Book of Abstracts

COST Action MP0801:
Physics of Competition and Conflict
Annual Meeting 2012

11th-13th July 2012

National University of Ireland, Galway

Programme

Wednesday 11th July (Aras Moyola, NUI Galway)

08.30-09.00	**Registration**
09.00-09.15	Welcome
09.15-10.00	Pablo Brañas Garza - *Experimental Altruism*
10.00-10.30	Tea & Coffee
10.30-11.00	Anxo Sanchez - *There is no such thing as network reciprocity when humans play a Prisoner's Dilemma*
11.00-11.30	Helmuth Hüffel - *Thermodynamics of Swarms*
11.30-12.00	Sorin Solomon - *When the collective acts on its components: inter-scale auto-catalytic mechanisms of change in social, economic and natural systems*
12.00-12.30	Tiziana Di Matteo - *Hierarchical Information Clustering by Means of Topologically Embedded Graphs*
12.30-14.00	**Lunch**
14.00-14.30	Igor Grabec - *Development of traffic jam in adverse weather*
14.30-15.00	Yurij Holovatch - *Transportation network stability: A case study of city transit*
15.00-15.30	Janusz A. Holyst - *Analytical approach to the model of scientific revolutions*
15.30-16.00	Coffee
16.00-16.30	Magda Fontana - *The Diffusion of Complexity within Economics*
16.30-17.00	James Gleeson - *Spreading of Facebook applications*
17.00-17.30	Haluk O. Bingol - *Gossip on weighted networks*
20:00-	**Dinner** (The House Hotel)

Thursday 12th July (Aras Moyola, NUI Galway)

9.00-9.45   Scott Kelso - *Coordination, criticality and conflict*

9.45-10.15   Wojciech Waga - *Monte-Carlo model of the human genome evolution*

10.15-10.45   Coffee

10.45-11.15   Frank Schweitzer - Systemic risk in economic and financial networks

11.15-11.45   Mishael Milakovic - *Equilibrium models of competitive firms*

11.45-12.15   Giulia Rotundo - *Network analysis of financial networks*

12.15-12.45   Vygintas Gontis - *Agent-based Versus Macroscopic Modeling of Competition and Business Processes in Economics and Finance*

12.45-14.15   Lunch

14.15-14.45   Michel Schilperoord - *Research Policy Laboratories: Agent-Based Modelling for Ex-Ante Evaluation for Complex Policy Instruments*

14.45-15.15   Pablo Lucas & Diane Payne- *Integration of Decision Modelling and Agent-Based Modelling*

15.15-15.45   Panos Argyrakis - *A network approach for the scientific collaboration in the European Framework Programs*

15.45-16.15   Coffee

16.15-16.45   Sascha Delitzscher and Serge Galam - *The stick versus the carrot in countering terrorism in public opinion*

16.45-17.15   Jürgen Mimkes - *The Lagrange principle in physical economics*

17.15-17.45   Sudhir Jain - *The Competitiveness of the English Football Leagues*

Friday 13th July (Aras Moyola, NUI Galway)

9.00-9.45   Peter Turchin - *Towards an Analytical, Predictive Science of History*

9.45-10.15   Coffee

10.15-13.15   *COST MP0801: Review meeting*

10.15-12.0   **Evaluation session A**
Open to all participants

10.15-10.45   Peter Richmond - *Background and summary of WG2, WG4 and WG5* (20 min + 10 min discussion)

10.45-11.15   Andrea Scharnhorst - *WG1 activities and outcomes* (20 min + 10 min discussion)

11.15-11.45   Renaud Lambiotte - *WG3 and WG6 activities and outcomes* (20 min + 10 min discussion)

11.45-12.00   Peter Richmond - General *summary, including STSMs, publications, the final book and follow-on activities (10 min + 5 min discussion)*

12.00-13.15   **Evaluation session B**
Attended by MC members, the external evaluators and the COST Office representatives.

Financial report from the COST Office, comments and questions from the DC Rapporteur and the External Evaluators, general discussion, future plans including final-reporting requirements and deadlines.

13.15-13.30   Close

Experimental Altruism

Pablo Brañas Garza

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There is no such thing as network reciprocity when humans play a Prisoner's Dilemma

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Abstract. In a pioneering work by Nowak and May, it was found that the behavior observed in a Prisoner's Dilemma was dramatically different in a lattice than in a well mixed population (mean-field approach): Indeed, in the lattice the cooperative strategy was able to prevail by forming clusters of like agents who outcompeted defection. Subsequently, the issue was considered in literally hundreds of papers, and very many differences between structured populations and mean-field systems were identified, although by no means they were always in favor of cooperation. In fact, it has been recently realized that this problem is very sensitive to the details of the system, in particular to the type of evolutionary dynamics considered. In this Paper, we show that if instead of theoretically assuming some arbitrary dynamics, one follows the standard approach in physics and uses the input from the experimental evidence, the behavior of agents playing a Prisoner's Dilemma is the same at the mean field level as in very different networks. To this end, instead of considering some kind of imitative dynamics, we will resort to the behavior reported by Grujic et al. [1] in the largest experiment reported to date about the spatial Prisoner's Dilemma. The experiment showed a rather low level of cooperation, whereas the analysis of the actions taken by the players showed a heterogeneous population consisting of "mostly defectors" (defected with probability larger than 0.8), a few "mostly cooperators" (cooperated with probability larger than 0.8), and a majority of so-called moody conditional cooperators. This last group consisted of players that switched from cooperation to defection with probability $PDC = 1 - d - \gamma\rho$ and from defector to cooperator with probability $PCD = a + \beta\rho = 1 - PDD$, ρ being the density of cooperative actions in the neighborhood of i in the past iteration. In a mean-field approach, it is assumed that the relevant magnitudes are the densities of cooperators, defectors and mostly defectors, and it is also assumed that what a typical player observes as her neighborhood is the same irrespective of her strategy. With these hypothesis, the cooperation level, i.e., the fraction of cooperative actions taken by the players in the stationary regime can be computed. Comparison of this result with simulations on different types of networks, to check what are the effects of the approximations on our analytical predictions, allows us to establish our claim that the cooperation level is independent of the type of network and is perfectly well described by the mean-field approach. We will also present the results of a very large scale experiment (1229 participants) carried out on December 20th, 2011 in Zaragoza that fully confirm our predictions.

[1] J. Grujic, C. Fosco, L. Araujo, J. A. Cuesta, and A. Sánchez, PLoS ONE 5, e13749 (2010).

Thermodynamics of Swarms

Helmuth Hüffel

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Abstract. We present a detailed analysis of a swarm model of Brownian particles. Numerical simulations of amorphous swarming behavior find analytic understanding by studying stability properties of equilibria. The velocity distribution and the entropy of the swarming particles are studied in dependence on the underlying noise; phase transitions are discussed

When the collective acts on its components: inter-scale auto-catalytic mechanisms of change in social, economic and natural systems

Sorin Solomon

Hebrew University of Jerusalem, Israel

Abstract

General Interest Aspects. In many social, biological and human systems interactions exist between the collective and the individuals comprising the collective. For instance, higher brain functions influence single neuron activity, the general economic mood influences individual firms and the general well-being of organisms influences the behavior of single cells. The existence of these effects has long been known, and has influenced seminal concepts such as the *meme* and *Gaia*. However, studying them within formal models that permit precise mathematical treatment and empirically verifiable predictions is a long-standing challenge.

Main results. The interactions between the collective and the individuals comprising it generate autocatalytic loops that promote unexpected discontinuous systemic transitions/crises (climatic, ecological, social, health-related, cultural). In spite of the apparently overwhelming number of individual elements and causes, the collective crisis is dominated by only a few factors that are amplified by the autocatalytic loop. This allows a high level of crisis predictability and control.

Wider implications. Beyond the epistemological issues (logical closure and consistency à la Godel and Whitehead, computability à la Turing and Chaitin), the collective ↔ individual autocatalytic loop has vast real-life practical implications for ecology, social change, medicine, and natural and artificial cognition. In economic crisis propagation, these effects are dramatic; the percolation transition towards systemic crisis becomes discontinuous, and there are a number of regimes and corresponding response policy options. In particular, there are stability ranges where appropriate policies can avoid macroscopic crisis, and beyond which the percolation to macroscopic scales becomes unstoppable.

Technical Description. Agent-based models have improved the standards for empirical support and validation criteria in social, biological, cognitive and human sciences. Yet, the inclusion, in these models, of vertical interactions between various aggregation levels remains a challenge. We study analytically, numerically and by simulation the generic consequences of interactions between the collective and its individual components:

- the appearance of an autocatalytic loop between the dynamics of the collective and its components;

- the system, which is dominated by a limited number of factors amplified by this collective ↔ individuals autocatalytic loop;

- the microscopic features, which are not involved in the autocatalytic loop and are irrelevant at the systemic level; and

- how the above clarify the interplay between macroscopic predictable features and the ones dependent on random unpredictable individual events.

Using the social and market percolation framework, we study the dramatic effects of the collective $\leftrightarrow$ individuals autocatalytic loop on economic crisis propagation:

- the percolation transition becomes discontinuous;

- there are a few relevant regions and regimes corresponding to a quite diverse range of response policy options;

- there are stability ranges where appropriate policies can help to avoid macroscopic crisis percolation; and

- beyond those regions the systemic crisis might become unstoppable

Hierarchical Information Clustering by Means of Topologically Embedded Graphs

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Abstract. We introduce a graph-theoretic approach to extract clusters and hierarchies in complex data-sets in an unsupervised and deterministic manner, without the use of any prior information. This is achieved by building topologically embedded networks containing the subset of most significant links and analyzing the network structure. For a planar embedding, this method provides both the intra-cluster hierarchy, which describes the way clusters are composed, and the inter-cluster hierarchy which describes how clusters gather together. We discuss performance, robustness and reliability of this method by first investigating several artificial data-sets, finding that it can outperform significantly other established approaches. Then we show that our method can successfully differentiate meaningful clusters and hierarchies in a variety of real data-sets. In particular, we find that the application to gene expression patterns of lymphoma samples uncovers biologically significant groups of genes which play key-roles in diagnosis, prognosis and treatment of some of the most relevant human lymphoid malignancies.

Development of traffic jam in adverse weather

Igor Grabec and F. Švegl

Amanova, Ljubljana, Slovenia

Abstract. Adverse weather generally decreases visibility and increases slipperiness that can cause development of traffic jams on high-ways. The article presents a new model for prediction of the jam length based upon information about a proper speed limit at the critical road sector. For the prediction the model also applies a time series of traffic flow at this sector that is forecast by an intelligent module based upon records of traffic activity in the past. The forecast flow is converted to traffic jam characteristic by integrating the number of cars that are stopped due to decreased road capacity while more detailed description of the jam properties is given by the solutions of partial differential equations. Performance of the corresponding computer program is demonstrated by forecasting the evolution of the traffic jam during rush-hour at the point of maximal traffic activity of high-ways at Ljubljana in Slovenia where inconvenient influences of weather are often observed.

Transport network stability: A case study of city transit

Yurij Holovatch[1], Bertrand Berche[2], Christian von Ferber[3,4] and Taras Holovatch[2,3]

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[2]Statistical Physics Group, Institut Jean Lamour, Universite de Lorraine, France
[3]Applied Mathematics Research Centre, Coventry University, UK
[4]Institut für Theoretische Physik II, Heintich-Heine Universität Düsseldorf, Germany

Abstract. A review of our recent work on analysis of public transportation networks (PTN) will be presented. Special attention will be paid to their fractal properties and to analysis of their stability. One of the goals of our study is to present criteria, that allow to *a priori* quantify the attack stability of real world correlated networks of finite size and to check how these criteria correspond to analytic results available for infinite uncorrelated networks. As a case study, we consider public transportation networks of several major cities of the world. To analyze their resilience against attacks, either the network nodes or edges are removed in specific sequences (attack scenarios). During each scenario the size $S(c)$ of the largest remaining network component is observed as function of the removed share c of nodes or edges. To quantify the PTN stability with respect to different attack scenarios we use the area below the curve described by $S(c)$ for $c \in [0,1]$ recently introduced [1] as a numerical measure of network robustness. This measure captures the network reaction over the whole attack sequence. We present results of the analysis of PTN stability against node and link-targeted attacks [2].

[1] C. M. Schneider, T. Mihaljev, S. Havlin, H. J. Herrmann, preprint arXiv:1102.1929v1 (2011); C. M. Schneider, A. A. Moreira, J. S. Andrade, Jr., S. Havlin, H. J. Herrmann, PNAS **108**, 3838 (2011).

[2] B. Berche, C. von Ferber, T. Holovatch, Yu. Holovatch, preprint arXiv:1201.5532v1 (2012) (to appear in Adv. Compl. Syst.); C. von Ferber, B. Berche, T. Holovatch, Yu. Holovatch, J. Transport. Security (in preparation).

Analytical approach to the model of scientific revolutions

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Warsaw University of Technology, Poland.

Abstract. The model of scientific paradigms spreading throughout a community of agents with memory is analyzed using the master equation. The case of two competing ideas is considered for various networks of interactions, including agents placed at Erdos-Renyi graphs or complete graphs. The pace of adopting a new idea by the community is analyzed, along with the distribution of periods after which a new idea replaces the old one. The approach is extended for the chain topology to the more general case when more than two ideas compete. Our analytical results agree with the numerical simulations for several models. Comparison of two variants of star topology brought interesting results. In the first variant, when we require that the innovation first appears in the central node, the rate of the expansion of the new idea is the fastest possible among all the topologies, and the mean expansion time $<T>i$ (which is the shortest possible) scales like $N \log N$. However, if we remove this requirement and let the innovation appear in any node with equal probability, $<T>i$ grows to N^3 (higher than that in a chain, where the mean distance between nodes is much larger) and almost the whole time is taken by convincing the central agent to the new idea. For details see arXiv:1106.0438.

The Diffusion of Complexity within Economics

Michael Golosovski[1], Magda Fontana[2] and Sorin Solomon[1]

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[2]University of Turin, Italy

Abstract. The research addresses the issue of change in economic theory by investigating the birth and development of the Complexity approach to economics. The history of economic thought can be interpreted as succession of paradigms la Kuhn: our work focuses on the diffusion process that precedes the celebration of the birth of a new paradigm and the funeral of the old one. The research identify the hardcore of the Complexity approach in the scientific production of the Santa Fe Perspective -the view of a group of scientists working in the Economics Program (1988-2004) at the Santa Fe Institute for the Study of Complex Systems-and, starting from a representative database of working papers, analyzes its temporal diffusion through citation analysis.

The first level of analysis consisted in identifying among the papers published during the program the period where real paradigm shifting papers were generated. The characteristics of those papers were then extracted. We call the set of those papers "the original set". The original set is then used as the starting point for reconstructing the evolution and diffusion of the complexity approach throughout the scientific communities.

To do so we find the set of papers that cite the original set: "the set of followers of rank 1". As a first measurement we study the distribution of author's locations and of the publications' journals among the papers of rank 1. We study the characteristics of these "geographical" and "community" diffusion patterns. In particular the patterns followed by the new paradigm papers is compared to the diffusion pattern of papers originating in the SFI program in the periods with no paradigm shifting policy.

Spreading of Facebook applications

**James Gleeson[1], J-P Onnela, Felix Reed-Tsochas,
Mason Porter and Davide Cellai[1]**
[1]University of Limerick, Ireland

Abstract. We study an empirical dataset showing the growth in popularity of Facebook applications in the first months following their launch [Onnela and Reed-Tsochas, PNAS, 2010]. Installers of applications faced a choice among thousands of applications, and the distribution of sizes of applications shows a slowly-decaying heavy tail. We propose a model that reproduces many of the qualitative features of the data, including longitudinal (temporal) features.

Gossip on Weighted Networks

Mursel Tasgin and Haluk O. Bingol

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Abstract. We investigate how suitable a weighted network is for gossip spreading. The proposed model is based on the gossip spreading model introduced by Lind et.al. on unweighted networks. Weight represents "friendship". Potential spreader prefers not to spread if the victim of gossip is a "close friend". Proposed local metric, gossip spreading, is related to the triangles and cascades of triangles. It gives more insight about the structure of a network. We analyze gossip spreading on real weighted networks of human interactions. 6 co-occurrence and 7 social pattern networks are investigated. Gossip propagation is found to be a good parameter to distinguish co-occurrence and social pattern networks. As a comparison some miscellaneous networks of comparable sizes and computer generated networks based on ER, BA, WS models are also investigated. They are found to be quite different than the human interaction networks.

Coordination, criticality and conflict

J.A. Scott Kelso

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Abstract. In certain well-defined situations, principles of self-organization can be shown to govern patterns of coordination in brain and behavior. Critical instabilities have been used both as a methodology to identify key collective state variables and their dynamics on a given level of description and as a generic mechanism for effecting change. Fluctuations can play a constructive role, testing whether patterns are stable enough to persist and (especially near criticality) allowing the system to discover new, more adaptive patterns that fit current circumstances. In some cases, using various approximations, it has proven possible to derive patterns of coordination at one level from (nonlinear) interactions between component processes at another. However, one may view this as an idealization. When symmetry is broken, novel dynamical features emerge in which collective states and their multistability disappear giving way to a more subtle dwell escape metastable regime: 'integrative' tendencies for the components to couple coexist with 'segregative' tendencies for the parts to express their autonomy. Such spatiotemporal metastability offers a new picture of behavioral and brain coordination and suggests that the strategy of conflict (between the ideal and what is) be replaced with the strategy of complementarity.

Monte-Carlo model of the human genome evolution

Wojciech Waga, Dietrich Stauffer, Stanislaw Cebrat

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Abstract. We have used diploid Penna ageing model based on the Monte Carlo method to simulate evolution of the human genome. Virtual genome was characterized by the parameters of the human genome: about 25 000 of genes, 22 pairs of autosomes, the same way of sex determination (X and Y chromosomes in the male genome) the same number of genes and recombination frequency in the corresponding chromosome pairs. Since real chromosomes in the human genome differ significantly in coding density (number of genes per recombination units) we have observed in the simulations different ways of their evolution. More densely packed chromosomes tend to enter complementing strategy, forming gene clusters while less densely packed ones stay under purifying selection. As a result, risk of both: inbreeding depression (lower reproduction potential of spouses highly genetically related) and outbreeding depression (lower reproduction potential of spouses less genetically related) can be observed, like it was described in natural human populations several times. This phenomenon can be observed only in the spatially organized genomes and spatially distributed individuals and cannot be explained by the widely accepted mean field genetic theories. Furthermore, we have observed deterioration of Y sex chromosome, leading to loss of genetic information of that chromosome and significantly shorter life span of men.

Systemic risk in economic and financial networks

Frank Schweitzer

ETH Zurich

Abstract. The term 'systemic risk' commonly denotes the risk that a whole system consisting of many interacting agents fails. It is a macroscopic property which emerges from the nonlinear interactions of agents. Using the concept of complex networks, agents are represented by nodes in a network, whereas their interactions are modeled by links between them. Both nodes and links can follow their own dynamics and there is a feedback between these.

Starting with some empirical insights in large economic networks, such as financial networks and networks of ownership and control, the talk discusses two main ingredients for systemic risk in such networks: (a) topology, and (b) agent heterogeneity. We highlight the importance of agent's position in the network, the number of neighbors (degree distribution), and cycles (closed loops of directed links) between agents, to increase systemic risk. On the other hand, we demonstrate that agent's heterogeneity, i.e. differences in their failing threshold and their fragility, may decrease systemic risk.

[1] Lorenz, Jan, Battiston, Stefano, Schweitzer, Frank: Systemic Risk in a Unifying Framework for Cascading Processes on Networks, European Physical Journal B vol. 71, no. 4 (2009), pp. 441-460.

Equilibrium models of competitive firms
Mishael Milakovic

Network analysis of financial networks

Giulia Rotundo

Department of Economics and Business,
University of Tuscia, Italy

Abstract. The talk is going to offer a view on risk of financial networks through methods proper of complex networks and operational research. The main targets are

1. the understanding of paths of ownership and control;

2. the analysis of level of market concentration;

3. the overlap among funds and

4. active versus passive management of funds.

Case studies are considered.

[1] D'Arcangelis, A. M., Rotundo, G.: 'Mutual funds relationship and risk analysis', BIR research workshop, submitted.

[2] Rotundo, G.: Centrality Measures in Shareholding Networks. In: Ekrem Duman, Amir Atiya (eds.) Use of Risk Analysis in Computer-Aided Persuasion, NATO Science for Peace and Security Series - E: Human and Societal Dynamics, Vol. 88, pp. 12 - 28 (2011).

[3] Rotundo, G., D'Arcangelis, A. M.: Ownership and control in shareholding networks, Journal of Economic Interaction and Coordination, Vol. 5, Issue 2, pp. 191-219 (2010).

[4] Rotundo, G., D'Arcangelis, A. M.: Network analysis of ownership and control structure in the Italian Stock market. Advances and Applications in Statistical Sciences Vol. 2, Issue 2, pp. 255-273 (2010)

Agent-based Versus Macroscopic Modeling of Competition and Business Processes in Economics and Finance

Vygintas Gontis, Aleksejus Kononovicius, Bronislovas Kaulakys

Institute of Theoretical Physics and Astronomy,
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Abstract. We will present examples of agent-based and stochastic models of competition and business processes in economics and finance. We start from as simple as possible models, which have microscopic, agent-based, versions and macroscopic treatment in behavior. Microscopic and macroscopic versions of herding model proposed by Kirman and Bass diffusion of new products are considered in this contribution as two basic ideas. Bass Diffusion model is of great interest for us as representing very practical and widely accepted area of business modeling. Nevertheless, we will focus more on the universal nature of herding behavior leading to the macroscopic description by nonlinear stochastic differential equations applicable to the finance and other complex systems.

Research Policy Laboratories: Agent-Based Modelling for Ex-Ante Evaluation for Complex Policy Instruments

Michel Schilperoord

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University College Dublin, Ireland.

Abstract. Policy design and evaluation methods for funding R&D networks are challenged by the imponderability of research and innovation, which are characterised by true uncertainty and are exposed to risks and failures. However, recent studies of network architectures and their dynamics indicate that the success of innovation networks is related to specific network structures as well as mechanisms of network evolution. From this it follows that there is scope for the improvement of the policy instruments used to create and to support research and innovation networks. In 2010 the EU DG-INFSO Evaluation Unit has commissioned a Tender study using agent-based modelling to address the structuring effects of FP ICT R&D networks. Our model provides extrapolations and scenarios for the potential future development paths of these networks. The model we use is empirically calibrated and validated using FP7 ICT network data of DG INFSO. With our simulation tool, a major obstacle of recent research and innovation network evaluation approaches can be avoided, namely the strong time dependence, which stems from the need to await the outcomes of the networks with the consequence of an only ex-post adaptation of policy designs. With our simulation tool, instead, evaluation of the performance of network evolution becomes a governance-like process, which tries to exclude developments during the very evolution of the networks that are evolutionarily inefficient, i.e. those that create network-based environments that do not support ongoing innovation and learning. Of course, the epistemological caveat caused by the true uncertainty of research innovation remains. However, with this tool ex-ante evaluation will rely on evidence-based data and theoretical frameworks about causal mechanisms and processes.

Integration of Decision Modelling and Agent-Based Modelling

Pablo Lucas, Diane Payne

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University College Dublin, Ireland.

Abstract. Collective decision-making scenarios involving a network of public and / or private organisational agents present a range of complex modelling challenges. Different decision modelling approaches have been successful in generating accurate predictions of actual collective decision-making regarding policy issues. These include both final outcomes and individual position of agents that describe their willingness to exchange with others, maximise group control or individual policy interests. However it is necessary to improve the underlying assumptions to describe behaviour in collective decision-making processes. To date this has not been systematically tested due to the difficulties imposed by the particularly time-consuming nature of collecting context-specific data for both decision and network analyses. Our contribution is therefore the integration of decision-modelling techniques into an agent-based modelling (ABM) framework for testing simulated scenarios involving a range of different agents and networks. In doing so, one can configure the ABM to analyse both actual decision-making scenarios and other plausible variations, such as the potential effect of group size or network structure in the decision-making process. In turn this same ABM can be applied to actual case studies for analysing complex policy and group dynamics.

A network approach for the scientific collaboration in the European Framework Programs

Panos Argyrakis

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University of Thessaloniki, Greece

The stick versus the carrot in countering terrorism in public opinion

Sascha Delitzscher and Serge Galam

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École Polytechnique, France.

Abstract. Passive counter-terrorist measures distinguish between 'stick' and 'carrot' strategies. Using a random walker model to describe the impact of these strategies on certain observables connected to terrorism, we investigate the influence of stick and carrot on public opinion, their success in reducing terrorism and their consequences to further strategic approaches.

The Lagrange principle in physical economics

Juergen Mimkes

Department of Physics, Paderborn University, Germany.

Abstract. *In mathematics*, the Lagrange principle is a very general approach to mini-max problems. If a function $F(x, y)$ has to be minimized under the maximum of a function $F(x, y) =$ const., a Lagrange function $L(x, y) = K(x, y) - \lambda F(x, y) =$ minimum may be constructed, λ is the Lagrange multiplier. At minimum or equilibrium the derivative of the function L with respect to x and y will be zero. This will lead to the solution of the minimal problem.

In standard economics, costs (K) have to be minimized under constraints of maximal utility U. The general function U is unknown, but in standard economics the Cobb Douglas function $F(K, N) = AK^{\alpha}N^{1-\alpha}$ is generally applied. But there is no rule, that this function must be used.

In physical economics, the Lagrange function $L(x, y)$ corresponds to free energy, $L(x, y) = K(x, y) - \lambda S(x, y) =$ minimum. The utility function U of physical economics is defined by the entropy function S of the specific economic system.

Example: The different Lagrange functions in standard economics and physical economics will be applied to budget restrictions of a pub with N_1 permanent and N_2 temporary employees.

The Competitiveness of the English Football Leagues

Sudhir Jain, M Purewall

Mathematics, Aston University, Birmingham, UK.

Abstract. We analyse historical results from the four English football leagues since the inception of the premier league in 1992. By considering the parity amongst teams and the predictability of games, we are able to differentiate between the competitiveness of the various leagues. Our results would appear to indicate that the premier league is the least competitive.

Towards an Analytical, Predictive Science of History

Peter Turchin

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Department of Mathematics,
University of Connecticut

POSTER

Quality of life indicators from illusive concepts to tangibles resources

Tania-Georgia Viciu[1], Carmen-Eugenia Costea[2], Adrian Vasile[1]

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[2]Bucharest University of Economic Studies, Faculty of Commerce, Dept. of BCSMQ, Romania

Abstract. Quality of life represents an interdisciplinary topic that was developed in order to understand the social and economic problems both at national and individual level. The paper advocates the importance of the inclusion of population measures in the estimations of the quality of life indicators, rather than simply developing an indicator based on economic indices. Recent studies stress the importance of these indicators and their rising influence on developing and implementing public policies. David Cameron's speech given in 2006 at "Google Zeitgeist Europe Conference" illustrates the political approach toward quality of life concepts. Cameron, then member of the British opposition party, states that "improving our society's sense of well-being is, [...], the central political challenge of our times". Therefore, quality of life studies represent a topic of interest that can play an active role in public policies. Recent studies portray these indices as tangible, rather than illusive concepts, which can be used as a proxy for implementing such policies. The article presents the relationship between public policies and quality of life indicators in Romania by using a dualist approach to the analysis conducted. Moreover, a list of both subjective and objective quality of life indicators is proposed in order to analyze multidimensional phenomenon such as human development and economic growth. The indicators used vary from life expectancy at birth, female labor force to GDP per capita.

Key words: quality of life indicators, human development, economic growth, public policies
JEL classification: A13, O38, Z13

[1] Bérenger, V., Verdier-Chouchane, A. (2007) Multidimensional measures of well-being: standard of living and quality of life across countries, World Development, Vol. 35, No.7

[2] Cummins, R., Eckersley, R., Pallant, J., Van Vugt, J., Misajon, R. (2003) Developing a national index of subjective wellbeing: The Australian unity wellbeing index, Social Indicators Research, Vol. 64

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Statistical analysis of stress-fluctuations in the bubble model of 2d foams

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Abstract. Complex behaviour of a system of interacting units (particles, agents) is often due to the nonlinear interactions between these units at the local level. Here we present a study of global stress fluctuations in a dense packing of interacting soft disks under shear. This so-called bubble model, first developed by Durian [1] and later refined by Langlois et al [2], captures many of the characteristics of two-dimensional liquid foams. In particular, it has been shown to reproduce the empirical Herschel-Bulkley relationship for the variation of average value of the stress in the flow regime with strain rate, for flowing foam [3]. In this study we look at the fluctuations of stress about the mean. Probability distribution functions of stress changes show fat tails for stress drops, while computation of the Hurst exponent shows long-term memory for decreasing trends but not for increasing trends. We use a rescaling method used in the econophysics community [4] to analyse so-called microtrends in the data, and apply this to the analysis of contact changes of the bubbles as stress is built up and released.

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Can Network Theory inform Consumer-Brand Relationships?

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Abstract. Social networking sites (SNSs) such as Facebook and Twitter have become integrated into consumers' lives more than anyone could have ever predicted (Boyd and Ellison, 2007). This poster presents a study of consumer-brand relationships (CBRs) on such SNSs. CBRs are multi-dimensional constructs encompassing trust, love, acceptance and commitment (Fournier, 1998). Extant research has investigated offline CBRs: such studies seek to define what they are and why they exist, their outcomes, their measurement, how they are strengthened and how they can be damaged. Our study is unique as it draws on network theory to better understand the nature of consumer-brand relationships. We postulate the consumer-brand relationship as a 'triadic' phenomenon (Kozinets, 2010; Hoffman and Fodor, 2010). The triadic view places importance on consumer-consumer interactions, and considers the outcomes of such interactions on CBRs. We investigate the extent to which consumer-consumer interactions can, on occasion, create or destroy the brand, where the context of the study is the online social network, and the unit of analysis is the network interaction. We question whether consumers' positions on a network (their centrality, social tie strength or homophily, for example) influence their interactions with brands and other consumers on SNSs, and we explore the resulting effects on CBR outcomes. A two-step iterative methodology is proposed, combining quantitative network analysis (Borgatti, 2007; Scott and Carrington, 2011) with an emergent qualitative methodology known as Netnography (Kozinets, 2010).

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Bursting dynamics of the high-frequency empirical return and non-linear stochastic model

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Contents-Based cooperation and emotion flow in online chats

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