

Collective Intelligence 2012

April 18–20 @ MIT

Chairs

Thomas Malone (MIT)

Luis von Ahn (Carnegie Mellon University)

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Deborah Gordon (Stanford University)

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Michael Bernstein (MIT)

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Panagiotis Ipeirotis (NYU)

Special thanks to the National Science Foundation for sponsorship

Collective Intelligence 2012 Overview

Wednesday April 18, 2012

5:30 - 7:30 PM: **Registration and Opening Reception** — Ting Foyer, Tang Center

Thursday April 19, 2012

8:00 - 9:00 AM: **Registration and Breakfast** — Ting Foyer, Tang Center

9:00 - 9:05 AM: **Welcome** (Malone, von Ahn) — Wong Auditorium, Tang Center

9:05 - 10:45 AM: **Plenary Talks** (Benkler, Couzin, Gordon, Woolley) — Wong Auditorium

10:45 - 11:15 AM: **Break** — Ting Foyer

11:15 AM - 12:30 PM:

Paper Session 1A: Social and Psychological Issues — Wong Auditorium

Paper Session 1B: Applications of Crowdsourcing — MIT Faculty Club 6th fl., DR East

12:30 - 1:45 PM: **Lunch** — MIT Faculty Club 6th fl., Dining Room 5

1:45 - 3:30 PM: **Plenary Talks** (Ipeirotis, Kraut, Mason, Miller) — Wong Auditorium

3:30 - 4:00 PM: **Break** — Ting Foyer

4:00 - 5:45 PM: **Plenary Talks** (Churchill, Hutchins, Shneiderman, Zittrain) — Wong Aud.

5:45 - 7:00 PM: **Local Lab Visits**

6:45 - 9:00 PM: **Poster Session & Conference Dinner** — MIT Museum

Friday April 20, 2012

8:00 - 9:00 AM: **Registration and Breakfast** — Ting Foyer

9:00 - 10:45 AM: **Plenary Talks** (Adamic, Chabris, Lakhani, Page) — Wong Auditorium

10:45 - 11:15 AM: **Break** — Ting Foyer

11:15 - 12:30 PM:

Paper Session 2A: Defining Collective Intelligence — Wong Auditorium

Paper Session 2B: Statistics & Game Theory — MIT Faculty Club 6th fl., DR East

12:30 - 1:45 PM: **Lunch** — MIT Faculty Club 6th fl., Dining Room 5

1:45 - 3:30 PM:

Paper Session 3A: Crowd and Social Dynamics — Wong Auditorium

Paper Session 3B: Communities — MIT Faculty Club 6th fl., Dining Room East

3:00 - 3:30 PM: **Break** — Ting Foyer

3:30 - 5:15 PM: **Plenary talks** (Camerer, Chen, Salganik, Wolfers) — Wong Auditorium

Collective Intelligence 2012 Schedule

Wednesday April 18, 2012

5:30 - 7:30 PM

Registration and Opening Reception

Ting Foyer, Tang Center

Thursday April 19, 2012

8:00 - 9:00 AM

Registration and Breakfast

Ting Foyer, Tang Center

9:00 - 9:05 AM

Welcome

Wong Auditorium, Tang Center

Thomas W. Malone (MIT)

Luis von Ahn (Carnegie Mellon)

9:05 - 10:45 AM

Plenary Talks

Wong Auditorium, Tang Center

Session chair: Thomas W. Malone (MIT)

Legitimacy in Cooperative Human Systems Design: Mediating Power, Structure, and Motivational Misalignment

Yochai Benkler (Harvard)

Collective Intelligence in Animal Groups

Iain Couzin (Princeton)

The Regulation of Foraging in Ant Colonies

Deborah Gordon (Stanford)

Collective Intelligence in Human Groups

Anita Woolley (Carnegie Mellon)

10:45 -11:15 AM

Break

Ting Foyer, Tang Center

11:15 AM - 12:30 PM

Paper Session 1A: Social and Psychological Issues

Wong Auditorium, Tang Center

Session chair: Robert Kraut (Carnegie Mellon)

Tracking The 2011 Student-Led Movement in Chile Through Social Media Use

M. Barahona, C. García, P. Gloor, and P. Parraguez (P. Universidad Catolica de Chile)

Using social media archives of the 2011 Chilean student unrest and dynamic social network analysis, we study how leaders and participants use social media such as Twitter, and the Web to self-organize and communicate with each other, and thus generate one of the biggest “smart movements” in the history of Chile. In this paper we i) describe the basic network topology of the 2011 student-led social movement in Chile; ii) explore how the student leaders are connected to, and how are they seen by (a) political leaders, and (b) University authorities; iii) hypothesize about key success factors and risk variables for the Student Network Movement’s organization process and sustainability over time. We contend that this social media enabled massive movement is yet another manifestation of the network era, which leverages agents’ socio-technical networks, and thus accelerates how agents coordinate, mobilize resources and enact collective intelligence.

What “Crowdsourcing” Obscures: Exposing the Dynamics of Connected Crowd Work During Disaster

Kate Starbird (University of Colorado Boulder)

The aim of this paper is to demonstrate that the current understanding of crowdsourcing may not be broad enough to capture the diversity of crowd work during disasters, or specific enough to highlight the unique dynamics of information organizing by the crowd in that context. In making this argument, this paper first unpacks the crowdsourcing term, examining its roots in open source development and outsourcing business models, and tying it to related concepts of human computation and collective intelligence. The paper then attempts to characterize several examples of crowd work during disasters using current definitions of crowdsourcing and existing models for human computation and collective intelligence, exposing a need for future research towards a framework for understanding crowd work.

Crowdsourcing Collective Emotional Intelligence

Rob Morris and Rosalind Picard (MIT)

One of the hallmarks of emotional intelligence is the ability to regulate emotions. While emotions can be regulated in many ways, a particularly powerful approach is cognitive reappraisal – a technique that involves reinterpreting the meaning of a thought or situation. Habitual use of this strategy is linked to many key indices of physical and emotional health, and laboratory studies show it can help down-regulate negative emotions, without incurring the physiological costs associated with other regulatory strategies. Unfortunately, cognitive reappraisal is not always easy to apply. Thinking flexibly about stressful thoughts and situations requires creativity and poise, faculties that often elude us when we need them the most.

In this paper, we propose an assistive technology that coordinates collective intelligence on demand, to help individuals reappraise stressful thoughts and situations. In two experiments, we assess key features of our design and we demonstrate the feasibility of crowdsourcing empathetic reappraisals with on demand workforces, such as Amazon's Mechanical Turk.

Paper Session 1B: Applications of Crowdsourcing

Dining Room East, MIT Faculty Club, 6th floor

Session chair: Panos Ipeirotis (New York University)

Markerless Motion Capture in the Crowd

Ian Spiro, Thomas Huston, and Christoph Bregler (New York University)

This work uses crowdsourcing to obtain motion capture data from video recordings. The data is obtained by information workers who click repeatedly to indicate body configurations in the frames of a video, resulting in a model of 2D structure over time. We discuss techniques to optimize the tracking task and strategies for maximizing accuracy and efficiency. We show visualizations of a variety of motions captured with our pipeline then apply reconstruction techniques to derive 3D structure.

Crowdsourcing Gaze Data Collection

Dmitry Rudoy, Dan B Goldman, Eli Shechtman, and Lihi Zelnik-Manor (Technion, Adobe)

Knowing where people look is a useful tool in many various image and video applications. However, traditional gaze tracking hardware is expensive and requires local study participants, so acquiring gaze location data from a large number of participants is very problematic. In this work we propose a crowdsourced method for acquisition of gaze direction data from a virtually unlimited number of participants, using a robust self-reporting mechanism. Our system collects temporally sparse but spatially dense points-of-attention in any visual information. We apply our approach to an existing video data set and demonstrate that we obtain results similar to traditional gaze tracking. We also explore the parameter ranges of our method, and collect gaze tracking data for a large set of YouTube videos.

Analytic Methods for Optimizing Realtime Crowdsourcing

Michael S. Bernstein, David R. Karger, Robert C. Miller, and Joel R. Brandt (MIT, Adobe)

Realtime crowdsourcing research has demonstrated that it is possible to recruit paid crowds within seconds by managing a small, fast-reacting worker pool. Realtime crowds enable crowd-powered systems that respond at interactive speeds: for example, cameras, robots and instant opinion polls. So far, these techniques have mainly been proof-of-concept prototypes: research has not yet attempted to understand how they might work at large scale or optimize their cost/performance trade-offs. In this paper, we use queueing theory to analyze the retainer model for realtime crowdsourcing, in particular its expected wait time and cost to requesters. We provide an algorithm that allows requesters to minimize their cost subject to performance requirements. We then propose and analyze three techniques to improve performance: push notifications, shared retainer pools, and precruitment, which involves recalling retainer workers before a task actually arrives. An experimental validation finds that precruited workers begin a task 500 milliseconds after it is posted, delivering results below the one-second cognitive threshold for an end-user to stay in flow.

12:30 - 1:45 PM

Lunch

Dining Room 5, MIT Faculty Club 6th floor

1:45 - 3:30 PM

Plenary Talks

Wong Auditorium, Tang Center

Session Chair: Luis von Ahn (Carnegie Mellon)

Crowdsourcing: Quality Management and Scalability

Panos Ipeirotis (New York University)

Social Design for Collective Intelligence

Robert Kraut (Carnegie Mellon)

Group Identity, Culture, and Collective Intelligence

Winter Mason (Stevens Institute of Technology)

Crowd Computing and Human Computation Algorithms

Rob Miller (MIT)

3:30 - 4:00 PM

Break

Ting Foyer, Tang Center

4:00 - 5:45 PM

Plenary Talks

Wong Auditorium, Tang Center

Session Chair: Eric Horvitz (Microsoft Research)

Perspectives on Intelligence from Within and Outside the Collective

Elizabeth Churchill (Yahoo! Research)

Cultural Practices, Emergent Patterns, and Collective Intelligence

Ed Hutchins (UCSD)

Managing the Social Dynamics of Collective Intelligence

Ben Shneiderman (Maryland)

Human Computing's Oppenheimer Question

Jonathan Zittrain (Harvard)

5:45 - 7:00 PM

Local Lab Visits

MIT Center for Collective Intelligence

NE25 (Five Cambridge Center), Corner of Main St. and Ames St., 7th Floor

The recent successes of systems like Google, Wikipedia and many others suggest that the time is now ripe for many more such systems, and the goal of the MIT Center for Collective Intelligence is to understand how to take advantage of these possibilities. The center's open house will highlight research on measuring collective intelligence, the Climate CoLab, collaborative innovation networks, and other current projects.

The CCI open house will be at NE25 (Five Cambridge Center, same building as Legal Seafood Restaurant), at the corner of Main St. and Ames St., one block from the Kendall T station. Enter via the main building lobby and go to the 7th Floor.

MIT Computer Science & Artificial Intelligence Laboratory (CSAIL)

32 Vassar St, Building 32, Corner of Main St. and Vassar St., Room 32-G882

The Computer Science and Artificial Intelligence Laboratory (CSAIL) is the largest interdepartmental lab at MIT, with over 800 faculty, researchers, and graduate students studying problems across the spectrum of computing. This lab tour will highlight the latest projects in CSAIL on social computing, crowd computing, cooperative work, and web science, from the User Interface Design group, the Haystack group, and the Decentralized Information group.

The CSAIL demos can be found in the Stata Center (building 32, located at 32 Vassar St). The demo session is in the Hewlett Reading Room, 32-G882. Enter the building from the main entrance, nearest the corner of Vassar St and Main St, then take the first set of elevators on the right up to the 8th floor, then just follow the signs.

MIT Media Lab

75 Amherst Street, Building E14, Corner of Amherst St. and Ames St.

The MIT Media Lab brings together designers, engineers, artists, and scientists to develop and study technologies that transform the ways people live, work, learn, and play. Media Lab researchers are dedicated to inventing a better future, creating technologies that not only augment human capabilities, but also relate to people on more "human" terms and empower people to invent new possibilities for themselves and their communities.

This lab tour will highlight projects from the Social Computing group (led by Sep Kamvar), the Lifelong Kindergarten group (led by Mitchel Resnick), and the Tangible Media Group (led by Hiroshi Ishii). Come to the new Media Lab building (MIT building E14) at 75 Amherst Street, on the corner of Amherst and Ames. The demos will be in the research group lab spaces: room E14-274 for Social Computing, E14-445 for Lifelong Kindergarten, and E14-3F for Tangible Media.

6:45 - 9:00 PM

Poster Session & Conference Dinner

MIT Museum

Social aspects of virtual teams

Daphna Shwarts-Asher (College for Academic Studies)

The Wikipedian revolution: collective intelligence in the Egyptian Blogosphere

Gloria Mark, Justin Chung, Ban Al-Ani, and Jennifer Jones (UCI)

Collective creativity: Where we are and where we might go

Lixiu Yu, Jeffrey V. Nickerson, and Yasuaki Sakamoto (Carnegie Mellon and Stevens Institute of Technology)

Crowd Memory: Learning in the collective

Walter S. Lasecki, Samuel White, Kyle I. Murray, and Jeffrey P. Bigham (University of Rochester)

Patterns of social influence in networks of situated cognitive agents

Russell C. Thomas and John S. Gero (George Mason University)

Who is authoritative? Understanding reputation mechanisms in Quora

Sharoda A. Paul, Lichan Hong, and Ed. H. Chi (Palo Alto Research Center)

Leading the collective: Social capital and the development of leaders in core-periphery organizations

Benjamin Collier and Robert Kraut (Carnegie Mellon)

Macrosopes: models for collective decision making

Subramanian Ramamoorthy, András Z. Salamon, and Rahul Santhanam (University of Edinburgh)

Collective cognitive authority: expertise location via social labeling

Terrell G. Russell (University of North Carolina at Chapel Hill)

Motivations for participation in socially networked collective intelligence systems

Jon Chamberlain (University of Essex)

A Computational Analysis of Collective Discourse

Vahed Qazvinian and Dragomir R. Radev (University of Michigan)

GalaxySearch – Discovering the Knowledge of Many by Using Wikipedia as a Meta-Searchindex

Hauke Fuehres, Peter A. Gloor, Michael Henninger, Reto KleeB, and Keiichi Nemoto (University of Cologne, MIT, U. App.Sci. NW Switzerland, Fuji Xerox)

Broadcast search in Innovation Contests: Case for Hybrid Models

Thomas Gegenhuber and Marko Hrelja (Johannes Kepler University)

The effects of prediction market design and price elasticity on trading performance of users: an experimental analysis

Ivo Blohm, Christoph Riedl, Johann Füller, Orhan Köroglu, Jan Marco Leimeister, and Helmut Krcmar (Technische Universität München, Harvard, Universität Innsbruck, Universität Kassel)

Rationale awareness for quality assurance in iterative human computation processes

Lu Xiao (University of Western Ontario)

Automatic Prediction of Small Group Performance in Information Sharing Tasks

Wen Dong, Bruno Lepri, and Alex (Sandy) Pentland (MIT)

Friday April 20, 2012

8:00 - 9:00 AM

Registration and Breakfast

Ting Foyer, Tang Center

9:00 - 10:45 AM

Plenary Talks

Wong Auditorium, Tang Center

Session Chair: Paul Resnick (University of Michigan)

Information Propagation and Filtering Over Social Networks

Lada Adamic (Michigan)

Aristotle's Hypothesis and the Relationship Between Individual Intelligence and Collective Intelligence

Christopher Chabris (Union College)

Accessing the Ideas Cloud

Karim Lakhani (Harvard)

A Tale of Two Models of Collective Accuracy: Generated and Interpreted Signals

Scott Page (University of Michigan)

10:45 - 11:15 AM

Break

Ting Foyer, Tang Center

11:15 - 12:30 PM

Paper Session 2A: Defining Collective Intelligence

Wong Auditorium, Tang Center

Session chair: TBA

An Existing, Ecologically-Successful Genus of Collectively Intelligent Artificial Creatures

Benjamin Kuipers (University of Michigan)

People sometimes worry about the Singularity (Vinge 1993, Kurzweil 2005), or about the world being taken over by artificially intelligent robots. I believe the risks of these are very small. However, few people recognize that we already share our world with artificial creatures that participate as intelligent agents in our society: corporations. Our planet is inhabited by two distinct kinds of intelligent beings --- individual humans and corporate entities --- whose natures and interests are intimately linked. To co-exist well, we need to find ways to define the rights and responsibilities of both individual humans and corporate entities, and to find ways to ensure that corporate entities behave as responsible members of society.

Collective Intelligence in Humans: A Literature Review

Juho Salminen (Lappeenranta University of Technology)

This literature review focuses on collective intelligence in humans. A keyword search was performed on the Web of Knowledge and selected papers were reviewed in order to reveal themes relevant to collective intelligence. Three levels of abstraction were identified in discussion about the phenomenon: the micro-level, the macro-level and the level of emergence. Recurring themes in the literature were categorized under the above-mentioned framework and directions for future research were identified.

Toward A Comparative Cognitive History: Archimedes and D. H. J. Polymath

Lav R. Varshney (IBM Research)

Is collective intelligence just individual intelligence writ large, or are there fundamental differences? This position paper argues that a cognitive history methodology can shed light into the nature of collective intelligence and its differences from individual intelligence. To advance this proposed area of research, a small case study on the structure of argument and proof is presented. Quantitative metrics from network science are used to compare the artifacts of deduction from two sources. The first is the work of Archimedes of Syracuse, putatively an individual, and of other ancient Greek mathematicians. The second is work of the Polymath Project, a massively collaborative mathematics project that used blog posts and comments to prove new results in combinatorics.

Paper Session 2B: Statistical and Game Theoretical Methods

Dining Room East, MIT Faculty Club, 6th floor

Session chair: Yiling Chen (Harvard)

Learning to Predict the Wisdom Of Crowds

Seyda Ertekin, Haym Hirsh, and Cynthia Rudin (MIT, Rutgers)

The problem of “approximating the crowd” is that of estimating the crowd’s majority opinion by querying only a subset of it. Algorithms that approximate the crowd can intelligently stretch a limited budget for a crowdsourcing task. We present an algorithm, “CrowdSense,” that works in an online fashion to dynamically sample subsets of labelers based on an exploration/exploitation criterion. The algorithm produces a weighted combination of a subset of the labelers’ votes that approximates the crowd’s opinion.

When Majority Voting Fails

Yu-An Sun and Christopher Dance (Xerox)

Quality assurance remains a key topic in human computation research. Prior work indicates that majority voting is effective for low difficulty tasks, but has limitations for harder tasks. This paper explores two methods of addressing this problem: tournament selection and elimination selection, which exploit 2-, 3- and 4-way comparisons between different answers to human computation tasks. Our experimental results and statistical analyses show that both methods produce the correct answer in noisy human computation environment more often than majority voting. Furthermore, we find that the use of 4-way comparisons can significantly reduce the cost of quality assurance relative to the use of 2-way comparisons.

Crowd & Prejudice: An Impossibility Theorem for Crowd Labelling without a Gold Standard
Nicolas Della Penna and Mark D. Reid (ANU NICTA)

A common use of crowd sourcing is to obtain labels for a dataset. Several algorithms have been proposed to identify uninformative members of the crowd so that their labels can be disregarded and the cost of paying them avoided. One common motivation of these algorithms is to try and do without any initial set of trusted labeled data. We analyse this class of algorithms as mechanisms in a game-theoretic setting to understand the incentives they create for workers. We find an impossibility result that without any ground truth, and when workers have access to commonly shared 'prejudices' upon which they agree but are not informative of true labels, there is always equilibria where all agents report the prejudice. A small amount of gold standard data is found to be sufficient to rule out these equilibria.

12:30 - 1:45 PM

Lunch

Dining Room 5, MIT Faculty Club 6th floor

1:45 - 3:30 PM

Paper Session 3A: Crowd and Social Dynamics

Wong Auditorium, Tang Center

Session chair: Lada Adamic (University of Michigan)

Group Foraging in Dynamic Environments

Michael E. Roberts, Sam Cheesman, and Patrick McMullen (DePauw University)

Previous human foraging experiments have shown that human groups routinely undermatch environmental resources much like other animal species. In this experiment, we test whether humans also selectively rely on others as information sources when the environmental state is uncertain, and we also test whether overt signals of other foragers' success influence group matching behavior and group adaptation to a changing environment. The results show evidence of reliance on social information in specific conditions, but participants were primarily influenced by their individual assessments of food location rather than the success of other foragers.

Effects of Social Influence on the Wisdom of Crowds

Pavlin Mavrodiev, Claudio J. Tessone, and Frank Schweitzer (ETH Zurich)

Previous human foraging experiments have shown that human groups routinely undermatch environmental resources much like other animal species. In this experiment, we test whether humans also selectively rely on others as information sources when the environmental state is uncertain, and we also test whether overt signals of other foragers' success influence group matching behavior and group adaptation to a changing environment. The results show evidence of reliance on social information in specific conditions, but participants were primarily influenced by their individual assessments of food location rather than the success of other foragers.

Thermodynamic Principles in Social Collaborations

Huan-Kai Peng, Ying Zhang, Peter Pirolli, and Tad Hogg (Carnegie Mellon, Palo Alto Research Center, Inst. for Molecular Manufacturing)

A thermodynamic framework is presented to characterize the evolution of efficiency, order, and quality in social content production systems, and this framework is applied to the analysis of Wikipedia. Contributing editors are characterized by their (creative) energy levels in terms of number of edits. We develop a definition of entropy that can be used to analyze the efficiency of the system as a whole, and relate it to the evolution of power-law distributions and a metric of quality. The concept is applied to the analysis of eight years of Wikipedia editing data and results show that (1) Wikipedia has become more efficient during its evolution and (2) the entropy-based efficiency metric has high correlation with observed readership of Wikipedia pages.

Paper Session 3B: Communities

Dining Room East, MIT Faculty Club, 6th floor

Session chair: Matthew Sagalnik (Princeton)

Visualizing Collective Discursive User Interactions in Online Life Science Communities

Dhiraj Murthy, Alexander Gross, and Stephanie Bond (Bowdoin College)

This paper highlights the rationale for the development of BioViz, a tool to help visualize the existence of collective user interactions in online life science communities. The first community studied has approximately 22,750 unique users and the second has 35,000. Making sense of the number of interactions between actors in these networks in order to discern patterns of collective organization and intelligent behavior is challenging. One of the complications is that forums - our object of interest - can vary in their purpose and remit (e.g. the role of gender in the life sciences to forums of praxis such as one exploring the cell line culturing) and this shapes the structure of the forum organization itself. Our approach took a random sample of 53 forums which were manually analyzed by our research team and interactions between actors were recorded as arcs between nodes. The paper focuses on a discussion of the utility of our approach, but presents some brief results to highlight the forms of knowledge that can be gained in identifying collective group formations. Specifically, we found that by using a matrix-based visualization approach, we were able to see patterns of collective behavior which we believe is valuable both to the study of collective intelligence and the design of virtual organizations.

Collaborative Development in Wikipedia

Gerald C. Kane and Sam Ransbotham (Boston College)

Using 16,068 articles in Wikipedia's Medicine Wikiproject, we study the relationship between collaboration and quality. We assess whether certain collaborative patterns are associated with information quality in terms of self-evaluated quality and article viewership. We find that the number of contributors has a curvilinear relationship to information quality, more contributors improving quality but only up to a certain point. Other articles that its collaborators work on also influences the quality of an information artifact, creating an interdependent network of artifacts and contributors. Finally, we see evidence of a recursive relationship between information quality and contributor activity, but that this recursive relationship attenuates over time.

Re-Differentiation as Collective Intelligence: The Ktunaxa Language Online Community
Christopher Horsethief (Gonzaga University)

This paper presents preliminary results of an investigation of collectively intelligent behavior in a Native North American speech community. The research reveals several independently initiated strategies organized around the collective problem of language endangerment. Specifically, language speakers, acting without benefit of a coordinator, presented instances self-organizing efforts to reverse the historical language simplification resulting from cultural trauma. These acts of collective intelligence serve to reduce entropy in the speech community identity.

3:00 - 3:30 PM

Break

Ting Foyer, Tang Center

3:30 - 5:15 PM

Plenary talks

Wong Auditorium, Tang Center

Session Chair: Duncan Watts (Yahoo! Research)

*When Rational Choice Erases or Magnifies Boundedly-Rational Choices in Economics:
Evidence From LUPI Lottery Games And Price Bubble Experiments*
Colin Camerer (Caltech)

Mechanism Design for Prediction Markets
Yiling Chen (Harvard)

Introduction to Wiki Surveys
Matthew Salganik (Princeton)

Forecasting Elections: Voter Intentions versus Expectations
Justin Wolfers (Wharton)