

Tails and Ties

Editorial: Topical Issue on Physics in Society

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Abstract. The study of behavioural and social phenomena has experienced a surge of interest over the last decade. One reason for this great attention is the huge amount of high quality data made available by the internet technologies. The many studies spanning concepts and problems belonging to economics, biology, ecology, physics and computer science, clearly indicates increasing interdisciplinary cross-fertilization, commonalities in the different approaches and communication across these disciplines. This issue of *The European Physical Journal B* is devoted to the interdisciplinary field of *Sociophysics*. The papers have been selected from the contributions presented at the 5th International Conference on “Applications of Physics in Financial Analysis” (APFA5) held in Torino from June 29th to July 1st 2006 (<http://www.polito.it/apfa5>). The synergy and richness of results obtained from the investigation of problems belonging to the area of complexity science from different perspectives clearly indicates future directions and research methodologies in this field.

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“One peculiarity of this age is the sudden acquisition of much physical knowledge ...A new world of inventions – of railways and of telegraphs – has grown up around us which cannot help seeing; a new world of ideas is in the air and affects us, though we do not see it ...the new ideas are modifying two old sciences – politics and political economy” (an excerpt from the book “*Physics and Politics*” published in 1872 by Walter Bagehot, after whom the “UK government and public administration best dissertation” prize is entitled).

After replacing “*railways and telegraphs*” by “*airways and the internet*”, the above sentence can help to understand the effects of the revolution sweeping through many aspects of the social life following the diffusion of new technologies. It was clear since 1872 that the development of concepts and tools emerging from new inventions and technologies can drive social sciences such as politics and political economics. However, the peculiarity of our age is that we assist and, in addition, take part in processes of mass communication which are responsible for interaction and correlation in diverse fields of human activity.

Internet-based communication and interactivity are changing the way collective human interactions occur, affecting sizes and scales of the major social and economic

problems. Thanks to the new technologies, we are today able to *observe* millions of people interacting because of culture, friendship, sex and business or simply because of massive online-games. Thanks to the same technologies, we are today able to *record* such individual interactions.

The availability of high-volume and high-quality records of data allows us to experience and exploit concepts and methods – traditionally belonging to the areas of statistical physics and complexity – in the social sciences. Formal tools able to quantify concepts such as scaling, criticality, self-similarity, only to cite a few examples, are being transferred from physics to social sciences. Similar approaches shed light into phenomena such as the spread of ideas or biological viruses among human populations. Extended systems evolving over space, such as urban textures, the world wide web and firms are described in terms of random structures in high-dimensional representation. Time series describe economic systems in one dimension, such as stock market indices and exchange rates. City size, income, word frequency, music genres are distributed according to *power laws* and evolve under the effect of *spatio-temporal correlations* typical of physical systems with many interacting units. The dynamics underlying social competition and conflicts have been

found to be remarkably universal. Statistical theory describing insurgent group formation and attacks explains the universal patterns observed in all modern wars and terrorism. The common idea is that the elementary social components – through their interaction – spontaneously develop collective behaviours that could not have been deduced on the basis of simple additivity. Social phenomena emerge and develop under the effects of interactions and information exchange through large numbers of heterogeneous agents, often behaving in an unpredictable and irrational way.

The social consequences of human unpredictability and irrationality were already envisaged by Vilfredo Pareto (1848-1923). Pareto, born of an exiled Italian family in Paris, went back to Torino, earning an engineering degree from the Politecnico di Torino in 1870. In his seminal book “*The Rise and Fall of Elites: Application of Theoretical Sociology*”, he wrote:

“...let us note that the greater part of human actions have their origin not in logical reasoning but in sentiment. This is principally true for actions that are not motivated economically. The opposite may be said of economic actions, especially those connected with commerce and industry. Man, although impelled to act by nonlogical motives, likes to tie his actions logically to certain principles in order to justify his actions. So it happens that an action A, which is in reality the effect of a cause B, is presented by its author as the effect of a very often imaginary cause C. The man who thus deceives his fellow man begins by deceiving himself, and he firmly believes his own contentions...”.

Why do systems as different as conflicts, airways, languages, internet, music genres and sex develop scale-free structures similarly to those found in critical phenomena observed in condensed matter? Statistical mechanics is yielding new insights into social phenomena by transferring and further developing ideas and concepts common to physics, biology and ecological systems. Many questions are still open and require the joint effort of scientists active in such disciplines.

The 5th International Conference on “*Applications of Physics in Financial Analysis*” (APFA5), held in Torino from June 29th to July 1st 2006, gathered together scientists working on these rapidly evolving topics (<http://www.polito.it/apfa5>). This special issue collects work presented at the conference with emphasis on economics, opinion dynamics and social networks approached by methods of statistical physics. Additionally, we provide here below a non-exhaustive list of work with the aim of exemplifying pioneering and more recent results in areas as *Culture; Competition and Conflicts; Cooperation and Scientific Research; Economy and Political Economy; Ecosystems; Friendship and Sex; Internet and World Wide Web; Languages; Opinion Dynamics; Power laws and fractals; Religion; Social network; Traffic*. Due to the quantity of developed ideas, the list is necessarily limited and unavoidably lacking of many important contributions in this research area. We deeply apologize to the authors of any missing work.

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