There are many prominent examples of large-scale *socio-technical systems* — Wikipedia, Amazon.com, del.icio.us, flickr.com — many less prominent examples, and even more examples of socio-technical systems that did not succeed. One feature all of these systems share is that success — how useful the system actually is to a user — depends critically on the decisions other users make as they use the system. Wikipedia wouldn't be very useful without other users writing articles, and Amazon.com wouldn't be able to provide recommendations or reviews without many others providing the necessary data. I explore how computers enable and encourage people to interact with each other in valuable ways.

I use the term "socio-technical system" because many modern systems rely on the interaction between the technical features and specific social behaviors to function properly. For example, Facebook is both its technical infrastructure (webpages, databases, etc.) and the behavior of its users; it wouldn't be interesting without regular 'status updates' from a wide variety of people. To build or understand socio-technical systems, it is vital to understand how the technology leads to the desired behavior, and when the required behavior doesn't happen, what is missing and how to fix it.

In my research, I identify *incentive mechanisms*: technological design patterns that lead to predictable, desirable behavior. Understanding and characterizing incentive mechanisms allows me to 1) better explain human behavior in existing socio-technical systems, and 2) design better socio-technical systems.

I often see people discussing how to build social media systems; indeed, many classes are taught on the subject. Most of these discussions focus on technical features: database design, REST APIs, explicit social networks, tags, etc. But building a social media system also means designing the desired *social* behaviors: contributing articles, updating statuses, rating posts, and commenting. Having a toolbox of incentive mechanisms allows us to move from building technical systems to engineering socio-technical systems. The ability to design the social behavior of users opens up many new possibilities for what socio-technical systems can be used for.

To identify and characterize incentive mechanisms, I draw on theories of motivation and incentives from human-computer interaction, economics, communications, and social psychology to understand, explain, and then predict behavior of users. I combine these theories with my computer science background to identify and design technical features that can reliably induce desired behaviors across a wide variety of computer systems. I use this interdisciplinary approach because these are complex problems that require a variety of approaches to study them; my research includes economic modeling, server log analysis, both lab and field experiments, and qualitative inquiry.

Deriving Incentive Mechanisms from Social Science Theory

The field of economics has much work on mechanism design for designing policies, institutions, and organizations. Social, cognitive, and behavioral psychology all have numerous theories of motivation, persuasion, and influence that can be applied to the design of technology. Communications studies the uses and gratifications for using systems, and how people focus on various cues to trigger behavior. I seek to identify

and develop incentive mechanisms that are derived from social science theory, but generally apply across a wide variety of social computing systems.

To derive generalizable incentive mechanisms, I frequently use mathematical modeling to understand and characterize behavior. With Thede Loder and Marshall van Alstyne, I developed a model of an *attention bond mechanism* that uses economic screening theory to address problems of unwanted spam email [4]. Jeff MacKie-Mason and I applied screening theory to develop a model of common information security technologies [3]. We use this model to explain why some attacks again password systems and CAPTCHAs are much more serious than others. We also developed a model of behavior in social computing systems to characterize a *minimum threshold mechanism* that induces users to contribute information to a shared information system by threatening to exclude those who don't contribute enough [6].

However, economic modeling has important practical limitations; it makes assumptions about behavior, such as the rational actor assumption, that are not always accurate. I use lab experiments and field experiments to test theoretical predictions in realistic settings. For example, I am currently running a field experiment to study an incentive mechanism from the philanthropy sub-literature in economics: the *power of the ask*. Sometimes the best way to induce contributions is to simply ask the user to contribute. By testing this mechanism on an existing social media system with an existing community of users, I am able to realistically measure its effects on contributions.

Sometimes, social theories can be directly applied to the design of technical systems. But often, there are important differences that complicate things. I specifically look for these instances. For example, economists have developed a number of mechanisms for inducing voluntary contributions to public goods. However, they often assume monetary contributions; these mechanisms don't work when contributions are information because excess information is difficult to divide up and return to users. My minimum threshold mechanism takes ideas from the public goods literature, but develops a mechanism that works contributing information to social media. Also, information has a quality dimension that money lacks; not all contributions are equivalent. My study of the power of the ask looks at how different forms of asking can result in various qualities of contributions.

Deriving Incentive Mechanisms from Successful Existing Systems

Sometimes, the best ideas come from seeing what is already working for successful social computing systems, such as delicious.com, Facebook, and Everything2. For example, along with Emilee Rader, I studied the social bookmarking website delicious.com. We found that users primarily contribute for personal reasons, but their contributions are made public as a *side effect* [1]. We also identified an important design constraint — incentive alignment — that ensures shared information is useful to others when it is contributed for private reasons. I am currently running a field experiment on a different social media site (Everything2.com) to establish causality, to test whether this idea generalizes to other types of social media systems, and to measure how strong this incentive can be.

Future Plans

I have begun to characterize four different incentive mechanisms that are useful in socio-technical systems: the screening mechanism, the side effect mechanism, the minimum threshold mechanism, and the power of the ask. I plan to continue developing a number of general-purpose incentive mechanisms for social media systems. So far, I have mainly studied mechanisms that encourage contribution of information, and ensure contributed information is high quality; I also plan to study mechanisms that induce additional valuable behaviors such as collaboration between users, end-user innovation, continued participation, and site governance.

My long-term plans include designing and developing a new social media system to address a specific real-world problem. Access to a real system is valuable for designing and implementing new features, and then conducting realistic, generalizable field experiments on them, much like the MovieLens system at the University of Minnesota has been a valuable platform for experimenting with recommender systems. The ultimate test of a theory of incentive mechanisms is how well it can be applied to building practical, real-world systems; the process of creating such a system will be a valuable learning experience. I took some first steps toward this goal in my dissertation: I identified a number of incentive mechanisms and then used them to propose features for a new social media system that encourages information sharing among home computer users to improve security decisions.

Major Publications

[1] Rick Wash and Emilee Rader. “Public Bookmarks and Private Benefits: An Analysis of Incentives in Social Computing.” *Proceedings of the American Society for Information Science and Technology (ASIS&T) Annual Meeting* (2007)

[2] Emilee Rader and Rick Wash. “Influences on Tag Choices in del.icio.us.” *Proceedings of the ACM Conference on Computer Supported Cooperative Work (CSCW)* (2008)

[3] Rick Wash and Jeffrey MacKie-Mason. “Incentive-Centered Design for Information Security.” *Proceedings of the International Conference on Electronic Commerce (ICEC)* (2007)

[4] Theodore Loder, Marshall van Alstyne, and Rick Wash. “An Economic Response to Unsolicited Communications.” *Advances in Economic Analysis and Policy*, vol. 6, no. 1 (2006). http://www.bepress.com/bejeap/advances/vol6/iss1/art2.

Working Papers

[5] Rick Wash. “Folk Models of Home Computer Security.”

[6] Rick Wash and Jeffrey MacKie-Mason. “Using a Minimum Threshold to Motivate Contributions to Social Computing.”