

## **ONLINE REPUTATION MECHANISMS: A ROADMAP FOR FUTURE RESEARCH**

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### **I. Introduction**

The First Interdisciplinary Symposium on Online Reputation Mechanisms took place at MIT, on April 26-27, 2003 with the aim of bringing together leading researchers from various disciplines that are active in the area of reputation systems, as well as executives from industry who are responsible for practical implementation of reputations systems. The objective of this symposium was to help us better understand how various lines of work connect to one another and how, together, they can contribute to the design and implementation of better feedback mechanisms for electronic commerce and our digital society at large.

### **II. Why is This Field Important?**

Reputation mechanisms have initially attracted attention as a mechanism for building trust and fostering cooperation in online trading communities, such as eBay, where more traditional quality assurance mechanisms (commercial law, government regulation, etc.) do not work as well. They have also emerged as an attractive approach for inducing “law and order” in loosely coupled networks of computer systems, such as software agent communities and peer-to-peer networks.

We believe that feedback mechanisms are poised to have a much wider impact on consumer behavior and public opinion formation. Their growing popularity can, therefore, have potentially important repercussions for a variety of business and public policy institutions ranging from marketing and advertising to litigation and the political process.

The majority of existing online feedback mechanisms have been developed by a variety of commercial and community groups and based on ad hoc principles and ideas. As these powerful systems proliferate, it is

important to conduct rigorous research in order to understand the full potential benefit of these mechanisms for business and society as well as to protect society from potentially harmful consequences of poorly designed feedback mechanisms. Such research requires a sustained effort and collaboration among several disciplines, including Economics, Computer Science/MIS, Sociology and Psychology, Management Science, and Political Science.

### **III. A Snapshot of the State-Of-The-Art**

The papers presented in the symposium collectively represent a snapshot of the state-of-the-art in the field. Current research on reputation mechanisms concentrates around three major themes:

1. Analyzing the performance of existing reputation mechanisms
2. Proposing novel designs for reputation mechanisms
3. Exploring the use of reputation mechanisms in novel settings

The following sections provide the main themes of work presented in the symposium.

#### **Theme 1: Analyzing the Performance of Existing Reputation Mechanisms**

##### *Empirical Studies*

A substantial amount of recent research has focused on empirical evaluations of existing reputation mechanisms. The majority of these works focus on eBay’s feedback mechanism and concentrates on studying the relationship between a seller’s reputation score, auction closing prices, and the probability that an auction will receive at least one bid.

Other topics addressed by empirical studies include understanding the drivers and evolution of buyer participation on eBay’s feedback mechanism. Preliminary results indicate that a buyer’s propensity to leave feedback for a seller has a positive correlation with the amount of positive seller reciprocation that this buyer has experienced in the past. Furthermore, experienced buyers (buyers who

have completed large numbers of transactions), as well as buyers who transact with high frequency tend to leave feedback less often.

### *Experimental Studies*

An increasing number of experimental studies also aim to shed light on how people react to reputation mechanisms. Again, most studies relate to systems that are similar to eBay. Important themes in experimental studies include:

- The relative importance of positive vs. negative reputation.
- The power of reputation relative to that of stable partnerships.
- The dual role of reputation as sanctioning and signaling.

### *Analytical Studies*

A game-theoretic model of eBay's mechanism was presented in the symposium. The analysis concluded that eBay's mechanism is capable of inducing high (but not perfect) levels of cooperation and that the unusually low fraction of negative feedback on eBay is a natural consequence of equilibrium behavior. Furthermore, it investigated the impact of incomplete feedback submission and easy name changes and concluded that (i) eBay's mechanism can be more efficient in the presence of incomplete feedback submission if it treats missing feedback as positive feedback and (ii) one approach for discouraging players from changing their identities is to start new players with a profile that corresponds to "bad reputation" and have them "pay their dues" at the initial phase of the game.

## **Theme 2: Proposing Novel Designs for Reputation Mechanisms**

Most of the work in this theme comes from researchers in computer science and multi-agent systems. The general consensus was that there are some very interesting ideas that need to be more rigorously validated by embedding them in an economic framework. This is an area where there are great opportunities for collaboration between computer scientists and economists, even though researchers from both fields acknowledged the existence of a "language barrier" (which, we are confident, can be

overcome through more sustained contact between researchers of the two disciplines.)

### *Mechanisms for Eliciting Truthful Feedback*

In most online systems feedback submission is voluntary. In the absence of concrete incentives, online community members may thus refrain from providing feedback or provide intentionally or unintentionally untruthful feedback. A number of researchers are working towards developing mechanisms that provide strict incentives to online community members to both participate (i.e. provide feedback) as well as truthfully report their observations.

### *Implicit Extraction of Reputation*

An important theme of this discussion was the use of data mining techniques that can automatically extract reputational information from publicly available networked data structures, such as the Web, Usenet groups, etc. An impressive amount of information about someone's social standing, past behavior, and interaction habits can be inferred in this way. Such implicit reputation mechanisms are an intriguing complement to mechanisms that rely on explicit feedback. They can be particularly useful in terms of bootstrapping feedback mechanisms (i.e. substitute for feedback during the initial phase when feedback is scarce) as well as in situations where feedback is unreliable or subject to strategic manipulation.

### *Distributed Feedback Mechanisms*

Most commercial feedback mechanisms are based on centralized architectures. That is, feedback is solicited and stored in a single repository, controlled by a single organization (e.g. eBay, Epinions, Amazon). Motivated by issues of privacy, trust, and scalability, some researchers are beginning to look at distributed feedback mechanism architectures. In such systems, agents receive reputational information from a variety of sources, including direct experience, feedback from third parties, and implicitly extracted information. An important challenge is to develop algorithms through which these sources of information are combined in a "sensible" way to adjust the agent's beliefs. A further challenge relates to modeling the effectiveness of such complex systems and comparing it to that of centralized feedback systems.

### **Theme 3: Exploring the Use of Reputation Mechanisms in Novel Settings**

The majority of current research on reputation mechanisms has focused on the application of such mechanisms in online marketplaces. Increasingly, researchers are looking into other domains where such systems can play a useful role. Some examples include:

- Peer-to-peer networks
- Wireless grids
- Professional guilds

In contrast to the above proposals, Jeff Ely, a Professor at Northwestern University presented a paper where he outlined an (abstract) setting in which publicly available reputational information ends up harming otherwise honest service providers. His paper shows that the development of reputation mechanisms may not be socially beneficial in all cases.

#### **IV. The Way Forward**

##### **Reputation Formation in Competitive Settings**

Most analytical and experimental studies of reputation formation in trading environments have made the assumption that the seller is a monopolist. The dynamics of reputation apparently change in interesting ways when there are several competing sellers. Heski Bar-Isaac, a Postdoctoral Fellow at Northwestern University, presented some preliminary work on this topic. His most striking finding was that competition changes reputational incentives in a non-monotonic manner: the power of reputation rises, then falls, then rises again as a market becomes more competitive. This is an interesting area where more analytical work is needed.

##### **Usability Considerations**

Industry participants ranked usability of reputation mechanisms near the top of their open issues. Users of eBay and Epinions are currently having difficulties understanding what the reputation measures mean and, more importantly, how to factor them into their decision-making. A lot of the analytical models presented by researchers in this symposium are substantially more complex than eBay's current mechanism. An important research and practical

question therefore revolves around the design of mechanisms that are both theoretically sound as well as easy to understand for the average Internet user.

##### **Representations and Ontologies for Reputation**

There is a lack of consensus regarding the fundamental concepts that relate to reputation mechanisms. The current diversity of designs and concepts associated with reputation mechanisms might be contributing to the confusion faced by consumers when using such systems. The development of ontologies in this domain would be a step forward, both for developing more standardized and usable reputation mechanisms, as well as for developing machine-readable reputation measures that could be used in the context of peer-to-peer networks and multi-agent systems.

##### **Relationship between Online and Offline Reputation**

Online reputation mechanisms are increasingly aggregating opinions about offline firms and products. For many of these firms, consumers have access to offline measures of reputation based on brands, physical stores, advertising, etc. As more and more consumers visit online forums it is important to understand how a firm's online and offline reputations interact and how they influence consumer purchase decisions.

##### **When is Reputation Bad**

The paper presented by Jeff Ely presented an interesting setting where the availability of public reputational information can be harmful for an (otherwise honest) service provider. It is important to understand the range of practical settings in which these results might apply, and therefore to identify classes of settings for which the development of online feedback mechanisms may not be a good idea.

##### **Emotional Factors**

Practitioners and sociologists seemed to agree that people associate an emotional value to their online reputation profile. eBay members are proud to be "power sellers" (a distinction earned once their reputation score surpasses a certain level) and get disproportionately angry when they receive negative feedback. The emotional factors associated with

reputation mechanisms thus seem to be an important driver of these mechanisms' effectiveness and deserve further study.

### **Social Impact of Ubiquitous Reputational Information**

The combination of online feedback mechanisms and implicit reputation extraction systems discussed in the symposium points to a future where lots of reputational information about firms and individuals will be readily available on the Internet. Some symposium participants referred to this trend as the "end of practical obscurity" and suggested that its social consequences need to be carefully considered.

### **Social Impact of Centralized Reputation Repositories**

The current generation of online feedback mechanisms relies on a centralized repository of ratings for online community members. As the importance of such information grows, the privacy implications of having so much sensitive information under the control of a single organization (the mechanism operator) must be carefully understood.

### **Multi-Cultural Aspects of Reputation Mechanisms**

The majority of empirical and experimental studies of online reputation mechanisms have been performed in the U.S. It is important to understand how cultural differences may affect the way in which such mechanisms influence behavior in other cultures.

### **Impact of Reputation Mechanisms on Traditional Institutions**

Several participants remarked that current research on reputation mechanisms is rather narrowly focused on the study of existing systems, most notably eBay's system. As we argued in Section 2, online feedback has an increasingly important role to play in a variety of other settings that involve offline decision making, such as brand building, product development, and public opinion formation. More macro-level research is needed in order to understand how the spread of online feedback mechanisms might impact more traditional institutions such as advertising, the media, and the legal system, in the context of the above settings.

### **Conclusions**

Overall, the First Interdisciplinary Symposium on Online Reputation Mechanisms has been considered a great success by its organizers and participants. There are already discussions for following up this event with a collected volume of papers on the topic as well as plans to organize a second symposium next year at Cornell University. Most importantly, however, the success of the symposium has shown that online reputation mechanisms are an emerging phenomenon of important commercial and social implications that deserve further attention and collaborative research.

For further information, please visit the website at:

<http://www.si.umich.edu/~presnick/reputation/symposium/>

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The Center for eBusiness has recently entered into Phase II, adjusting its agenda to focus more explicitly on business value, while at the same time including technologies beyond the Internet in its purview. The early period of exploration and experimentation is coming to an end and there is now the opportunity, and the necessity, to focus more explicitly on using digital technologies to deliver measurable business value. Amidst all this change, the business fundamentals of investment, revenues, expenses, profits, and satisfying customers have only grown more important. At the same time, a broader, inter-related set of technologies is at our disposal. While the Internet has been an important catalyst, related digital technologies are often at least as relevant.

We are co-located with MIT Sloan's Center for Information Systems Research initiative and the Center for Coordination Science to facilitate collaboration. We also collaborate with the Media Lab and the Program on Internet and Telecoms Convergence.



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