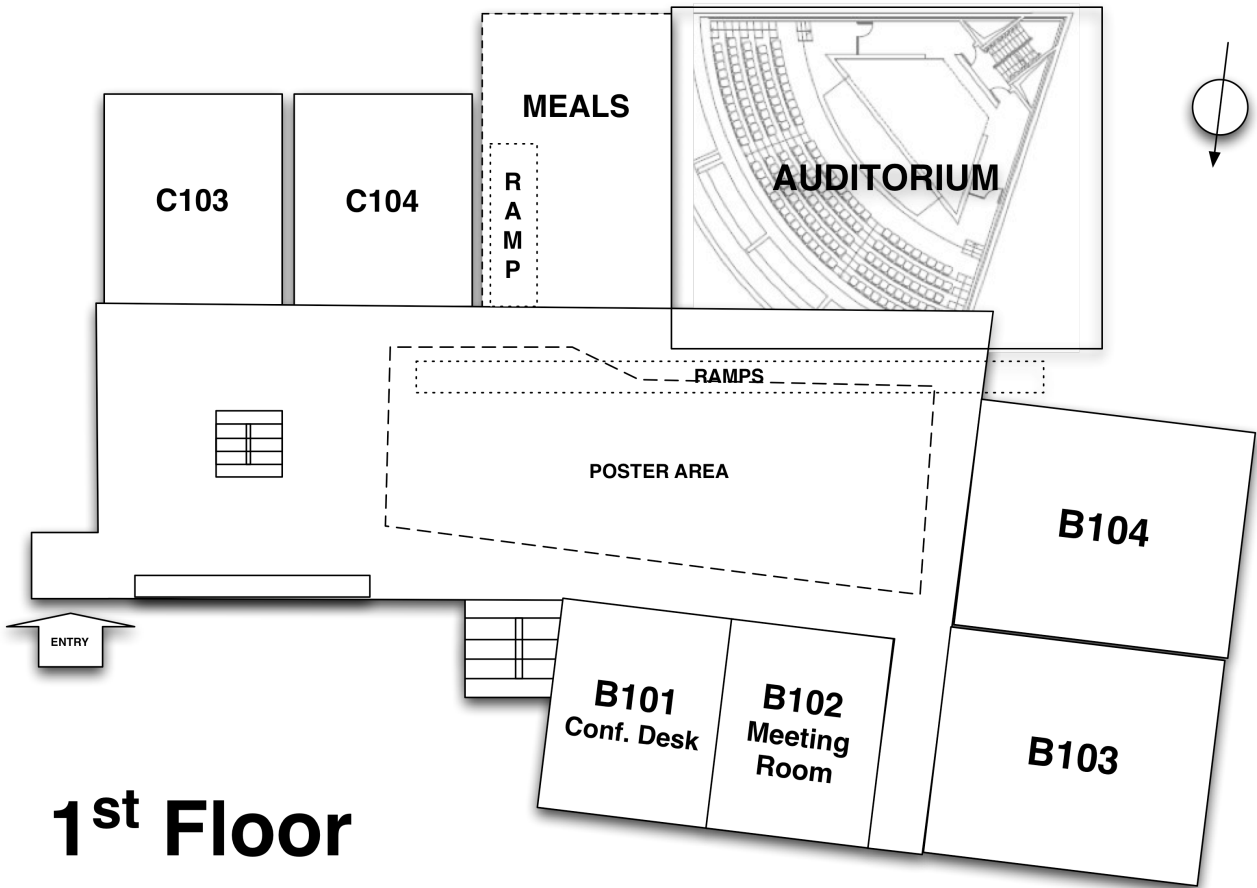
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**Abstract:** We consider the network dynamics of the soft consensus model and we investigate the dynamical behavior of two important measures of network structure, complexity and modularity. The dynamical mechanism of the soft consensus model is driven by the minimization of a cost function combining a collective measure of dissensus with an individual mechanism of opinion changing aversion. The dissensus measure plays a key role in the model and induces a network of pairwise interactions between the individual opinions. The pairwise interaction coefficients take values in the unit interval and define the adjacency matrix of an undirected weighted graph. The measures of complexity and modularity express in two different ways how far the network structure is from some appropriate (transitive) partitioning. We illustrate their dynamical behaviour in the context of the soft consensus model by means of a number of computer simulations.

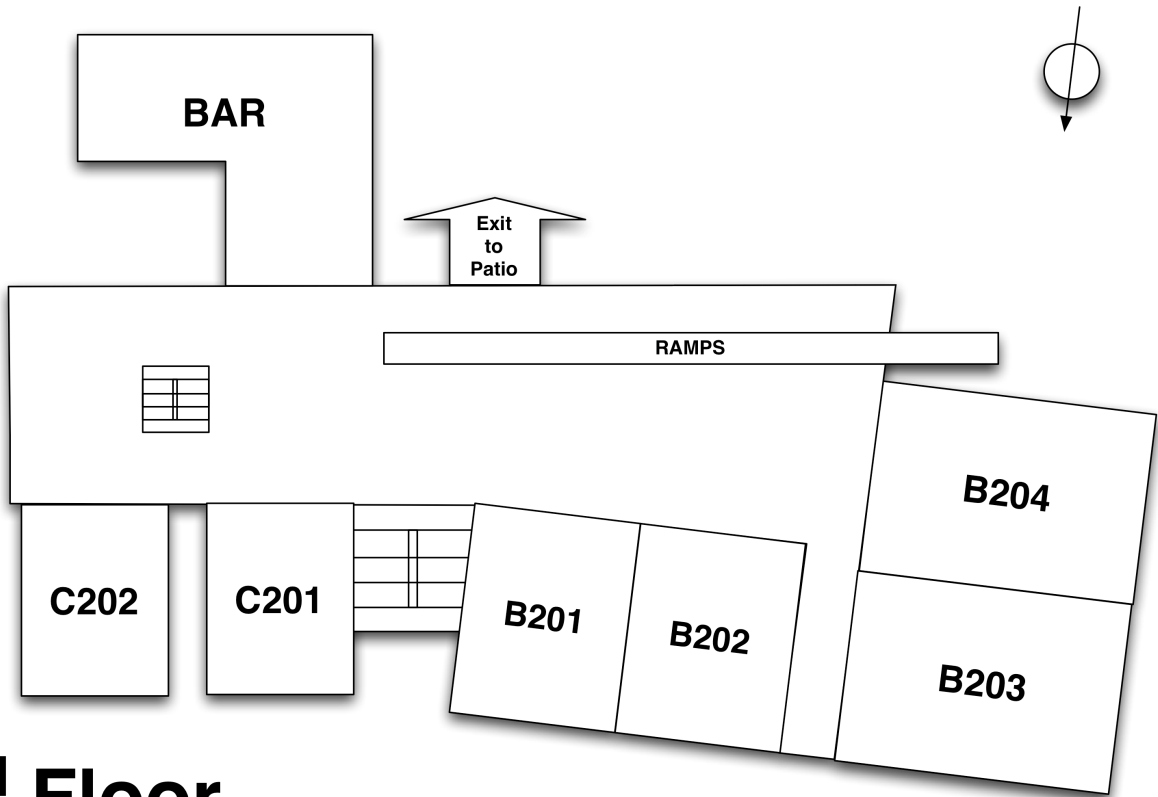
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