

# Computational Social Systems and the Internet

Peter Cramton<sup>1</sup>, Rudolf Müller<sup>2</sup>, Eva Tardos<sup>3</sup>, and Moshe Tennenholtz<sup>3</sup>

<sup>1</sup> Economics Department, University of Maryland, College Park, MD 20742-7211, USA

<sup>2</sup> Department of Quantitative Economics, Faculty of Economics and Business Administration, Maastricht University, 6200 MD Maastricht, The Netherlands

<sup>3</sup> Department of Computer Science, Cornell University, Ithaca, NY 14853, USA

<sup>4</sup> William Davidson Faculty of Industrial Engineering and Management, Technion - Israel Institute of Technology, Technion City, Haifa 32000, Israel

**Abstract.** The seminar “Computational Social Systems and the Internet” facilitated a very fruitful interaction between economists and computer scientists, which intensified the understanding of the other disciplines’ tool sets. The seminar helped to pave the way to a unified theory of social systems on the Internet that takes into account both the economic and the computational issues—and their deep interaction.

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The Internet has an increasing influence on the functioning of traditional social systems, in particular if those systems are related to economic transactions. The Internet also enables the formation of new social systems. Social systems enabled or supported by the Internet are by definition computational as they can make use of intense computational support. Search engines that are based on page ranking, sponsored links, recommender systems, reputation systems and massive auctions, are prominent examples. They are also mechanisms, in the sense that the implementation of the system pre-defines the actions that can be taken by participants, and the strategic behavior of the participants is what defines the actual performance of the system.

Due to these developments, the performance of a computational system is not anymore solely a question of its technical characteristics, the design of the underlying algorithms, but is heavily influenced by the behavior of its users and other computational systems to which it is connected. In recent years, Computer Science has responded to this development by incorporating more and more Game Theory and Economic Theory into its tools and models.

The interaction between the social sciences (and in particular economics and game theory) and computer science may lead to influence in both directions. In the particular case of computational social systems we see, for example, that

traditional models in economic theory, such as the concept of Bayesian Equilibrium in games with incomplete information, complemented by models that have been developed in Computer Science. For example, issues such as approximation and worst case / competitive analysis are suggested as natural alternatives to Bayesian analysis. Furthermore, the Computer Science approach questions assumptions made in many economic models in terms of decision capabilities of participating agents. Economic theory often neglects the bottlenecks due to exponential computation and communication in a mechanism on one hand, and the powerful capabilities of computer programs on the other.

Still, the adaptation of Game Theory and Economic Theory within Computer Science is at an early stage. In particular, this is true for experimental studies of the newly generated social systems. Behavioral economics is an area in economics that successfully incorporates behavioral sciences by use of laboratory experiments with human participants. As Computer Science has suggested new tools, their verification is still pending. This is further underlined by the fact that many of the social systems on the Internet are based on non-monetary incentives.

The seminar on computational social systems brought together leading researchers from theoretical computer science, artificial intelligence, economic theory, and behavioral economics to discuss computational social systems on the Internet from the viewpoint of their disciplines. The participants discussed theories which can support the emerging markets in the Internet, and suggest insight into future markets. Points of departure have been social and economic mechanisms suggested and inspired by the Internet, such as reputation systems, ranking systems, recommender systems, and online auctions and other markets. In 47 excellent presentations, models and analysis tools inspired by social systems on the Internet were presented and critically evaluated by the audience, based on the tradition of each of the disciplines. An important role in the seminar was devoted to the study of combinatorial auctions and to the study of congestion settings, as these areas have already a tradition of interdisciplinary research.

By far the most important contribution of the seminar is the research network that is established through the exchange of ideas among the scholars. This is especially beneficial for interdisciplinary seminars like this one. The mix of economics, computer science, and operations researchers fostered an exchange of methods, and problems that is likely to lead to path-breaking research in the essential area of social networks and the Internet.