Program

August 3, Thursday

8:30 – 9:00 Registration

9:00 – 9:05 Imre Kondor
(Collegium Budapest, Institute of Advanced Study, HU)
Welcome Address by the Rector of the Collegiums Budapest

9:05 – 9:10 Sorin Solomon
(Racah Institute of Physics, The Hebrew University of Jerusalem, IL, and ISI Torino, I)
Welcome Address for the EU Coordination Action GIACS

9:10 – 9:30 Dirk Helbing
(Dresden University of Technology, Inst. for Transport and Economics, D)
Introduction to the Workshop

9:30 – 10:00 Self-Introduction of the Keynote Speakers and Their Fields

10:00 – 10:45 Bernardo A. Huberman
(Hewlett Packard, USA)
Harvesting Organizational Knowledge

10:45 – 11:05 Coffee Break

11:05 – 11:50 Stefan Bornholdt
(University of Bremen, Inst. for Theoretical Physics, D)
Physics of Networks: Tools for a Complex World

11:50 – 12:35 Jean-Louis Deneubourg
(University of Brussels, B)
Learning from Social Insects and Applications of Ants Algorithms

12:35 – 13:45 Lunch

13:45 – 14:30 Neil F. Johnson
(University of Oxford, UK)
The Making and Breaking of Partnerships based on Money, Power, Love and War

14:30 – 15:15 Dick Sanders
(SCA Packaging, B)
Why Complexity Science Is So Important To Business Today And Why It Is So Difficult To Get This Message Across

15:15 – 15:35 Coffee Break

15:35 – 16:20 Kai Nagel
(Berlin University of Technology, D)
Societies as Complex Systems: How to Organize them Better

16:20 – 17:05 Oliver Rose
(Dresden University of Technology, Inst. for Applied Computer Science)
Simple Models and Grand Challenges in Modeling and Simulation of Complex Manufacturing Systems

17:05 – 19:05 Poster Session
The Keynote Speakers Form the Committee to Determine the 3 Best Posters

19:15 – 22:00 Social Dinner

August 4, Friday

9:00 – 9:45 Albert-László Barabási: (Notre Dame, USA)
Complex Networks, and Applications

9:45 – 10:30 Karl Kempf: (INTEL, USA)
Complexity and Evolution in Semiconductor Supply Chains

10:30 – 10:50 Coffee Break

10:50 – 11:35 Vince Darley: (Eurobios, UK)
From Theory to Practice: Obstacles and Solutions to the Application of Complexity Science to Business Problems

11:35 – 12:20 Armando Bazzani: (Bologna, I)
A Complex Systems Approach to Urban Mobility Governance

12:20 – 13:30 Lunch

13:30 – 14:15 Eric Bonabeau: (Icosystems, USA)
Business Life is a miracle

14:15 – 14:45 Gabor Vattay (Eötvös Loránd University, Budapest, Hungary)
Measuring the spatial structure of traffic congestion in the Internet

14:45 – 15:15 Guy Theraulaz (CNRS, Centre de Recherches sur la Cognition Animale, UPS, F)
How group size influences the organization of work in social insects and human communities

15:15 – 15:35 Coffee Break

15:35 – 16:20 Peter Hofmann: (DaimlerChrysler CC, TU DD, D)
Complexity Management in Technological Systems

16:20 – 17:05 3 Selected Poster Contributors

Presentations of 3 Best Posters (15 minutes each)
The Keynote Speakers Determine the Winner of the Best Poster Award

17:05 – 17:25 Break

17:30 – 18:15 Dario Floreano
(Swiss Federal Institute of Technology Lausanne, CH)
Swarms of Autonomous Robots: Design, Control, and Experimentation

August 5, Saturday

9:00 – 10:40 Contributed Talks (20 minutes each)

Maciej A. Nowak
(M. Kac Center for Complex Systems Res., Jagiellonian Uni., Cracow, PL)
Free Random Variables - Matrix-Valued Probability Theory for Complex Systems

Karsten Peters
(TU Dresden, Institute for Transport & Economics, D)
Logistic Networks - Coping with Nonlinearity and Complexity

Markus Christen
(ETH Zürich, CH)
From Small World to Hierarchic Business Information Networks by Reorganizations - A Real World Study of a Failure

Jens Christian Claussen
(University of Kiel, D)
Fluctuations and Finite-Size Effects in Co-Evolutionary Dynamics: Unifying Approaches from Evolutionary Game Theory Lay Further Grounds for Quantitative Modelling of Multi-Agent Systems

Bertrand de la Chapelle
(French Ministry of Foreign Affairs, F)
The Emergence of the Notion of Multi-Stakeholder Internet Governance During the WSIS Process

10:40 – 11:10 Coffee Break

11:10 – 12:50 Contributed Talks (20 minutes each)

Janusz Holyst
(Warsaw University of Technology, Dept. of Physics, PL)
Ferromagnetic Fluid as a Model of Social Impact

Markus Kirkilionis
(University of Warwick, Mathematics Institute, UK)
Modularity in Dynamical Networks

Konstantin Klemm
(Leipzig University, Bioinformatics, D)
The Structure of Directory Trees

Alexander Zumdieck
(Institut Curie, Paris, F)
Self-organization in Substructures of the Cytoskeleton

Carsten Murawski
(University of Zurich, Swiss Banking Institute, CH)
Systemic Risk in Financial Markets - A Network Approach

12:50 – 14:00 Lunch

14:00 – 15:40 Contributed Talks (20 minutes each)

Hani Mahmassani
(Transportation Initiative, University of Maryland, USA)
Repeated auction games and learning dynamics in electronic logistics marketplaces: regulation through information

Stefano Battiston
(ETH Zurich, CH)
Avalanches and Self-Organized Robustness in Evolving Networks

Volker Barth
(University of Oldenburg, D)
A Model of Opinion Dynamics Among Firms
Juan Guillermo Diaz Ochoa
(Institute for Theoretical Physics, Bremen University, D)
Fairness State with Plastic Preferences

15:40 – 16:00 Coffee Break

16:00 – 16:10 Best Poster Award Ceremony (3,000 EUR)

16:10 – 17:50 Contributed talks (20 minutes each)

Atsushi Tero
(Hokkaido University,Creative Research Initiative, Sapporo, J)
Solving the shortest path problem by Physarum solver - Modeling of the Adaptive Network of True Slime Mold

Sudhir Jain
(Aston University, Birmingham, UK)
Persistence in an Ising Model of Socio-Economic Dynamics in High Dimensions

Edgardo Jovero
(Universidad Computense de Madrid, E)
A Chaotic Dynamic View of Investment Risk in Emerging Economies

Meredith Rolfe
(Nuffield College, Oxford, UK)
Encouraging Voter Turnout: Diffusion in Practice

Laszlo Gulyas
(AITIA Int. Inc./ Eötvös Loránd University , Budapest, Hungary)
Robust Networks From Local Optimization: A Bottom-Up Model To Generate Networks With Skewed Degree Distributions

Poster Contributions

1. Elena Ramirez Barrios
   (University of Kiel, Institute for Economics, D)
   Fairness State with Plastic Preferences

2. Zoltán Eisler
   (BUTE, H)
   Size Matters: Parametric Non-Universality in Stock Market Data

3. Jana Hudakova and Ondrej Hudak
   (Mathematical-Economical Consultancy, Kosice, SK)
   Social Behaviour of Agents: NPV and Markets

4. Limor Issacharoff
   (ENEA, CR Casaccia, CAMO Unit, Roma, I)
   Vulnerability of Technological Complex Networks

5. Pablo Kaluza
   (Fritz-Haber-Institut, Berlin, D)
   Design and Statistical Properties of Robust Functional Networks

6. Mikhail Krivoruchenko
   (Institute for Theoretical and Experimental Physics, Moscow, RUS)
   Best Linear Forecast of Volatility in Financial Time Series

7. Stefan Lämmer
   (Dresden University of Technology, D)
   Scaling Laws in the Spatial Structure of Urban Road Networks

8. Jan Lorenz
   (University of Bremen, D)
   Fostering Consensus in Continuous Opinion Dynamics under Bounded Confidence

9. Ágnes Lublóy
   (Corvinus University of Budapest, H)
   Topology of the Hungarian Payment System and its Systemic Risk Implications

10. Zoran Mihailovic
    (Institute of Nuclear Sciences Vinca, Belgrade, SER)
    Network Structure of Television

11. Alex K.S Ng
    (University of Oxford, Dept. of Engineering Science, UK)
    Towards a Formal Specification of Network Robustness: A Case Study of Metro Network

12. Paul Ormerod
    (Volterra Consulting, London, UK)
    Patterns of Cascade and Failures in Evolving Networks

13. Christoph Räth
    (Max-Planck Institute for Extraterrestrial Physics, Garching, D)
    Assessing Stock Market Models by Means of Phase Correlations

14. Martin Schönhof
    (Dresden University of Technology, D)
    Propagation of Traffic-Related Information on Freeways via Inter-Vehicle Communication

15. Julian Sienkiewicz
    (Warsaw University of Technology, Dept. of Physics, PL)
    Discrete Effects on Average Path Length Scaling in Complex Networks

16. Joana Simoes
    (Centre for Advanced Spatial Analysis, University College London, UK)
    Modelling a Mumps Outbreak Through Spatially Explicit Agents

17. Bence Tóth
    (BUTE, H and ISI Torino, I)
    Agend-Based Simulation of a Double-Auction Market with Heterogeneously Informed Agents

18. Germán Vargas
    (Universidad de los Andes, CO)
    Evolutionary Effectiveness Dynamics of Enterprise Innovation

19. Lukasz Jochemczyk
    (Warsaw University, Dept. of Psychology, PL)
    The crucial role of time that is wasted. The illusion of objectivity in negotiation

Abstracts

Bernardo A. Huberman[1]:

Harvesting Organizational Knowledge

[1] Hewlett Packard, USA

A key differentiator of successful organizations is their ability to extract, analyze and aggregate information quickly. This talk will present mechanisms for the identification of communities of practice and how information spreads within them. Furthermore I will describe a methodology for predicting the future of uncertain events that uses small groups of people participating in an information market.

Laboratory experiments show that this method vastly outperforms both the imperfect market and the best predictions of individuals.

Neil F. Johnson[1]:

The Making and Breaking of Partnerships based on Money, Power, Love and War

[1] University of Oxford, UK

We spend an enormous amount of time and effort in our lives forming and maintaining relationships of all sorts. In addition to our personal lives, the formation of commercial and political relationships is fundamental to our Society. For example, as consumers we are all individually in customer-client relationships with particular gas, electricity and phone companies; our employers are typically involved in business partnerships with other companies and our countries are involved in ever-changing political, strategic and commercial alliances (e.g. the EU and NATO). And, as they say, even birds and bees do it.

Indeed, Nature is awash with various types of mating and grouping rituals. But as people, companies, institutions and even countries become more 'sophisticated' or just downright picky in their requirements for a potential partner, does this mean that the world is going to be driven to a state where reliable long-term working partnerships do not form? A particular example of this concerns people's commercial allegiances to particular products, brands, companies or loyalty schemes such as airline frequent flyer programs. There are several obvious reasons why finding the right partner is so complicated: First, that partner must actually exist somewhere. Sec-

ond, you have to establish contact with this perfect partner. The fact that the right partner might be just out of reach of your existing network of contacts, is a particularly unfortunate but typical event. Third, even if you find your perfect match, you may not be the perfect match for them. A wants B who wants C who wants D who wants A. Fourth, and most importantly, you are not the only one looking. Since you and everyone else is simultaneously looking for that special relationship, we are each part of a collection of decision-making objects competing for a limited resource, which in this case is the perfect partner.

This talk examines this Complexity in how partnerships form and break up, and how their duration and stability is affected by the attributes of the constituent objects. In addition to numerical simulations and analytic analysis of suitable models, the talk will examine real-world data.

Dick Sanders[1]:

Why Complexity Science Is So Important To Business Today And Why It Is So Difficult To Get This Message Across

[1] SCA Packaging, Belgium

Markets are presently more dynamic than ever, causing tremendous difficulties to businesses, especially those that are traditionally managed and that have a successful history. The old adage "never change a winning team" seems still to be the going philosophy, even though the "winning team" is not winning anymore. On the other hand Complexity Science has developed in the last twenty-five years many insights into how a company can cope with the conditions of today and most certainly of tomorrow as well. There is however significant resistance to learning about and adopting the tenets of Complexity Science. It is felt that companies that do not embrace the results of this research will find it very difficult to survive. Companies will have to learn how to balance homeostatic and evolutionary forces, distribute control (even though "control" today is only perceived control), organize from the bottom-up and allow employees to rally around issues and solve them themselves without appealing to a central source. To achieve all of this the Complexity Science community will have to exert an extra effort to reach those in charge of businesses today.

Oliver Rose[1]:

Benefits and drawbacks of simple models for complex production systems

[1] Dresden University of Technology, Institute of Applied Computer Science, Germany

Semiconductor wafer fabrication facilities are among the most complex production facilities. A large product variety, hundreds of processing steps per product, hundreds of machines of different types, and automated transport lead to a system complexity which is hard to understand and hard to handle. For teaching planners and developing adequate material flow control mechanisms, simple models for this complex environment are required. We outline two simplifying approaches, one for fostering the understanding of the factory and one for the development of a control rule for a complex type of machines. In the first example we show how a simple model can be used to predict the factory behavior after a bottleneck work center breakdown.

In the second example, we discuss an approach how a few simple characteristics of a cluster tool can be used to run a fast sequencing algorithm for this tool type. In both cases, we present the practical benefits and the drawbacks of very simple modeling approaches.

Karl Kempf[1]:

Complexity and Evolution in Semiconductor Supply Chains

[1] INTEL, USA

Over the years at Intel Corporation, we have used complexity science to study our individual manufacturing systems (production lines and factories) and then our entire manufacturing system (the network of factories forming our "internal" supply chain). More recently we have expanded our studies again to include a) Intel as a buyer of goods and services that support the internal supply chain, b) Intel as a seller of the goods that emanate from the internal supply chain, and Intel as an innovator in terms of product development, manufacturing process development, and manufacturing capability development that fuel our business engine. At this stage in our investigation, we will be able to describe the complexity in the relationships, but only provide some early indications of solution approaches and potential impact.

Vince Darley[1]:

From Theory to Practice: Obstacles and Solutions to the Application of Complexity Science to Business Problems

[1] Eurobios, UK

Covering some 10 years of practical solutions to business problems driven by complexity science techniques, we will run through a number of scientifically interesting case studies, mostly taken from successful projects at Eurobios. Ranging from airlines to factories to postmen, many lessons can be drawn on why such techniques worked, and what new developments were required to make those techniques work.

These cases neatly illustrate an unfortunate gap between much academic work in these areas and the understanding required to analyse and deal with business applications. Crossing that gap is an exciting, scientific challenge for the field of complexity science.

Armando Bazzani[1]:

A Complex Systems Approach to Urban Mobility Governance

[1] University of Bologna, Italy

The City is a paradigm of a complex system. It has been realized that reductionist global models are not suitable to describe the urban dynamics whose complex nature implies the presence of emergent properties due to physical interactions and the free willing of citizens in the urban space. The governance of the modern metropolis is one of the main problems due to the obvious relation with the quality of life. In particular the urban mobility is a fundamental aspect for the governance and its modeling requires a multidisciplinary approach. We propose a microdynamical model for urban mobility that takes into account the tendencies and the "intelligent behaviour" of citizens. The model has the possibility of choosing among different kinds of mobility (pedestrian, public transportation, private cars). The interaction with the urban space is performed by introducing the concept of "chronotopos":i.e. a macroscopic urban area with time scheduled activities that causes the citizens mobility requests. The aim of the model is to create a virtual laboratory where the "new physical laws" of urban mobility can be studied taking advantage of the complex systems theory.

Eric Bonabeau[1]:

Business life is a miracle

[1] Icosystems, USA

Decisions, large and small, made by businesses every day suffer from so many flaws and biases that one may wonder how businesses survive at all. After exposing the weaknesses of human decision-making, I will explore how complexity science can help managers make better decisions by improving their abilities to consider a broader range of options and to better evaluate each one of those options.

Guy Theraulaz[1]:

How group size influences the organization of work in social insects and human communities

[1] CNRS-Centre de Recherches sur la Cognition Animale, France

In animal and human societies, complex designs can emerge from distributed collective processes. In such cases, the agents involved whether they are social insects or humans have limited knowledge of the global pattern they are developing. Of course, insects and humans differ significantly in what the individual agent can know about the overall design goals. A social insect, for example, hasn't a clue about what it s contributing to the collective structure and function. In contrast, most software engineers working as part of a team understand their projects purpose and overall goal. Nonetheless, as project complexity increases, individual developers real knowledge of the overall project rapidly shrinks; decisions become both localized and constrained by other project developments. The resulting constraints largely canalize choices, ultimately limiting the possible system-level construction rules at least on some scales. By viewing the complex dynamics of software development communities as a network of interacting agents involving both goals and constraints, we can compare them to other social networks and so build up evidence for basic principles of self-organization. Understanding these

principles offers a first step toward quantitative reference models to explain human behavior during open source software (OSS) development. Once we have such a reference model, we'll be able to better manage the software process because we'll be able to clearly and quantitatively understand which deviations are important and which are not. Such an understanding can benefit both software practitioners and information society in general. Existing OSS knowledge, which is based on a few qualitative studies offers no general lessons. We conducted a comparative study of how social organization takes place in a wasp colony and OSS developer communities. Both these systems display similar global organization patterns, such as hierarchies and clear labor divisions. As our analysis shows, both systems also define interacting agent networks with similar common features that reflect limited information sharing among agents. As far as we know, this is the first research study analyzing the patterns and functional significance of these systems weighted-interaction networks. By illuminating the extent to which self-organization is responsible for patterns such as hierarchical structure, we can gain insight into the origins of organization in OSS communities.

Dario Floreano[1] and Laurent Keller[2]:

Swarms of Autonomous Robots: Design, Control, and Experimentation

[1] Swiss Federal Institute of Technology Lausanne - EPFL, Switzerland
[2] University of Lausanne – UNIL, Switzerland

We investigate the evolutionary conditions that may have favored the emergence of cooperation and communication by means of synthetic evolution with mobile robots.
We evolve colonies of robots by varying the amount of genetic relatedness (homogeneous vs. heterogeneous) and the level of selection (individual vs. colony).
The results provide not only answers to open questions in biology, but also guidelines for evolving robust, reproducible, and reliably colonies of cooperating agents in software and hardware. In a first set of experiments we study colonies of sugar-cube robots engaged in a foraging task where cooperation brings an advantage to the colony at the expenses of the individuals that decide to cooperate. In a second set of experiments we study colonies of ant-inspired robots exposed to food and danger sources whose appearances change too fast to be captured by evolution. Here, communication of the source type brings an advantage to the colony at the expense of the individuals that decide to tell which is the food source. Results indicate that genetically related individuals evolved under colony level selection are more likely to display cooperative and communicative behav-

iors. Furthermore colonies of those individuals display higher performance and thus have a competitive advantage over other types of colonies.

The talk will also emphasize hardware principles and challenges involved in the design of robots for collective evolution without human intervention as well as potential applications.

Maciej A. Nowak[1]:

Free Random Variables – matrix - valued probability theory for complex systems

[1] M. Kac Center for Complex Systems Res., Jagiellonian Uni., Cracow, Poland

Free Random Variables can be viewed as a matrix-valued realization of the classical probability theory, where the role of the random variables is played by large random matrix. Recently it was proven, that this approach exhibits surprising analogies to classical probability theory, including central limit theorems, power-like stability and statistics of extreme events.

Several applications of this technique appeared recently in wireless telecommunication, economy and multivariate statistics of very large sets off data. After explaining basic features, borrowing on analogy to known concept of probability, I speculate on further possible applications, including dynamical, matrix valued random processes and various ways of revealing pertinent correlations from noisy systems.

Markus Christen[1]:

From small world to hierarchic business information networks by reorganizations - a real world study of a failure

[1] ETH Zurich Institute of Neuroinformatics, Switzerland

Business units in large enterprizes are frequently objects of reorganizations. These change the social network of the unit, expressed by the flow of information between the employees that is necessary for performing business processes. Reorganizations usually intend to increase the efficiency of the unit, measured in terms of the speed of business processes performed by the unit. We take a real-world example and investigate the change of the information-flow induced by a reorganization that transformed a small-world type into a hierarchical type network. We show that the robustness, determined in terms of how the business processes are affected by an outage of nodes in the information-flow, is a critical parameter that tends to counteract the intended gain in efficiency. The example demonstrates that reorganizations should not only focus efficiency in terms of classical business studies, but should include an analysis of the robustness of the information-flow network within a business unit as well. Otherwise, theoretically expected gain in efficiency may not be achievable in practice.

Jens Christian Claussen[1]:

Fluctuations and Finite-Size Effects in Co-Evolutionary Dynamics: Unifying Approaches from Evolutionary Game Theory Lay Further Grounds for Quantitative Modelling of Multi-Agent Systems

[1] University of Kiel, Theoretical Physics, Germany

Companies and customers as well as competing species in biologies are widely modeled by multi-agent systems, both investigated in simulations and in analytical models. While simulations can account for more details, their number of parameters and modeling degrees of freedom constitute a high complexity of the model, frequently exceeding the limits of a quantitative comparison to data. Analytical approaches therefore are necessary to connect different levels of coarse-graining, to understand counterintuitive collective effects, and to provide analytical insight for parts of the system, which then allows to combine computational models for one system level with analytical approximations for another system level. One particular issue in this context is the proper description of noise, both of external (due to uncorrelated influences, in a physical picture comparable to a heatbath) and of internal noise (stemming from the stochastic dynamics in a finite system). In the context of evolutionary game theory, which accounts for strategic and conflict situations in biological as well as in social and economic dynamics, co-

evolutionary dynamics traditionally is described by deterministic replicator dynamics assuming implicitly infinite population sizes. The explicit stochastic dynamics in finite populations however is more difficult to tackle but currently gains more attention.

Recently we have noted that even simple co-evolutionary dynamics of 2x2 games in finite populations can lead to unexpected stationary distributions of strategies significantly deviating from the Gaussian. However, the relationship between deterministic and stochastic approaches remained unclear. In, we address this problem by explicitely considering the limit of infinite populations. In particular, we identify different microscopic stochastic processes that lead to the standard or the adjusted replicator dynamics. Moreover, differences on the individual level can lead to qualitatively different dynamics in asymmetric conflicts and, depending on the population size, can even invert the direction of the evolutionary process. In this framework, the finite-size dependent stochasticity co-evolutionary mean-field dynamics can be described conveniently, which is relevant for all systems with a limited number of active agents. Future projects will address more complicated agent dynamics, the dynamics on networks and spatially structured populations, and the connection to market-based and social systems for which data is accessible.

Janusz Holyst[1]:

Ferromagnetic fluid as a model of social impact

[1] Warsaw University of Technology, Department of Physics, Poland

The paper proposes a new model of spin dynamics, which can be treated as a model of sociological coupling between individuals. Our approach takes into account two different human features: gregariousness and individuality. We will show how they affect a psychological distance between individuals and how the distance changes the opinion formation in a social group. Apart from its sociological applications the model displays the variety of other interesting phenomena like self-organizing ferromagnetic state or a second order phase transition and can be studied from different points of view, e.g. as a model of ferromagnetic fluid, complex evolving network or multiplicative random process.

Markus Kirkilionis[1]:

Modularity in Dynamical Networks

[1] University of Warwick, Mathematics Institute, UK

Many applications in economy and the social sciences have an underlying network structure that (a) varies in time by constantly creating new links and nodes, and (b) has a dynamical process defined on the nodes or links in addition. Typical examples are social networks where nodes are persons or companies, links are denoting 'friendship' or business relations. Persons and companies will usually in any context have a varying state space, modelling for example its wealth or current business volume. To define changes in the state space dynamical systems governing the node or link state spaces (weights in a graph theory context) have to be considered. The result is an interesting but very challenging mathematical structure of such a complex system. We will introduce the concepts and show that for simple dynamical systems modularity concepts can be introduced which help to analyse the network behaviour considerably. If time allows we make a connection to some game theoretic concepts.

Konstantin Klemm[1]:

The structure of directory trees

[1] University of Leipzig, Bioinformatics, Germany

We describe the topological structure and the underlying organization principles of the directories created by users of a computer cluster when storing his/her own files. For each of the 63 observed users, the branching ratio (number of directories with the same parent) exhibits a broad, typically scale-free distribution with a non-universal exponent. Thus users can be distinguished by the degree exponent of the scale-free trees they create. The size distribution of the branches (subtrees below the root) decays algebraically with a universal exponent -2. These scaling properties and further observations are captured by a model of incremental tree growth.
The single parameter of the model interpolates between agglomeration into star-like structures and fully random attachment that leads to deep hierarchies. The alignment between model and empirical trees reveals the universal features of trees created independently and unrestrictedly by different users. Individual differences of tree construction boil down to a single real-valued parameter that is extracted by the alignment.

Alexander Zumdieck[1]:

Self-organization in substructures of the cytoskeleton

[1] Institut Curie, Paris, France

The cytoskeleton is a complex network of protein filaments. It is essential for many active cellular processes like cell division or cell locomotion and determines the mechanical properties of eukaryotic cells. In cancer cells e.g. the cytoskeleton is altered so that cells are softer. A better understanding of processes that drive cytoskeletal dynamics is thus likely to be relevant also outside the field of biological physics. These processes include the Interaction of filaments with other proteins such as molecular motors as well as the polymerization and depolymerization of filaments. Important substructures are stress fibers, the contractile ring, and mitotic spindles.

We present physical descriptions of the cytoskeleton to uncover how the collective action of molecular motors, protein filaments and regulating factors can drive cellular processes. Focusing in particular on the effect of filament polymerization and depolymerization we investigate stress generation in contractile bundles and the dynamics and mechanics of contractile acting rings, important cytoskeletal structures, which constrict cells during cell division. Quantitative comparison of experimental data together with a phenomenological description of ring contraction allows us to estimate the essential parameters characterizing mechanics and dynamics of a contracting

ring. Using a more microscopic description of filament interactions in the ring, we identify physical mechanisms of ring contraction driven by motors and filament turnover. In particular we discuss how filament bundles may generate tension in the absence of molecular motors.

Carsten Murawski[1]:

Systemic Risk in Financial Markets - A Network Approach

[1] University of Zurich, Swiss Banking Institute, Switzerland

Financial institutions are connected with each other through a multitude of financial contracts. These contracts create a complex network of assets and liabilities, and expose financial institutions to default risk. The default of a financial institution might propagate through the network and thus poses a threat to the stability of the financial system. We characterize measures for default and systemic risk in terms of network properties, and analyze how various mechanisms employed by financial markets to mitigate the losses from default affect these risks.

Stefano Battiston[1]:

Avalanches and Self-Organized Robustness in Evolving Networks

[1] ETH Zurich, Switzerland

We consider a model of an evolving directed and weighted network embedded in space, inspired by recently investigated models of production networks. In contrast to Self-Organized Criticality models, local connections lead to a self-organization of the network into a robust state in which avalanches have a characteristic scale. We then assess whether long range connections are sufficient to induce the transition to a regime of scale free avalanches, or if instead the presence of a global feedback mechanism is necessary for this transition. The results of this work are relevant to the understanding of the efficacy of monetary policies in the global economy.

Volker Barth[1]:

A Model of Opinion Dynamics among Firms

[1] University of Oldenburg, Germany

How do firms respond to issues that are not native to them, like environmental or moral standards? How does a certain attitude towards such issues spread? We study these questions in a multi-agent model of opinion dynamics in a population of firms. A firm's attitude is mostly driven by the opinion of its boss, which in turn is adjusted in reaction to the opinion of other bosses as well as the performance of the other bosses companies.
The model allows the analysis of observed differences between economic sectors by examination of the role of networks of firms, differences in authority of certain bosses, and firm size effects.

Juan Guillermo Diaz Ochoa[1] and
Elena Ramirez Barrios[2]:

Fairness state with plastic preferences

[1] University of Bremen, Institute for Theoretical Physics, Germany
[2] University of Kiel, Institute for Economics, Germany

The definition of preferences assigned to agents is a concept that concerns many disciplines, from economy, with the search of an acceptable outcome for an ensemble of agents, to decision making an analysis of vote systems. We are concerned in the phenomena of good selection and economic fairness. In Arrow's theorem this situation is expressed as an impossibility of aggregate preferences among agents without running into some unfairness. This situation was also analyzed in a previous model in a network of agents with a random allocation. Both analysises are based on static preferences.

In a real society the individuals are confronted to the exchange of information that can modify the way they think. In particular the preferences of each person are influenced by this exchange. This consideration is unrealistic and do not permit to make an accurate analysis of the influence of the individual, or cluster of individuals, in the fairness state. The aim of this investigation is to consider the coupling of two systems, one for the formation of preferences and a second where an allocation of goods is done.

Atsushi Tero[1]:

Solving the shortest path problem by Physarum solver - Modeling of the Adaptive Network of True Slime Mold

[1] Hokkaido University, Creative Research Initiative, Japan

We describe here a mathematical model of the adaptive dynamics of a transport network of the true slime mold Physarum polycephalum, an amoeboid organism that exhibits path-finding behavior in a maze. This organism possesses a network of tubular elements, by means of which nutrients and signals circulate through the plasmodium. When the organism is put in a maze, the network changes its shape to connect two exits by the shortest path. By reproducing this phenomenon we introduce new method to solve shortest path problem.

Sudhir Jain[1]:

Persistence in an Ising Model of Socio-Economic Dynamics in High Dimensions

[1] Aston University, Birmingham, UK

The persistence problem for a socio-economic dynamics is investigated via extensive Monte Carlo simulations on high dimensional lattices (up to dimension 5). The model contains a crucial feedback term in the microscopic local field. We discuss the decay exponents of the persistence probability for each dimension (d=1 to 5) and for a wide range of bond concentration. The results are interpreted in both an economic and a social context.

Edgardo Jovero[1]:

A Chaotic-Dynamic View of Investment Risk in Emerging Economies

[1] Universidad Computense de Madrid, Spain

An open-economy neo-Keynesian model is developed which highlights market power and price-setting behavior as a source of the indeterminacy and structural instability characterizing the risk environment in emerging markets. This should explain why countries, which constitute the whole of the emerging economies as a group, provide different country investment risks individually.

This structural instability in the behavior of emerging countries can take the form of a Hopf bifurcation, the likelihood of which increases as the mark-up power increases. Evidence is presented as to the likelihood of a Hopf bifurcation occurring, using the qualitative geometric theory of nonlinear complex dynamical systems. The Keynesian view that structural instability globally exists in an emerging market economy is put forward, and therefore the need arises for policy to alleviate this instability in the form of dampened fluctuations is presented as an alternative view analyzing the nature of risk and its role in investment management.

Meredith Rolfe[1]:

Encouraging Voter Turnout: Diffusion in Practice

[1] Nuffield College, Oxford, UK

This paper starts with a simple premise: people do not go to the polls when they think that they may cast the deciding vote for a candidate that they care about. Instead, they are likely to vote when they know that their friends are likely to vote. Thus, voter turnout is a fantastic practical example of conditional decision-making and diffusion, and an empirically grounded model of the individual turnout decision exhibits previously unrecognized emergent patterns in simulations. In this paper, I describe how social networks, socio-political institutions and the media can impact voter turnout, and provide cross-national evidence in support of my claims.

László Gulyás[1]:

Robust Networks from Local Optimization: A Bottom-Up Model to Generate Networks With Skewed Degree Distributions

[1] AITIA Int. Inc. / Eötvös Loránd University, Budapest, Hungary

This paper addresses the problem of generating networks that are robust against random failures (i.e., against the random removal of nodes). More precisely, we are considering the generation of networks with skewed degree distributions. We construct an agent-based model in which agents represent the nodes of the network that connect to one another aiming to maximize their connectivity. Each agent can build a fixed number of links. However, information about the existing network is costly, so the agents must optimize under budget constraints, i.e., only having information about a limited number of existing nodes.

The model is related to the model of Simon that has become more widely known in its variant by Albert and Barabási, the 'preferential attachment' model. The main difference between these models and the one presented in this paper is that the former models require global access to information (i.e., the arriving new agent or node has to assess the distribution of links/size of the whole pre-existing population), while our model operates with limited information and utility maximization subject to this set of information. Analysis of the proposed model

via numerical simulation shows that the described system generates robust networks under a wide range of conditions and it is also able to generate special network classes, including scale-free networks. A key observation is that the pattern of information access, determined by the scheme used for pricing information about the existing network, is pivotal for the desired system-level property.

Zoltán Eisler[1]:

Size matters: parametric non-universality in stock market data

[1] Budapest University of Technology and Economics, Hungary

A careful analysis of the high resolution data of New York Stock Exchange and NASDAQ reveals that many characteristics of a stocks trading activity depend monotonously on the capitalization of the underlying company. This applies to the means of traded value per minute and trading frequency. Moreover, the degree of persistence in these quantities is not universal among stocks: their Hurst exponent increases logarithmically with company size. A similar tendency is present in intertrade times, together with multiscaling. These findings indicate that company size/capitalization acts as a continuous parameter that strongly influences the observed stylized facts.

Jana Hudakova & Ondrej Hudak[1]:

Social Behaviour of Agents: NPV and Markets

[1] Mathematical-Economical Consultancy, Kosice, Slovakia

Social behaviours of agents in groups are studied for a group of buyers and sellers, and for a group of people interacting in verbal and in nonverbal mode in villages and towns. Exchange of information is private. Maximalizing expected utility for agents the interaction of which is described using topology, statistical mechanics, cellular automata model, leads to interpretation of quantities describing their interactions in terms of verification of information. Personal radius dependencies as observed in experiments are qualitatively explained. Expectations of agents as concerning profit and risk and the state of the capial market lead to equilibrium structures in interactions, which are described and studied. Existence of mixed economy with hierarchical - and non - hierarchial firms is described as it is observed in developed market economies *large firms and smaller firms*. NPV and risk for firm projects is described using risk averse constant and is discussed in the frame of verification of information quantification.

Limor Issacharoff[1]:

Vulnerability of Technological Complex Networks

[1] ENEA, CR Casaccia, CAMO Unit, Roma, Italy

Technological networks such as the electrical grid, the telecommunication network, the motorways are considered to be part of a nation's Critical Infrastructures. Their operability is crucial for citizens' daily welfare and for national economy and security. Vulnerability analysis on these networks can be carried out at the structural (topological) and the functional levels. These studies are finalized to the optimization of the network's structure and for the management of their failures. We investigate the case of a high-voltage electrical transmission network and a traffic network as metaphors of complex systems where dynamical processes take place. The proposed analysis is a first step toward the study of networks' interdependency, aimed at a complete description of the cascade effects resulting from faults.

Pablo Kaluza[1]:

Design and Statistical Properties of Robust Functional Networks

[1] Fritz-Haber-Institut, Berlin, Germany

Using as an example the flow distribution model, networks with prescribed functions, robust against local damage, are designed through an evolutionary optimization process. Analyzing their statistical properties, we find that the requirements of robustness strongly affect the architecture: Networks with the same function, robust against deletion of links or deletion of nodes, belong to two different superfamilies of structural motif distributions.

Mikhail Krivoruchenko[1]:

Best linear forecast of volatility in financial time series

[1] Institute for Theoretical and Experimental Physics, Moscow, RUS

The autocorrelation function of volatility in financial time series is fitted well by a superposition of several exponents. Such a case admits an explicit analytical solution of the problem of constructing the best linear forecast of a stationary stochastic process. We describe and apply the proposed analytical method for forecasting volatility. The leverage effect and volatility clustering aretaken into account. Parameters of the predictor function are determined numerically for the Dow Jones 30 Industrial Average. Connection of the proposed method to the popular ARCH models is discussed.

Stefan Lämmer[1]:

Scaling laws in the spatial structure of urban road networks

[1] Dresden University of Technology, Institute for Transport & Economics, Germany

We analysed the urban road networks of the 20 largest German cities, based on a detailed database providing the geographical positions as well as the travel-times for network sizes up to 37,000 nodes and 87,000 links. As the human driver recognises travel-times rather than distances, faster roads appear to be shorter than slower ones. The resulting metric space has an effective dimension, which is a significant measure of the heterogeneity of road speeds. We found that traffic strongly concentrates on only a small fraction of the roads. The distribution of vehicular flows over the roads obeys a power law, indicating a clear hierarchical order of the roads. Studying the cellular structure of the areas enclosed by the roads, the distribution of cell sizes is scale invariant as well.

Jan Lorenz[1]:

Fostering Consensus in Continuous Opinion Dynamics under bounded Confidence

[1] University of Bremen, Germany

Consensus is important for society. Especially, when all relevant information has been collected and published but this information is not sufficient to bring a collective rational decision, which is plausible for everyone. Additionally, the success of some society related decisions depend on a consensual decision of the society (e.g. the decision to pay taxes or to commit to the constitution). Examples for continuous opinions are government investments in public goods (e.g. budget plan proposals) or political decisions about tax rates or social services. Another example is a commission of experts, which should reach a estimate about a certain issue, e.g. the tax revenues of the next year. In all these situations we got a group of agents which should reach a common agreement either for reaching a good approximation to the truth but on the other hand for the reason, that reaching consensus is a good in itself.

From social judgment theory and experiments we know that tend to reach agreement with other people, which have similar opinions. This leads to processes of continuous opinion dynamics under bounded confidence. So the question in this contribution is: Under which conditions

can consensus be reached and what can be done to structure the decision and discussion process to foster consensus. Several (sometimes counter-intuitive) results are presented concerning the manipulation of the opinion space (e.g. in dimensionality), the communication structure and the heterogeneity of agents. Results come from mathematical analysis and simulation. Mathematical analysis can give some bounds and conditions for the possibility of consensus, while simulation delivers bifurcation and phase diagrams, which describe certain parameter regions with certain outcomes. One result is that a multidimensional opinion space may lead to better chances for consensus, but only if opinions are budget plans, thus that all components have to sum up to a certain amount of money.

Ágnes Lublóy[1]:

Topology of the Hungarian payment system and its systemic risk implications

[1] Corvinus University of Budapest, Hungary

The first part of the paper deals with the topology and permanency of the Hungarian large value transfer system, called VIBER. A graph theoretical framework is applied; the graph representation allows a system wide assessment of high-value payments. By taking interdependences between institutions into account, seven centrality indices are defined. The different measures of centrality focus on different aspects of the payment topology. The aim of the application of graph theoretical methods is twofold. Firstly, the paper aims to analyze the permanency of the network over time. It is shown, that the structure of the payments is stable over a longer time horizon. Thus, the ad hoc relationships do not dominate the topology of the payments. The most central institutions are the same; the key players do not vary across days. One interesting feature of the topology is that only 30% of the existing linkages are permanent linkages, although nearly 90% of the payment orders is sent or received through these linkages.

Secondly, according to certain network criteria institutions most capable to generate contagion are determined. It is taken into account, that liquidity crisis could

arise if funds are not transferred to counterparties, although the counterparties have expected it. It is found, that systematically relevant institutions are directly or indirectly active players of the USD-HUF FX swap market. In the second part of the paper the effect of a potential liquidity crisis is measured and the importance of the lender of last resort function of the central bank of Hungary is investigated. In the simulations four different cases are identified, the scenarios of dead well, reciprocal payment, potential distressed periods and the scenarios of no FX swaps. In the rather unrealistic scenario of dead well contagion occurred in 35% of the cases. In the worst case measured in the number of illiquid banks ten out of 33 banks became illiquid. The maximum of the ratio of disruption the ratio of payment orders altogether not fulfilled over the daily turnover of VIBER was 15.08%. Interestingly, banks generating the highest number of contagious illiquidity are the same as the banks with the lowest shock absorbing capacity.
These systematically important banks trade actively on the HUF-USD FX swap market. In the scenario of reciprocal payment the contagion effect was much more limited. The contagion effect also decreased when some part of the FX swaps was filtered out from the transactions. However, truly distressed periods could not be identified.

Zoran Mihailovic[1]:

Network structure of television

[1] Institute of Nuclear Sciences Vinca, Belgrade, Serbia and Montenegro

We extend the ideas of the so called Q-analysis, which is based on the classical concepts of cohomology, using the latest results of the statistical physics of networks, in order to analyze in detail various media structures, television in particular. Using tools of algebraic topology, the Q-analysis is a general approach of complex structures analysis, since it incorporates intrinsic properties of main constituents of structure. It provides insight in construction developments of hypergraphs (hypernetworks) at different q-levels, where q is a dimension of main constituents of hypergraphs, that is simplices (completed graphs). Since simplices forms complex, called simplicial complex (hypernetwork), there are places where simplices are missing, called - holes. Holes influence transmission of information of any sort, and the scaling of main constituents (i.e. concepts) of Q-analysis: q-chains, q-faces, q-loops, etc., but also on the scaling of degree distribution. In the sense of Q-analysis the degree distribution P(k) is probability that chosen simplex shares k faces (of particular dimension) with another simplices, since the degree distribution of edges is just degree distribution of bipartite graphs. In the limit when q approaches 1 we obtain a network whose main constituents

are nodes connected by edges. The whole structure evolves with an addition of new nodes or simplices, so the evolution of hypernetwork is dictated by the structure itself resulting in the change of the scaling exponents. In the analysis of the structure of television shows, programs and themes several important issues are addressed and here we list just a few related to the ratings:

-Thematic connections and influences within shows and within program structure reveal ways of strategic planning for increased ratings.

-Certain combinations of themes within shows have large influence on thematic combinations within programs and we analyze the influence of these combinations (at various structure levels) on ratings.

-The news and the order of presentation of themes in the news and their relationship to the ratings

Alex K.S. Ng[1]:

Towards a formal specification of network robustness: A case study of metro network

[1] University of Oxford, Dept. of Engineering Science, UK

Researchers have been analyzing network robustness by two approaches, namely network modelling and network analysis. Network modelling approach is to build a mathematically defined network and to study its response and tolerance to attacks and failures. Network analysis approach is to measure the existing real-world networks by applying network metrics. However, researchers have not developed consensuses on the definition of robustness, methodologies and techniques to analyze network robustness. This paper defines the robustness as the tolerance of the network to the disruptions. Under this definition, we studied a metro network, namely Newcastle Metro network, and its robustness.

In this paper, we show that pre-existing network metrics, such as diameter, average shortest path and connectivity, cannot fully measure the robustness along the whole spectrum of the network, i.e. from the fragmented to the connected. We also show that a single network metric is incapable to uncover the network robustness completely. This paper proposes a generic scheme to measure the robustness of network with respect to network disconnection and network distance. A novel network metric to measure the impact of network disrup-

tions is proposed, namely network disconnectedness. The results show that the combination of network metrics, network disconnectedness and average shortest path, can identify the vulnerable structure in the network. This scheme can be generalized to measure the robustness of other types of networks.

Paul Ormerod[1]

Patterns of cascades and failures in evolving networks

[1] Volterra Consulting, London, UK

There is empirical evidence from a range of disciplines that as the connectivity of a network increases, we observe an increase both in the proportion of failure/extinction events, which are extremely large and at the same time an increase in the average fitness of the system. The probability of observing an extreme event remains very low, but it is markedly higher than in the system with lower degrees of connectivity.

We explain these phenomena by a simple agent-based model. We consider networks, which are populated by agents which are heterogeneous in terms of their fitness for survival. The network evolves over time, and in each period agents take self-interested decisions to increase their fitness for survival to form alliances which increase the connectivity of the network.

Christoph Räth[1]:

Assessing stock market models by means of phase correlations

[1] Max-Planck Institute for Extraterrestrial Physics, Garching, Germany

The analysis of financial time series has attracted growing attention in statistical physics motivated by the idea of understanding the market behaviour in terms of complex system theory. Stylised facts of the fluctuations of price indices were identified in price returns. Less attention has been paid to the analysis of possibly nonlinear temporal correlations in the time series. Microscopic models aim to reproduce the stylised facts. Here, we investigate two recently proposed multi-agent models with respect to their ability to reproduce temporal correlations. In both models the agents are treated as spins, which are exposed to fluctuations (a heat bath) and coupled by randomly time-dependent Ising-like interactions.
In first model the number of traders is fixed (closed market scenario) and the topological structure of the interaction network is considered to be unimportant. The second model simulates an open market by allowing variations in the number of agents (traders) within the framework of stochastic cellular automata (CA) arranged on a regular two-dimensional grid. The trading dynamics is modelled with the Ising-approach of the first model. However, the spread of information is limited to the emerging clusters of traders. Here we identify higher order temporal corre-

lations by analysing the Fourier phases. If a time series only contained linear correlations the Fourier phases were random and uniformly distributed. Any information beyond the (linear) autocorrelation will be contained in the phases and lead to deviations from the random distribution of them. An appropriate way of exploiting the information of the phase distribution is given by the analysis of so-called phase maps by means of entropy measures.

We report on the detection of Fourier phase correlations in the Dow Jones industrial index. By applying resampling and surrogate methods we demonstrate that the signatures in the phases are due to temporal correlations and not caused by the (non-Gaussian) nature of the distribution of the returns. While for the closed market model only weak phase correlations can be detected, the open market model is able to reproduce them almost as observed in the Dow Jones. Thus, measures of phase correlations yield a refined method for time series analysis. In this example proper market models are selected. Our findings suggest that besides the process for opinion formation - also the structure of the market, i.e. the complex interplay of the traders and its rules, plays a vital role for correctly modelling the market dynamics.

Martin Schönhof[1]:

Propagation of Traffic-Related Information on Freeways via Inter-Vehicle Communication

[1] Dresden University of Technology, Institute for Transport & Economics, Germany

A freeway with vehicles transmitting traffic-related messages via short-range radio is a technological representation for a complex network: A dynamical process runs on a network with dynamical topology. Here the network dynamics can strongly influence the message propagation because it is of the same timescale. In addition, if the cars generate the messages concerning irregularities in the traffic flow and also react to such information generated by other cars, the system has a feedback loop from the network topology to the generation of messages and from the message propagation to the network topology. The complexity of this system is restricted by its one dimensionality, i.e., the networks nodes are distributed in one dimension, but moving in different directions. By microscopic simulation of congested freeway traffic, where a certain fraction of cars are equipped with inter-vehicle-communication facilities, we investigate how the equipment level influences the efficiency of transmitting traffic related information such as the position of jam fronts.

Julian Sienkiewicz[1]:

Discrete effects on average path length scaling in complex networks

[1] Warsaw University of Technology, Department of Physics, Poland

Depending on the network's average degree, mean distance in scale-free and random complex networks may exhibit deviations from well known scaling laws such as dependence on logarithm of network's size or logarithm of degrees product. It can be shown both analytically and using numerical simulations that this behavior has its origin in discretization of path length distributions. A discussion about relevance of this feature to applications of real-world complex networks is presented.

Joana Simoes[1]:

Modelling a Mumps Outbreak through Spatially Explicit Agents

[1] Centre for Advanced Spatial Analysis, University College London, UK

Human-environment systems, as the ones where epidemics take place, are characterized by: heterogeneity, nonlinear relationships, and hierarchical structures that give rise to difficulties in understanding the system behavior. A good approach for this kind of problem is to start from a general understanding of the low-level processes and elements, and generate aggregate system behavior by simulating the individual entities in the system. In this study, it was developed an Agent Based Model that puts together a movement and an infection model. The biggest concerns were relaxing the assumption of random mixing of the population and considering an irregular space, with an heterogeneous distribution of individuals.

The model was applied to simulate a mumps outbreak in Portugal (1996), and it produced a good estimative of the infection pattern. Finally, the software that implements the model, aims to be a flexible product with good display and analysis capacities that can make the best out of the simulations, in this and other case studies.

Bence Tóth[1]:

The Epps effect, inter-stock influences and market efficiency

[1] Budapest University of Technology and Economics, Hungary / ISI Torino, Italy

The correlations in stock prices belong to the most important inputs for tools used in risk control, and their study also provides insight into the mechanisms of the market. We investigate the evolution of the Epps effect, the dependence of the correlations on the time horizon. We calculated the time-dependent and equal time cross-correlations for major NYSE stocks for the period of 1993 to 2003 using a shifted averaging window of one year. We have found that for early times the Epps effect is strong (for high frequency data the equal time correlations are very suppressed) and there are often lagged peaks in the time dependent cross correlation functions where the time lag indicates that the price of one stock influences that of another.

Coming closer to today, the correlation functions for high frequency data change strongly both in strength (growing correlations) and in their positions of maximum (decreasing time lag). These changes can mainly be attributed to the increasing speed of market processes (faster trading, faster information processing) hence to growing market efficiency. To prove this, we simulate a simple model of stock price time series and study the effect of growing trading frequency on the correlations.

We analytically calculate the impact of the changes and compare the results to the empirical data.

Germán Eduardo Vargas[1]:

Evolutionary Effectiveness's Dynamics of Enterprise Innovation

[1] Universidad de los Andes, Bogota, Columbia

The straggled, reactive and inertial orientation of Colombian entrepreneurship has been justified, inconsistently, for the hardness resources agency (internal and leveraged), concept that intensify the deficient technological capabilities being, because this situation only not become a technological means trouble, rather strategic purposes. In fact, a classical one effect of no conscientious recognition of this limitation, explain why so many organizations connect your successful with your "intelligence", but failure with exogenous factors impact. On this understanding and intervention level, this document illustrates 3 criterions of development: (1) integration for selection, (2) learning as absorption, and (3) innovation as evolutionary addressing, through which knowledge's constitutes as transversal action and organization principle, with 2 fundamental implications: (1) on theory help to comprehend the systemic determinants of innovation through knowledge structures; (2) on practice, an empirical analysis of this evolutionary system can help to insight focus areas for strategic stimulation of connections and synergies to better performance.

Bertrand de la Chapelle[1]:

The Emergence of the Notion of Multi-Stakeholder Internet Governance During the WSIS Process

[1] French Ministry of Foreign Affairs, France

The World Summit on the Information Society (aka WSIS), a UN process that took place between 2002 and 2005, gave birth to a very innovative notion of multi-stakeholder Internet Governance, involving actors from governments, civil society and the private sector. The emergence of this concept within a traditional diplomatic process is an interesting case study of network dynamics, propagation of ideas through percolation and the impact of leading individuals playing the role of convenors and connectors. The soon-to-be-established Internet Governance Forum (IGF) is planting the seeds of a new, international framework built on complex network dynamics that could progressively transform the present international architecture based on nation-states into a more issue-based governance framework.

Other Participants

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4. Peter Dick (Department of Health, Leeds, UK)
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6. Anita Frisch (OD Partner, Budapest, H)
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14. Jan Siegmeier (TU Dresden, Inst. for Transport and Economics, D)
15. Zoltán Toroczkai (Center for Nonlinear Studies, Los Alamos, USA)
16. Virág Vántora (National Office for Research and Technology, H)
17. Tamás Vicsek (ELTE, H)
18. John Williams (SCA Packaging, B)
19. Michal Ziembowicz (Warsaw University, PL)
20. Several Participants from Nokia, t.b.a. (Budapest, H)

Table of Contents

Index