Leveraging Computational Social Science to Address Grand Societal Challenges

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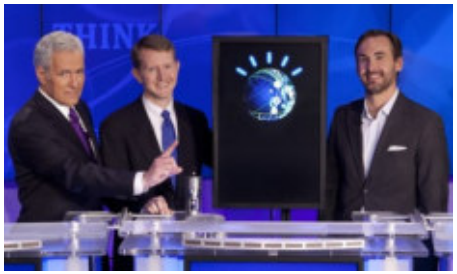
Three grand societal challenges

- Disaster Response: Katrina

- Accelerating Innovation: Watson



- Scaling up Global Health Solutions: Ananya

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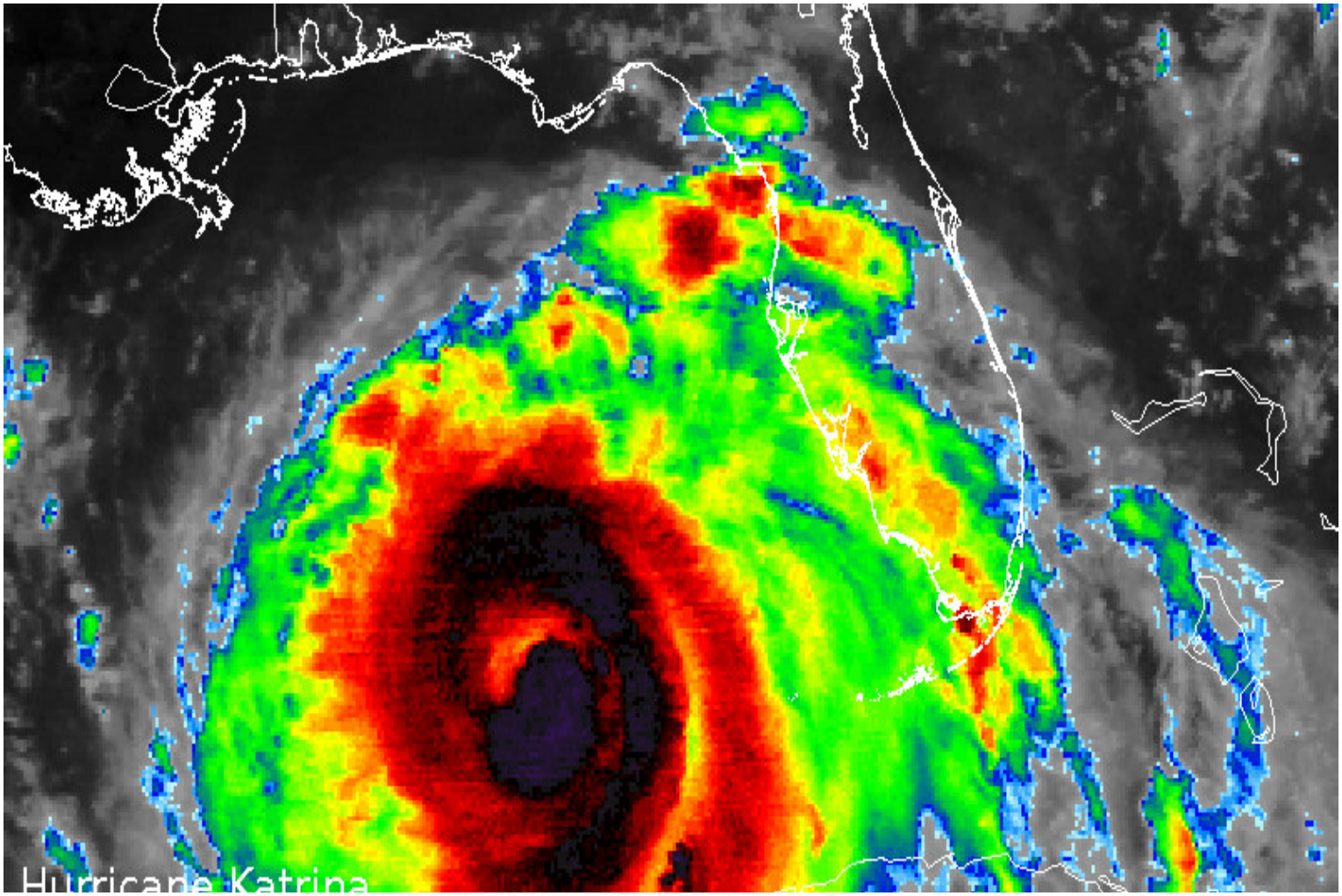
Hurricane Katrina: August 23, 2005



7 months later ….

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POLITICS

Hurricane Katrina SPECIAL REPORT

» Rebuilding | Landmarks | Storm & Flood | Special report

Report: Criticism of FEMA's Katrina response deserved

Inspector general: 'Much of the criticism is warranted'

From Mike M. Ahlers
CNN Washington Bureau

Friday, April 14, 2006 Posted: 1900 GMT (0300 HKT)

WASHINGTON (CNN) -- After being roundly criticized in a slew

story.katrina.flooding.gi.jpg

Three grand societal challenges

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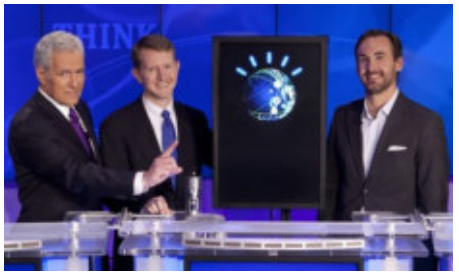

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Building the Team That Built Watson

Qaiser Muhammad/The New York Times

David Ferrucci led the team behind Watson, the victorious "Jeopardy" computer. "For the scientist in me," he says, "it was an irresistible challenge.".

By DAVID A. FERRUCCI
Published: January 7, 2012

THE assignment was one of the biggest challenges in the field of artificial intelligence: build a computer smart enough to beat grand champions at the game of "Jeopardy."

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Smarter Than You Think: What Is I.B.M.'s Watson? (June 20, 2010)

Computer Wins on 'Jeopardy!': Trivial, It's Not (February 17, 2011)

When I stepped up to lead the team at I.B.M. that would create this computer, called Watson, I knew the task would be formidable. The computer would have to answer an unpredictable variety of complex questions with confidence, precision and speed. And we would put it to the test in a publicly televised "human versus machine" competition against the best players of all time.

It was not easy finding people to join the Watson team in the mid-1990s. Most scientists I approached favored their own individual projects and career tracks. And who could blame them? This was an effort that, at best, would mingle the contributions of many. At its worst it would fail miserably, undermining the credibility of all involved.

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New York Times
1/7/2012

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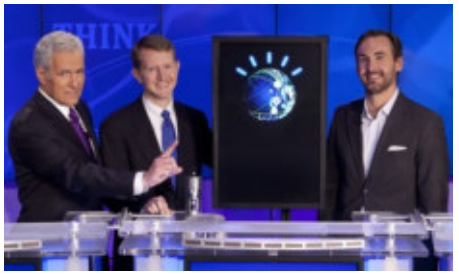

- Scaling up Global Health Solutions:
  Ananya

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The Tragedy of Neonatal Mortality

"Every year, three hundred thousand mothers and more than six million children die around the time of birth, largely in poorer countries."

"Most of these deaths are due to events that occur during or shortly after delivery"

"Death rates in India have fallen, but they're still ten times greater than in high-income countries like …"

Atul Gawande (July 29, 2013): How Do Good Ideas Spread? : The New Yorker
http://www.newyorker.com/reporting/2013/07/29/130729fa_fact_gawan

Chlorhexidine:
A Possible Tool to Address The Tragedy

Information

USAID FROM THE AMERICAN PEOPLE

MCHIP Maternal and Child Health Integrated Program

Who We Are | What We Do | Where We Work | Media Center | Tools and Resources

Home › Blogs › MCHIP's blog

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A New Tool for Newborn Health: Chlorhexidine

http://www.mchip.net/node/877

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Proof of Chlorhexidine's potential

Using a doll to show how to apply chlorhexidine properly in Nepal. (Photo courtesy of Monika Gutestam/Save the Children.)

*"A community cluster randomized controlled trial was done in Nepal, with results published in 2006 (Mullany). The trial demonstrated **24% lower mortality** among those randomized to chlorhexidine than those in the control group."*

*"Following publication of the Nepal study, replication trials were started in Bangladesh and Pakistan and completed in 2010. Results have been published recently in the Lancet (lead authors Arifeen and Soofi, respectively). All three trials showed significant benefit; across the three, **newborn mortality was reduced by about 1/5**th."*

http://www.mchip.net/node/877

The Case for "Scale Up"
Of the Use of Chlorhexidine to reduce Neonatal Mortality

"Chlorhexidine is very cheap. The amount of the chemical itself that's required per newborn costs only pennies. The formulated packaged product used in Nepal is now being procured in bulk for less than $0.15 per tube"

"Given the evidence now available on the effectiveness of chlorhexidine application to the cord-stump, its low cost, and the relative simplicity of implementation, **this intervention is being recognized as an extremely promising new weapon in our battle to reduce newborn mortality**—particularly in high mortality burden settings where, typically, hygiene conditions represent an important infection risk for newborns."

http://www.mchip.net/node/877

Key Takeaway

- We are in the midst of a perfect storm for leveraging Computational Social Science to understand and address grand societal challenges because of recent developments in:
  - *Theories*: Theoretical advances to address fundamental questions about existing and emerging socio-technical phenomena
  - *Methods*: Advances in creating "ensemble" methodologies based on theory-driven, data-driven and computational modeling analytic strategies
  - *Data*: Developments that provide the technological capability to capture, store, fuse, and query large tracts of behavioral data
  - *Computational infrastructure*: The surge in cloud computing and petascale computing that are critical to face the computational challenges in observing and analyzing these data

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  - How do we utilize this knowledge to design sequencing strategies that optimize the speed and scope of scale-up at minimal cost?

Theory: Questions we couldn't answer because of the ….

Challenges of empirically testing, extending, and exploring theories … until now

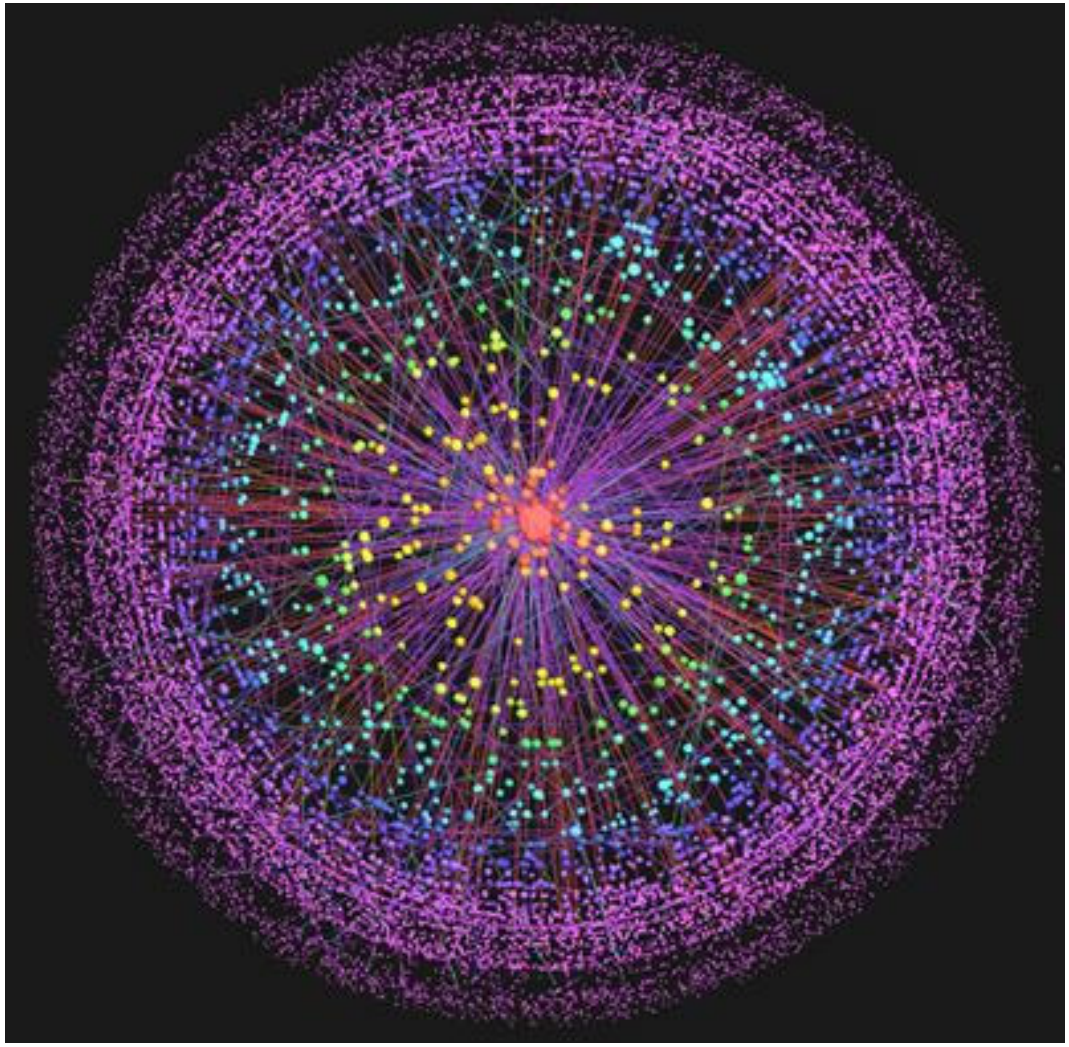
The Hubble telescope: $2.5 billion

Source: David Lazer

CERN particle accelerator: $1 billion/year

Source: David Lazer

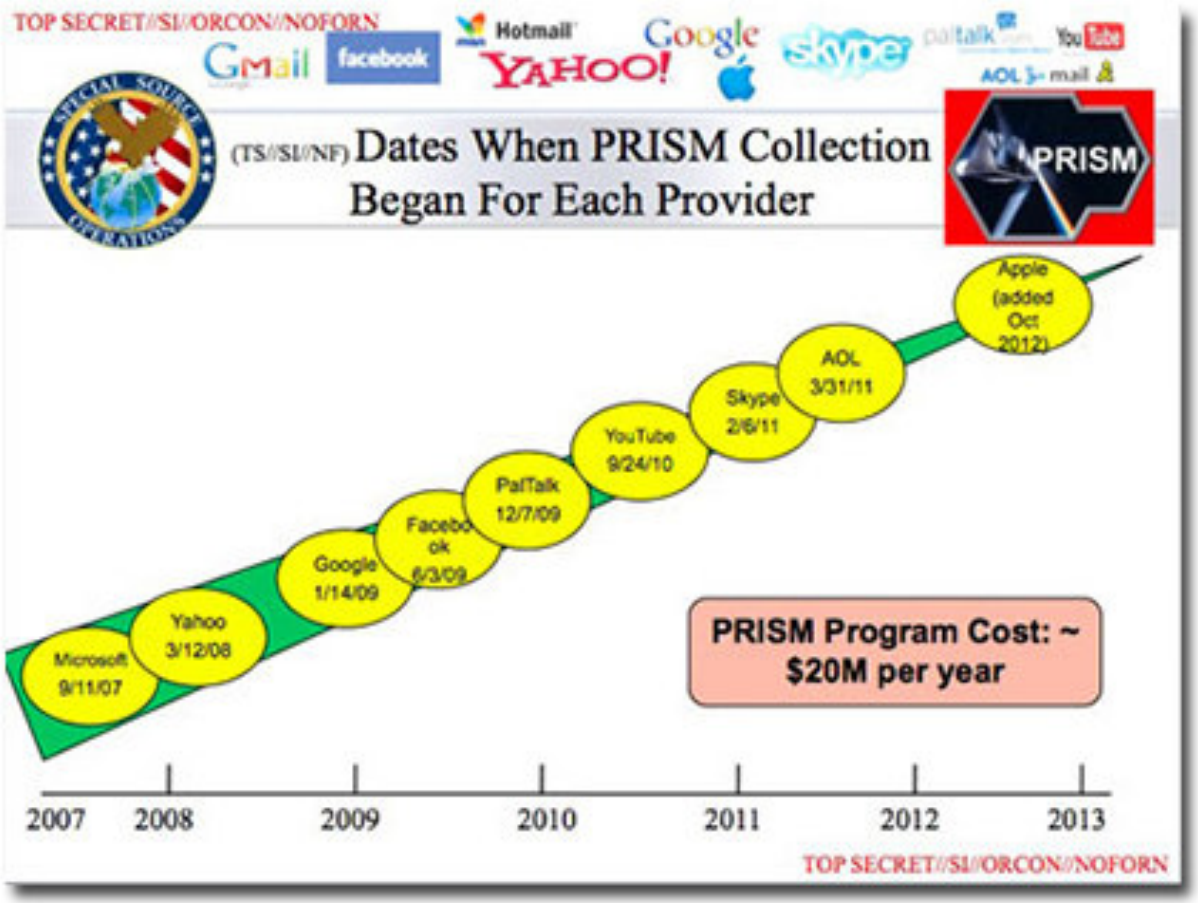
The Web/Internet: priceless*



Source: David Lazer

** Apologies to MasterCard*

The Web/Internet: priceless*
…. Or maybe not



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SOCIAL SCIENCE

Computational Social Science

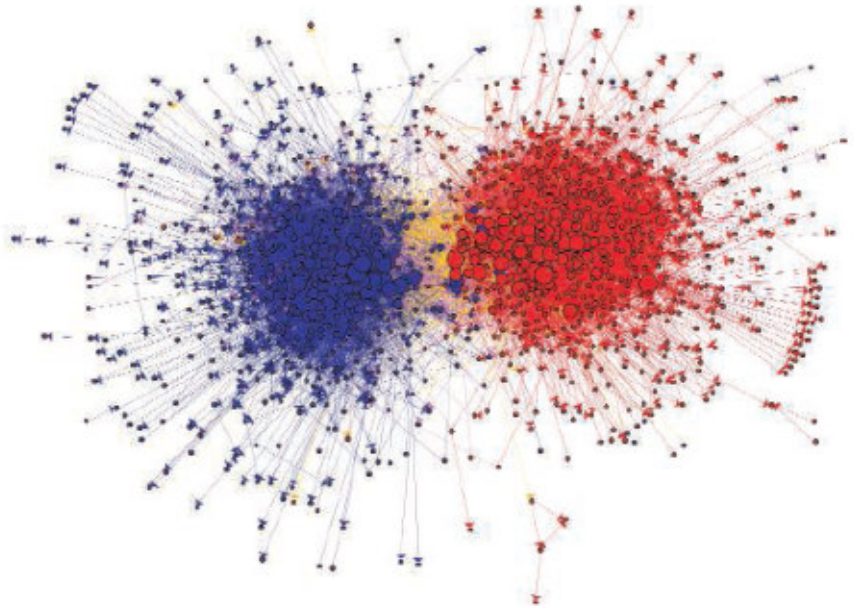
A field is emerging that leverages the capacity to collect and analyze data at a scale that may reveal patterns of individual and group behaviors.

David Lazer,[1] Alex Pentland,[2] Lada Adamic,[3] Sinan Aral,[2,4] Albert-László Barabási,[5] Devon Brewer,[6] Nicholas Christakis,[1] Noshir Contractor,[7] James Fowler,[8] Myron Gutmann,[3] Tony Jebara,[9] Gary King,[1] Michael Macy,[10] Deb Roy,[2] Marshall Van Alstyne[2,11]

We live life in the network. We check our e-mails regularly, make mobile phone calls from almost any location, swipe transit cards to use public transportation, and make purchases with credit cards. Our movements in public places may be captured by video cameras, and our medical records stored as digital files. We may post blog entries accessible to anyone, or maintain friendships through online social networks. Each of these transactions leaves digital traces that can be compiled into comprehensive pictures of both individual and group behavior, with the potential to transform our understanding of our lives, organizations, and societies.

The capacity to collect and analyze massive amounts of data has transformed such fields as biology and physics. But the emergence of a data-driven "computational social science" has been much slower. Leading journals in economics, sociology, and political science show little evidence of this field. But computational social science is occurring—in Internet companies such as Google and Yahoo, and in government agencies such as the U.S. National Security Agency. Computational social science could become the exclusive domain of private companies and government agencies. Alternatively, there might emerge a privileged set of academic researchers presiding over private data from which they produce papers that cannot be critiqued or replicated. Neither scenario will serve the long-term public interest of accumulating, verifying, and disseminating knowledge.

What value might a computational social science—based in an open academic environment—offer society, by enhancing understanding of individuals and collectives? What are the



Data from the blogosphere. Shown is a link structure within a community of political blogs (from 2004), where red nodes indicate conservative blogs, and blue liberal. Orange links go from liberal to conservative, and purple ones from conservative to liberal. The size of each blog reflects the number of other blogs that link to it. [Reproduced from (*8*) with permission from the Association for Computing Machinery]

[1]Harvard University, Cambridge, MA, USA. [2]Massachusetts Institute of Technology, Cambridge, MA, USA. [3]University of Michigan, Ann Arbor, MI, USA. [4]New York University, New York, NY, USA. [5]Northeastern University, Boston, MA, USA. [6]Interdisciplinary Scientific Research, Seattle, WA, USA. [7]Northwestern University, Evanston, IL, USA. [8]University of California–San Diego, La Jolla, CA, USA. [9]Columbia University, New York, NY, USA. [10]Cornell University, Ithaca, NY, USA. [11]Boston University, Boston, MA, USA. E-mail: david_lazer@harvard.edu. Complete affiliations are listed in the supporting online material.

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Theory:
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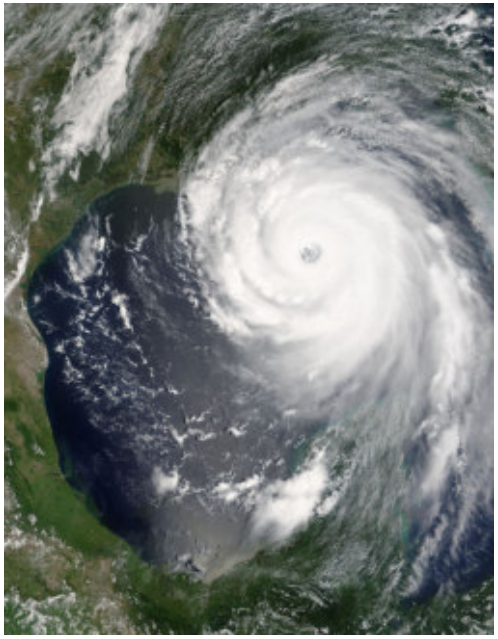
Hurricane Katrina 2005

Formed:	Aug 23, 2005
Dissipated:	Aug 31, 2005
Highest wind:	175 mph
Lowest press:	902 mbar
Damages:	$81.2 Billion
Fatalities:	>1,836



Map source: http://hurricane.csc.noaa.gov/

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SITREP Content

- Basic Format / Information
  1. Situation (What, Where, and When)
  2. Action in Progress
  3. Action Planned
  4. Probable Support Requirements and/or Support Available
  5. Other items

Typical SITREP

*Colorado Division of Emergency Management
SITUATION REPORT 2005-6
(Hurricane Katrina)
August 30, 2005*

Event Type: Hurricane Response

Situation: On August 29, Hurricane Katrina hit the gulf coast east of New Orleans. It was considered a Category 5 Hurricane, which brings winds of over 155mph and storm surge of 18 feet above normal. Massive property damage has occurred and undetermined number of deaths and injuries.

Colorado response to date include two deployments:
- Two members from the Division of Emergency Management to the Louisiana EOC, departed on August 29.

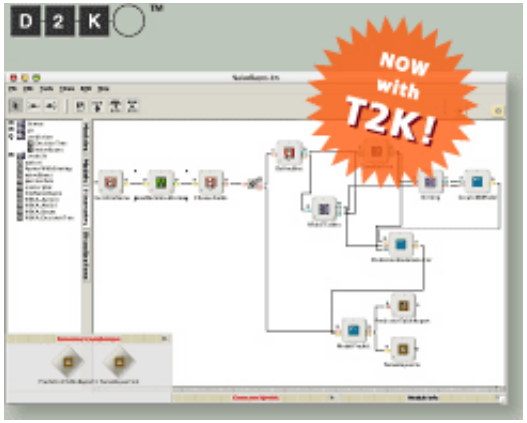
Weather Report: Katrina is moving toward the north-northeast near 18 mph. A turn toward the northeast and a faster forward speed is expected during the next 24 hours. This motion should bring the cent

Agencies Involved: Colorado Department of Military and Veteran Affairs, Department of Local Affairs, Division of Emergency Management, Governor's Office.* *

Additional Assistance Requested: Type III teams, consisting of Operations, Plans, and Logistics personnel (two individuals for each area). These teams could deploy to Alabama, Louisiana, and/or Mississippi. Teams will be at either working the State or Parish/County EOCs.

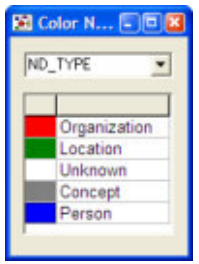
Text Analytics: Automated Coding

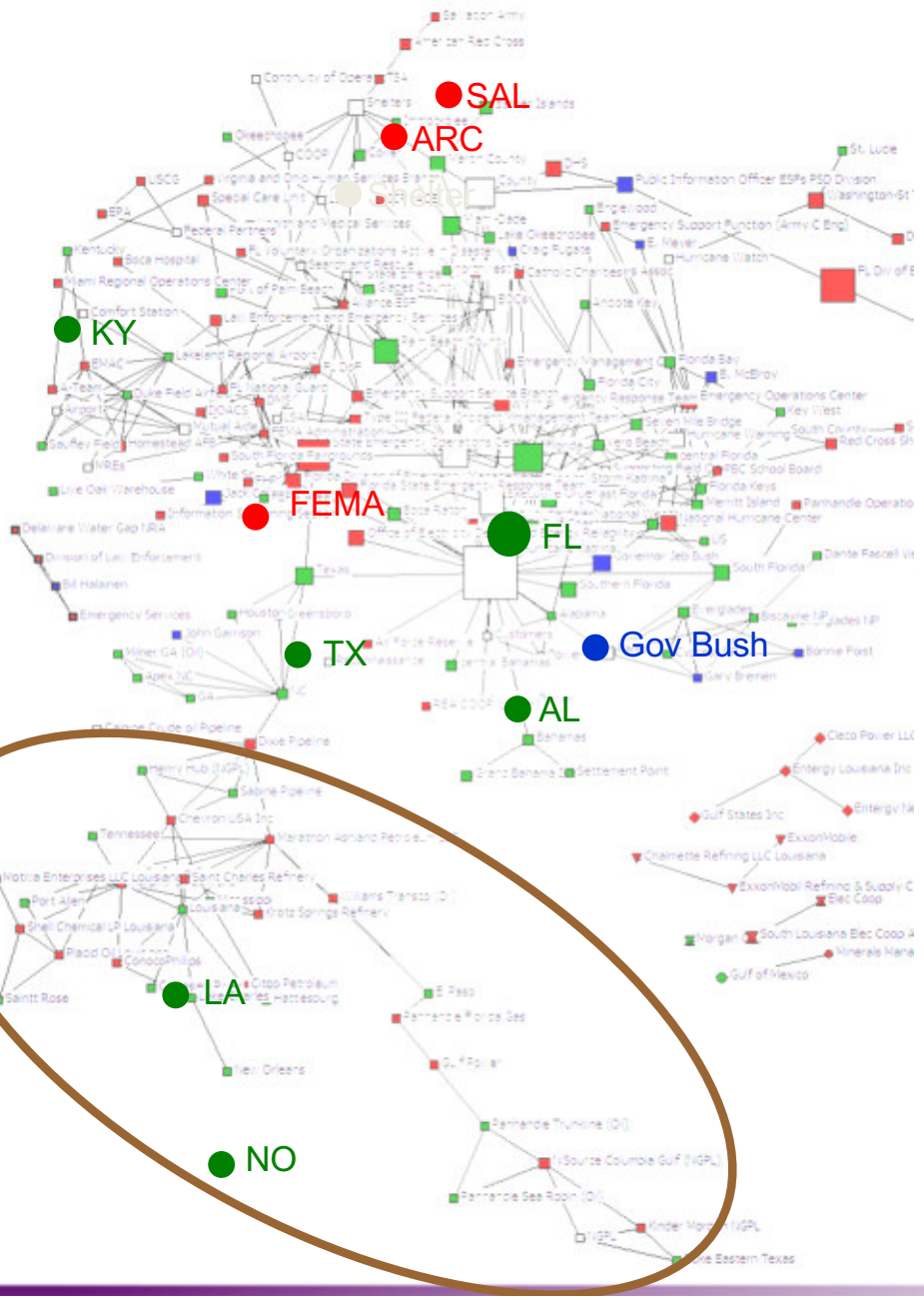
- T2K – The Text to Knowledge application environment is a rapid, flexible data mining and machine learning system
- Automated processing is done through creating itineraries that combine processing modules into a workflow
- Developed at the National Center for Supercomputing Applications, University of Illinois



Time Slice 1: 8/23 to 8/25/2005

Florida is the Topic of the Conversation





Petroleum Network formed Early

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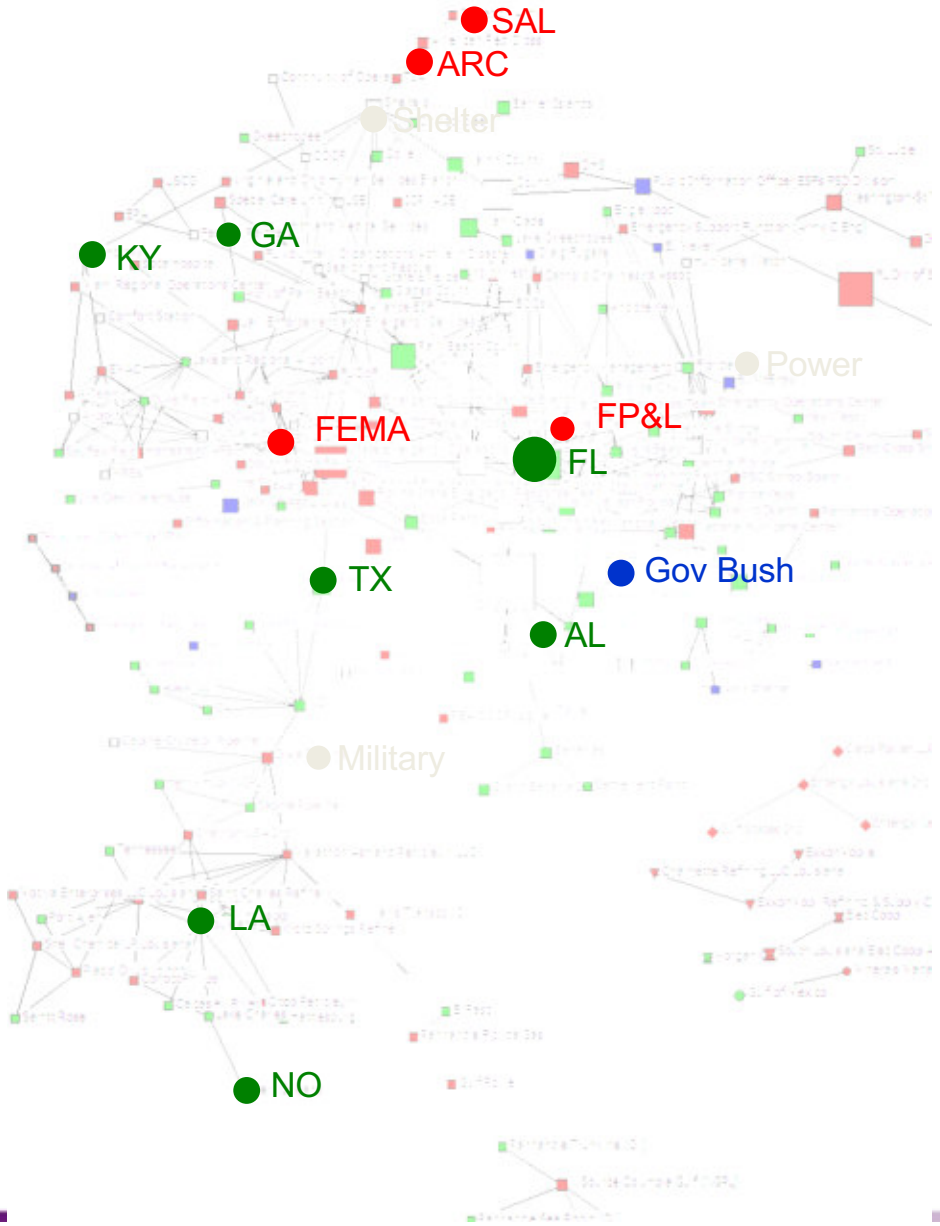
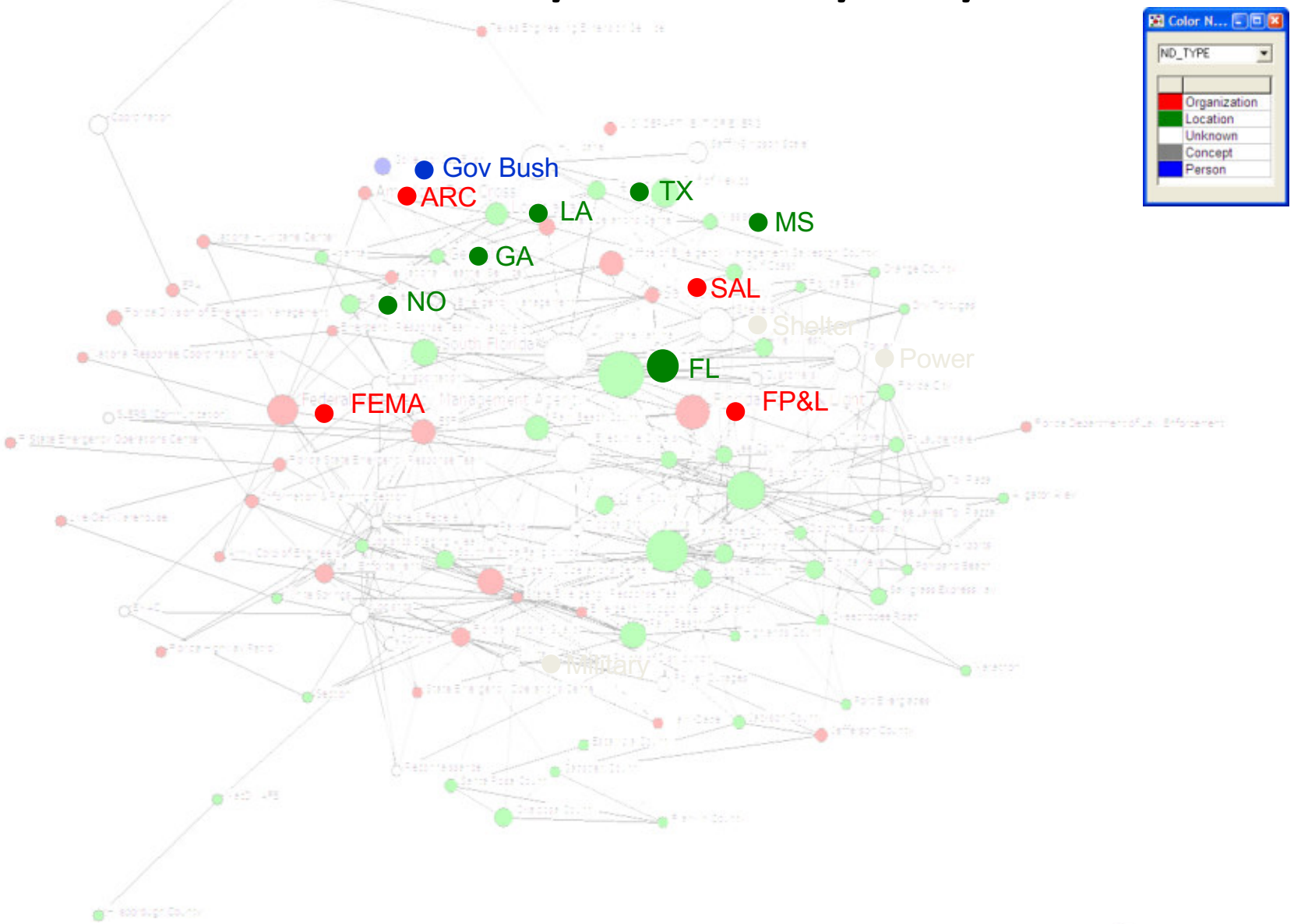
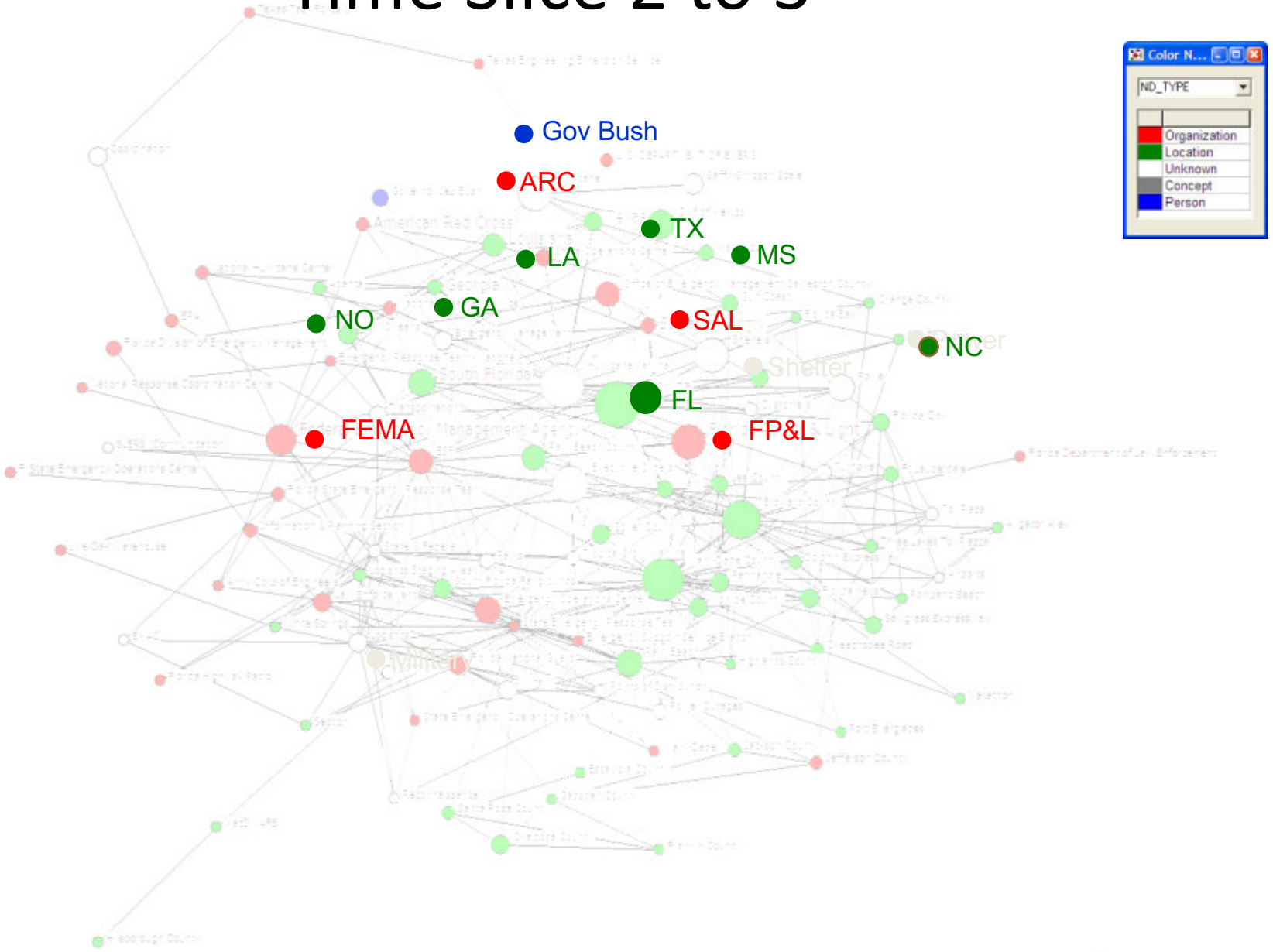
Time Slice 1 to 2



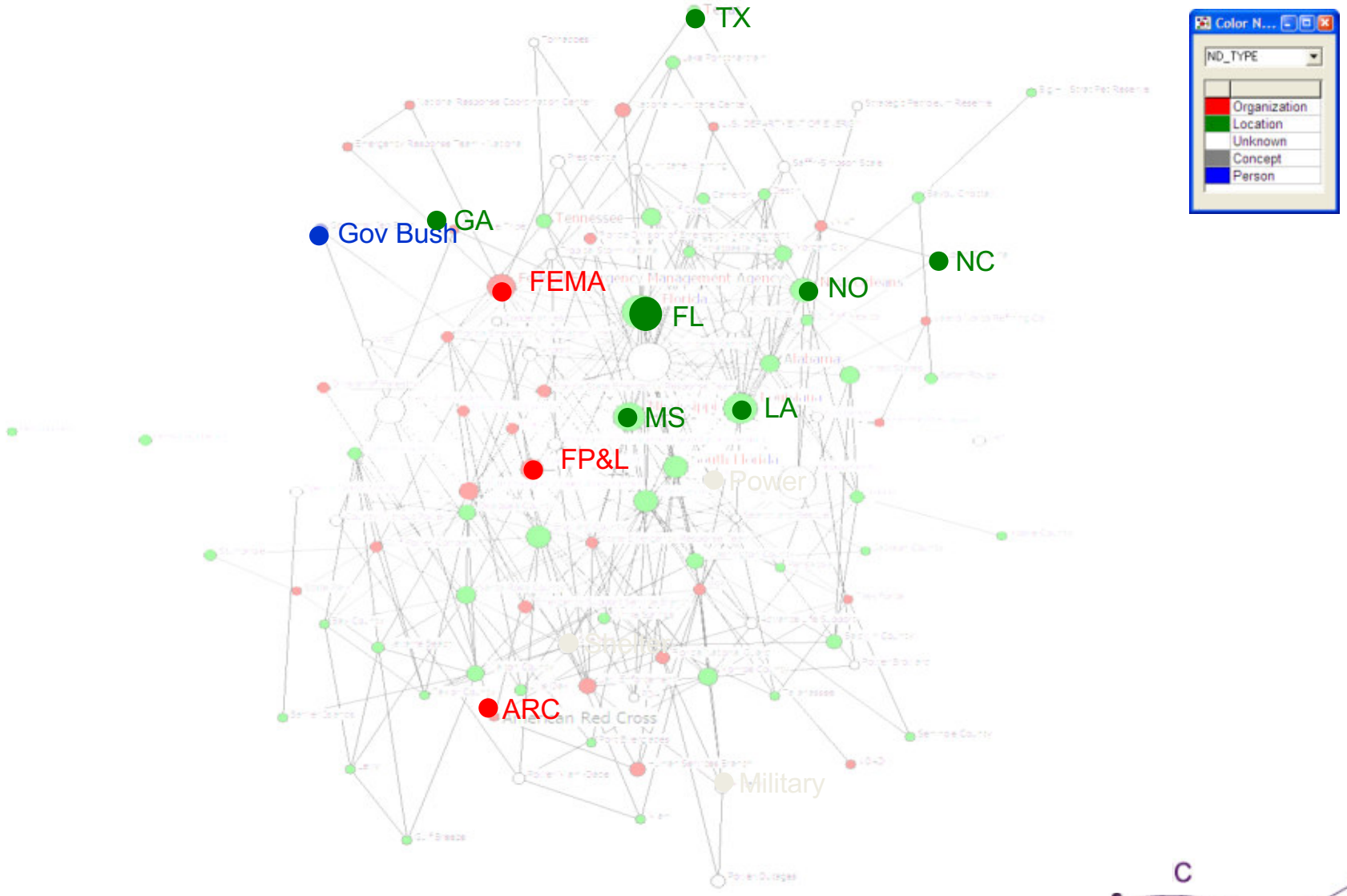
Time Slice 2: 8/26 to 8/27/2005



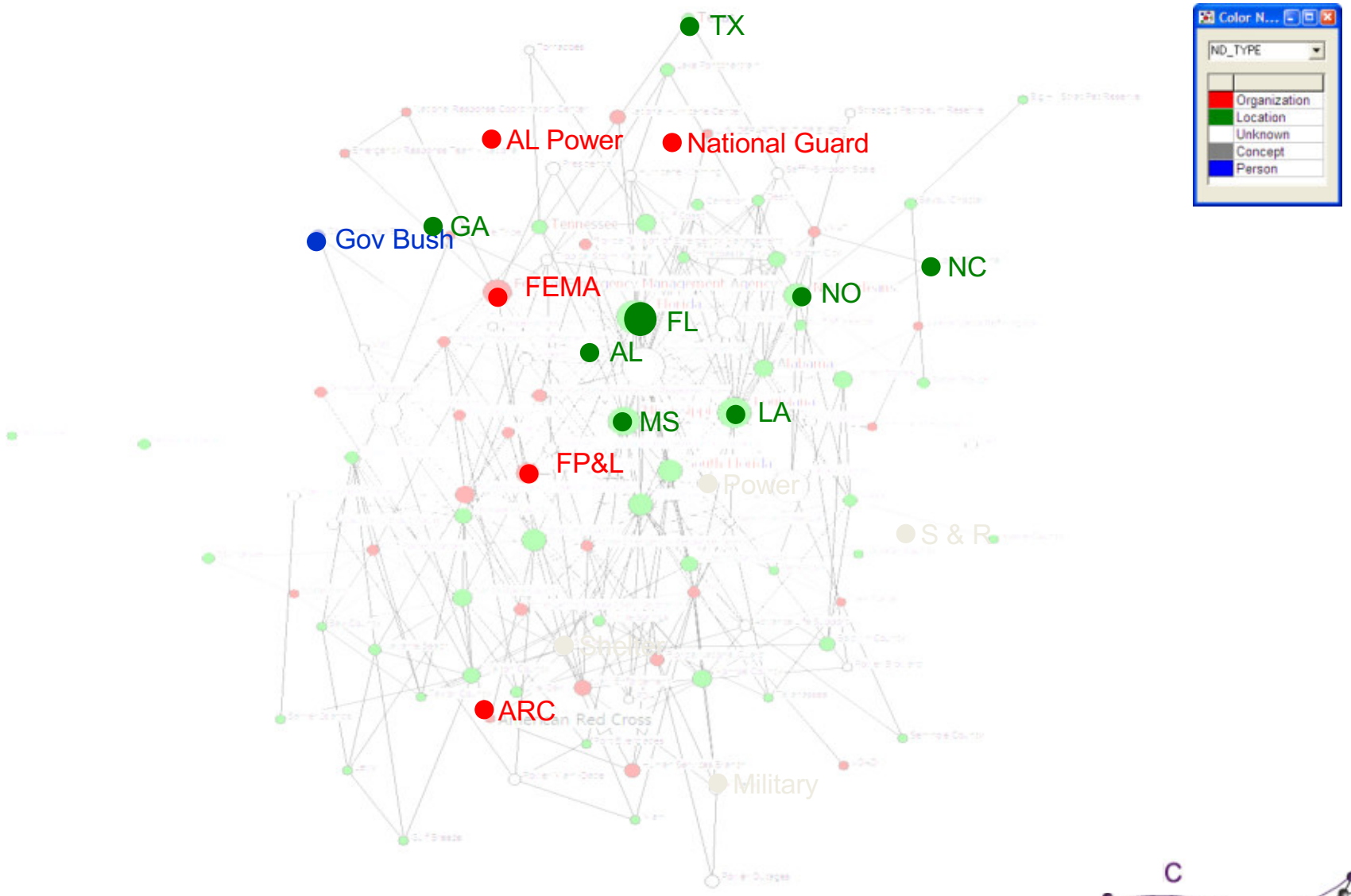
Time Slice 2 to 3



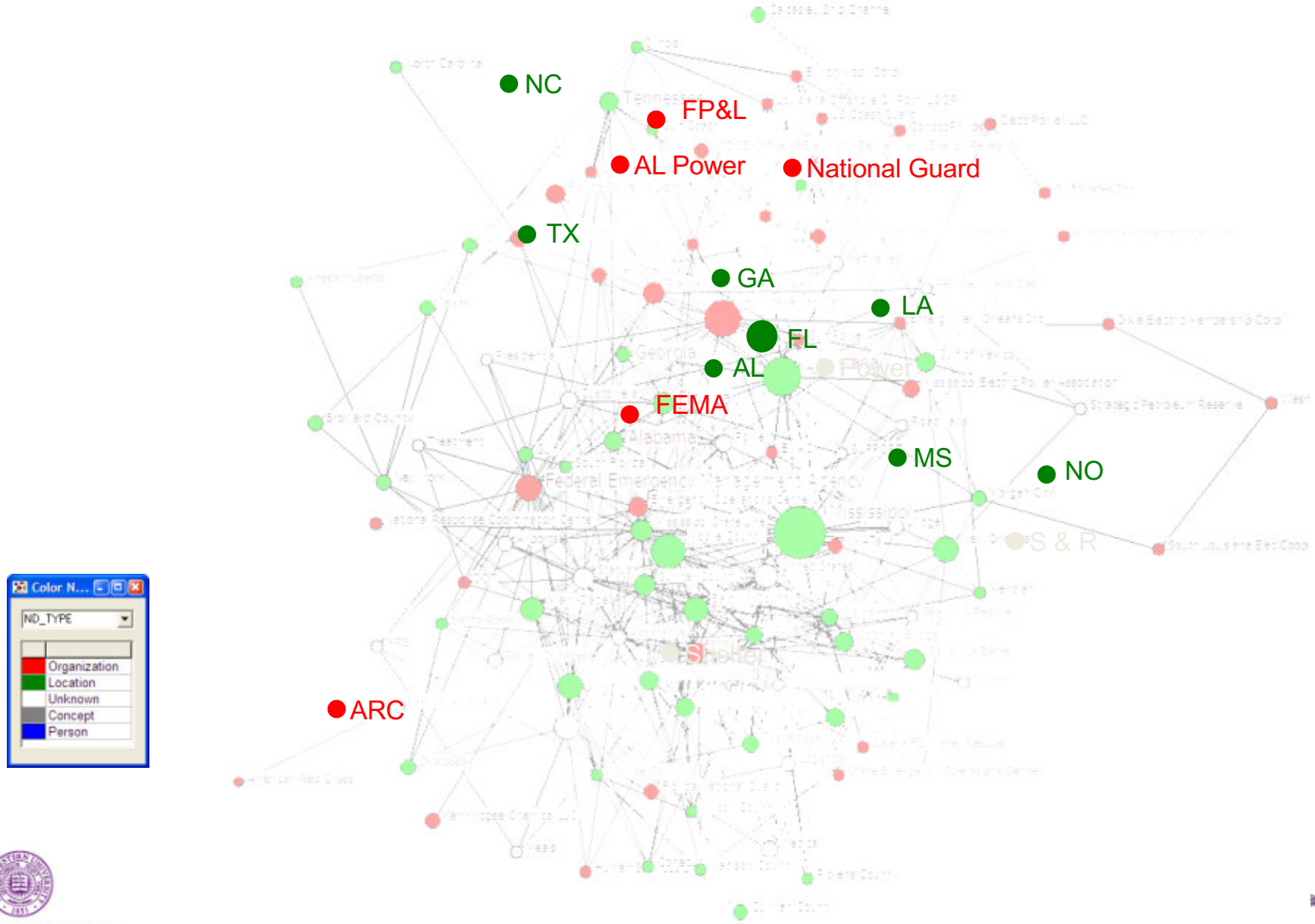
Time Slice 3: 8/28 to 8/29/2005



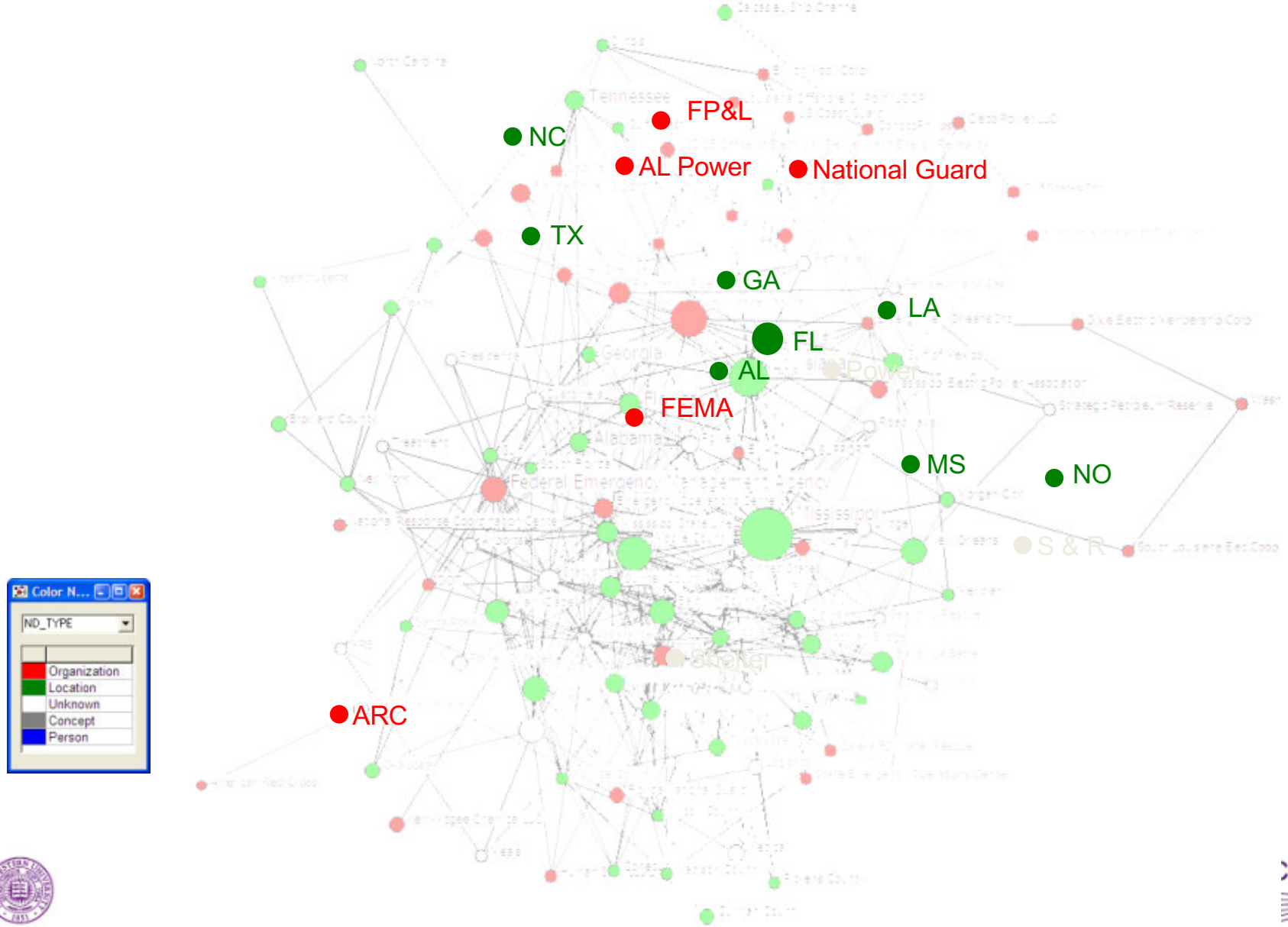
Time Slice 3 to 4



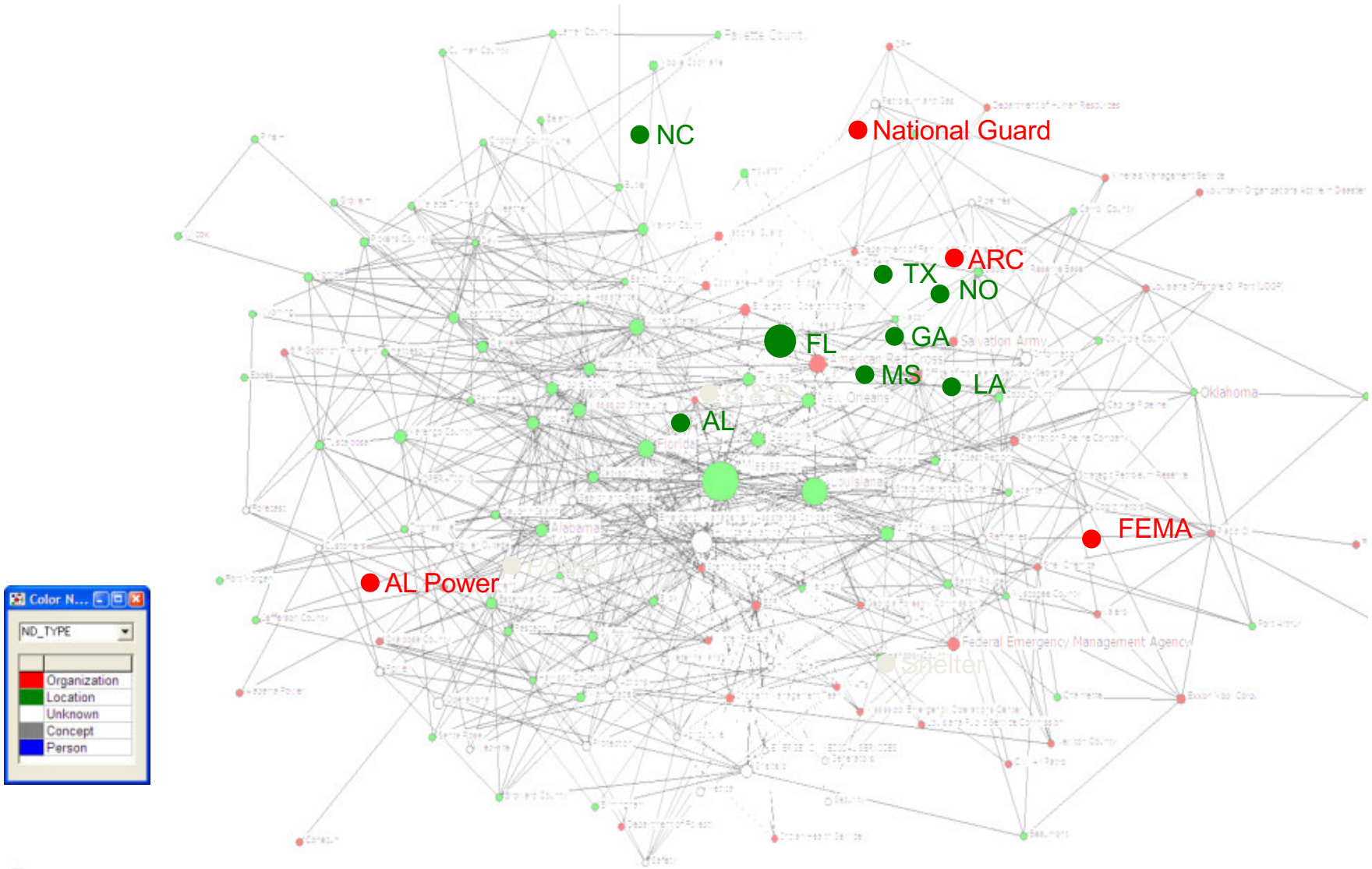
Time Slice 4: 8/30 to 8/31/2005



Time Slice 4 to 5



Time Slice 5: 9/1 to 9/2/2005



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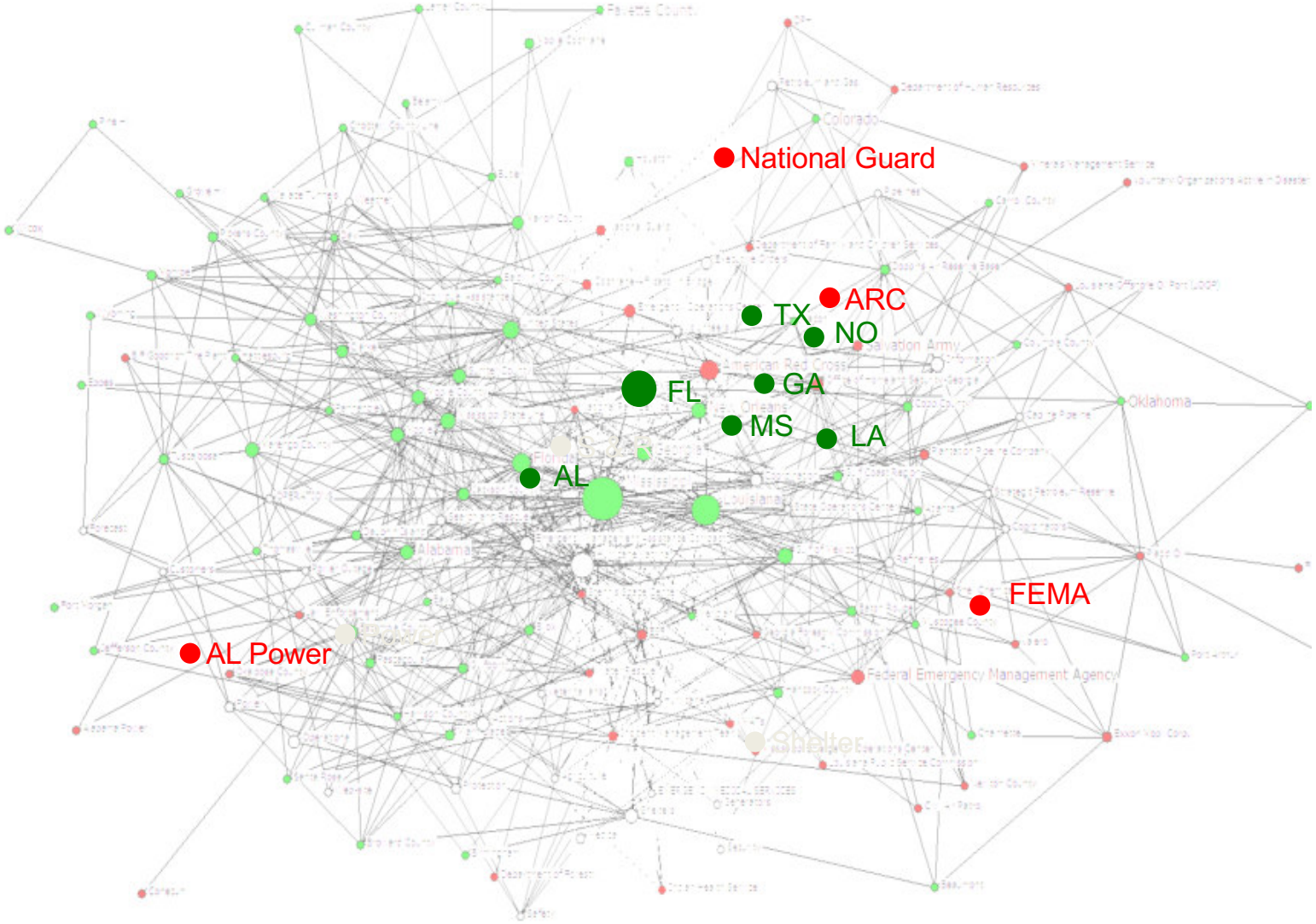
Time Slice 5 to 6



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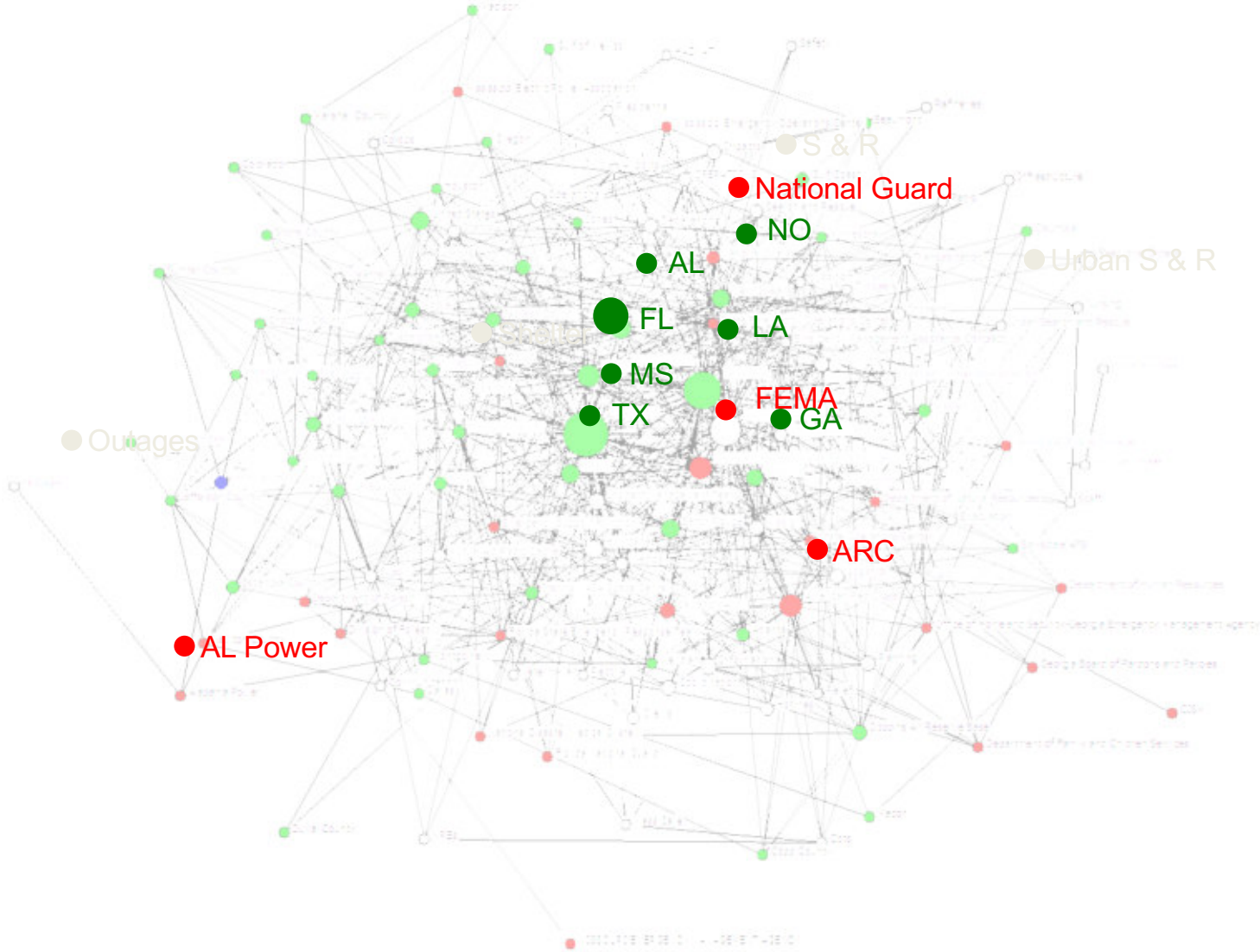
Time Slice 6: 9/3 to 9/4/2005



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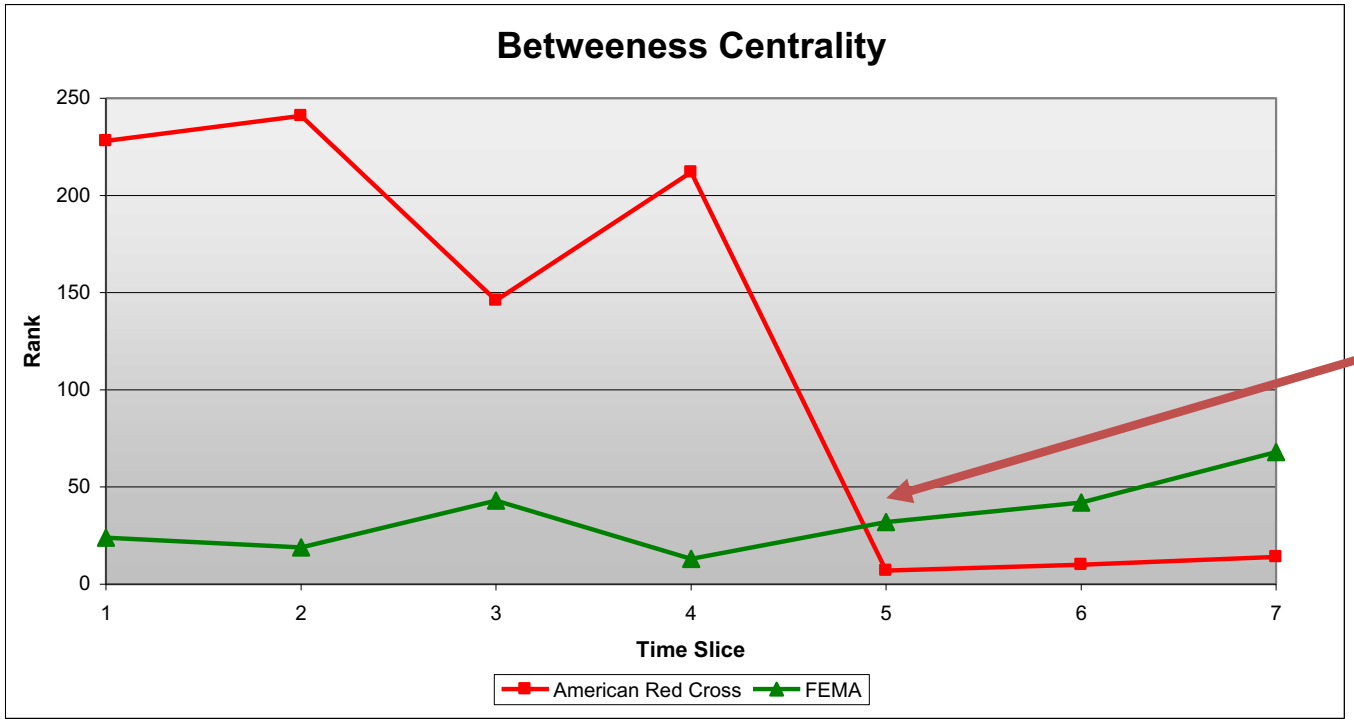
Change in Network Centrality Rankings

- **“American Red Cross” starts in the 200s and moves to the teens**
- **“FEMA” starts in the 20s, moves to the teens, and ends in the 60s**



Crossover where American Red Cross becomes relatively more central than FEMA (Sep 1, 2005)

FEMA drops rank and American Red Cross moves up

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How did the this challenge benefit from computational social science?

- Individuals don't have knowledge and the bandwidth to complete network surveys about their organization's interactions with other organizations
- Even more challenging to map networks where links exists not just between organizations, but with people, places and concepts
- Do all of this in close to real time in order to provide opportunities for mid-course corrections

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Qaiser Muhammad/The New York Times

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By DAVID A. FERRUCCI
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David Ferucci,
New York Times
1/7/2012

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The Conspiracy To End Cancer

By Bill Saporito | Monday, Apr. 01, 2013

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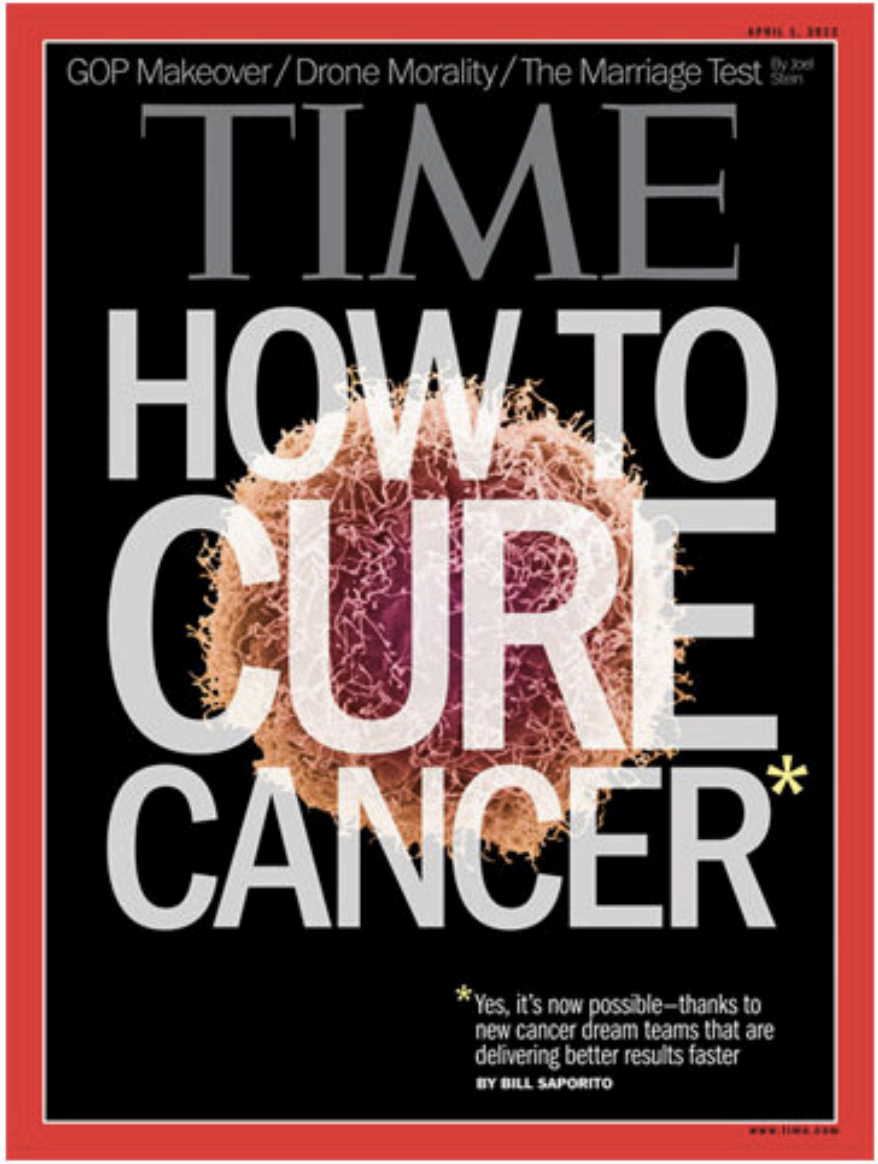
The hero scientist who defeats cancer will likely never exist.

No exalted individual, no victory celebration, no Marie Curie or Jonas Salk, who in 1955, after he created the first polio vaccine, was asked, So what's next? Cancer?--as if a doctor finished with one disease could simply shift his attention to another, like a chef turning from the soup to the entrée.

Cancer doesn't work that way. It's not just one disease; it's hundreds, potentially thousands. And not all cancers are caused by just one agent--a virus or bacterium that can be flushed and crushed. Cancer is an intricate and potentially...



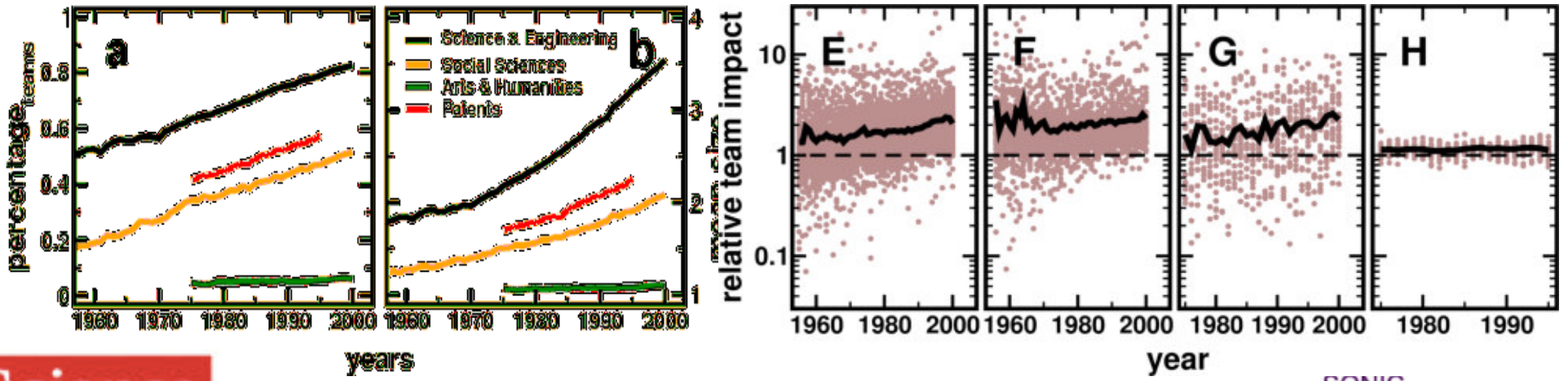
Move to Team Science

Studies of 19.9 million research articles over 5 decades as recorded in the network of Science database, and an additional 2.1 million patent records from 1975-2005 found three important facts.

1. For virtually all fields, research is increasingly done in **teams**

2. Teams typically **produce more highly cited research** than individuals do (accounting for self-citations), and this team advantage is increasing over time.

3. Teams now produce the **exceptionally high impact research**, even where that distinction was once the domain of solo authors.



Science
AAAS

Sources: Wuchty, Jones, and Uzzi, 2007a, 2007b

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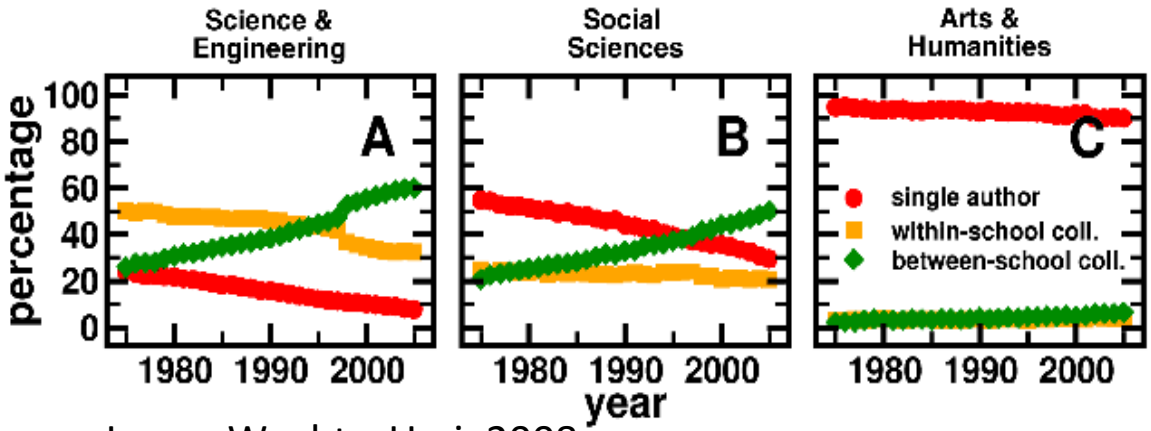
Move to *Virtual* Team Science

The trend toward virtual communities was ***not*** driven by a growth in teamwork by scientists working with other co-located scientists. Using the network of Science database to analyze the collaboration arrangements of over 4,000,000 papers over a 30 year period, they found that:

1. Team science is increasingly composed of co-authors located **at different universities**.

2. These **"virtual communities of scholars"** produce **higher impact work** than comparable co-located teams or solo scientists.

3. This change is true for all fields and team sizes, as well as for research done at elite universities



Source: Jones, Wuchty, Uzzi, 2008

Science AAAS

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Interdisciplinarity

***2015 Nature* special:** Interdisciplinarity

"Nature's special issue probes how scientists and social scientists are coming together to solve the grand challenges of energy, food, water, climate and health."

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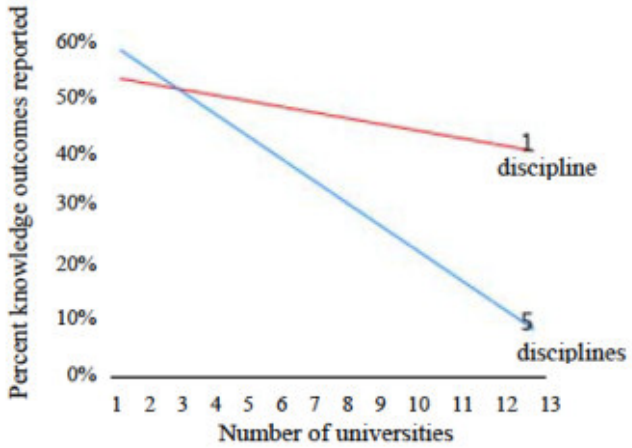
The Successes are by Teams, but not all Teams are Successful

Study of NSF-funded project teams finds collaborations involving more universities produced fewer patents, publications, and other knowledge outcomes, especially when more than one discipline was represented in the project.



Distance & Disciplinary Differences Most Challenging

Source: Cummings & Kiesler, 2008

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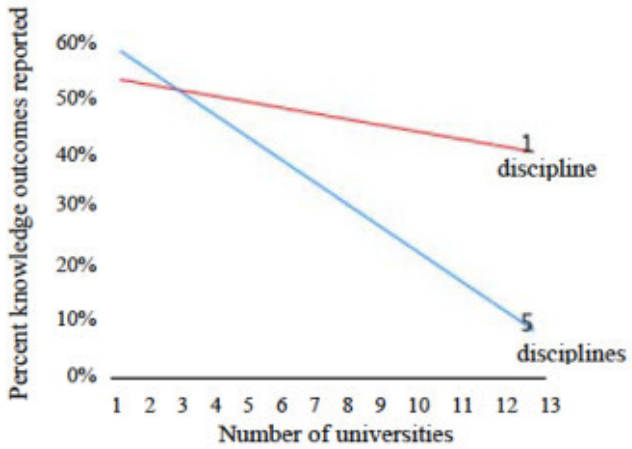
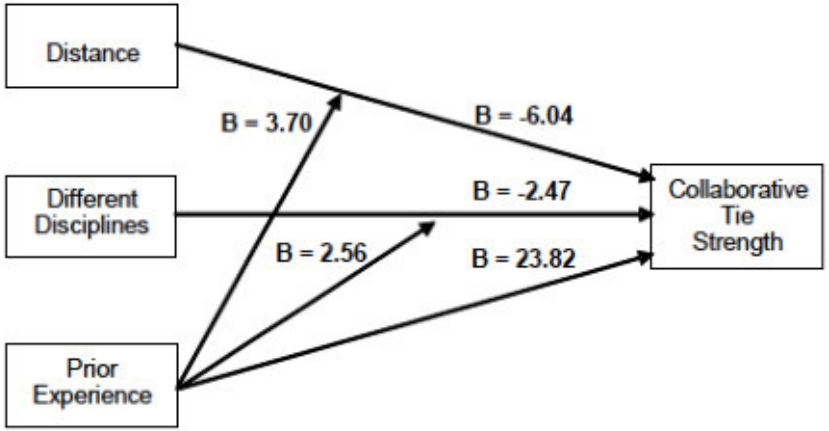


Distance & Disciplinary Differences Most Challenging



But, prior experience mitigates the harmful effects of distance and disciplinary differences

Source: Cummings & Kiesler, 2008

Battiere Effect

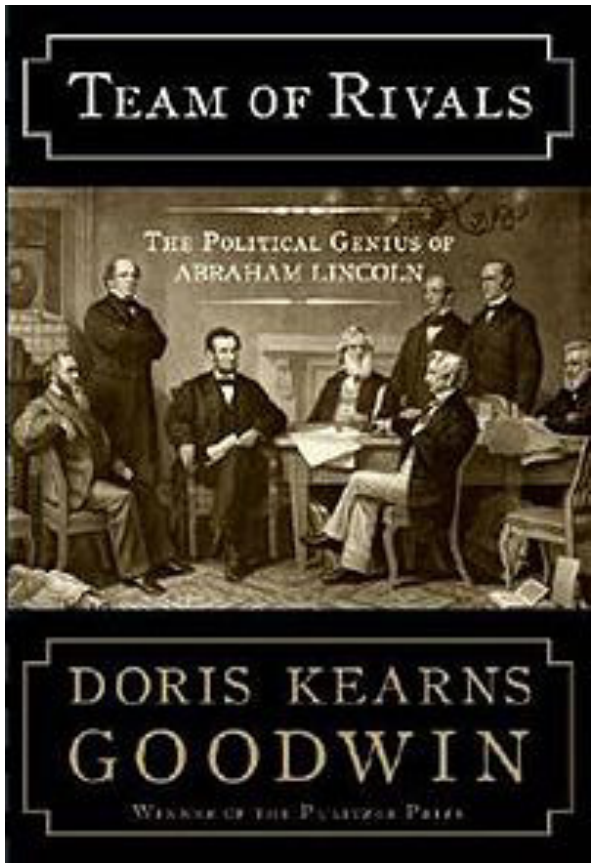
The No-Stats All-Star

Robert Seale for The New York Times

Statistical Anomaly His greatness is not marked in box scores or at slam-dunk contests, but on the court Shane Battier makes his team better, often much better, and his opponents worse, often much worse.

New York Times, Feb 15, 2009

Team of Rivals



Joe Klein: Obama's Team of Rivals

By Joe Klein | Wednesday, June 18, 2008

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Barack Obama has never been shy about comparing himself to Abraham Lincoln. He did so when he announced his candidacy at the Illinois state capitol, where both he and Lincoln served in the legislature. "The life of a tall, gangly, self-made Springfield lawyer tells us that a different future is possible," Obama said. "He tells us that there is power in words ... He tells us that there is power in hope." That was, well, audacious, to say the least — and the comparisons have continued, on issues large and small. But the most important similarity, in Obama's mind, is how he plans to govern if elected.

ILLUSTRATION FOR TIME BY STEPHEN KRONINGER; OBAMA: JOSHUA ROBERTS / BLOOMBERG

Time, June 18, 2008

The next administration

Donald Trump has a team of rivals too

Nov 26th 2016 | WASHINGTON, DC

Timekeeper

Tweet

THE president-elect's first administration hires had all been middle-aged white men who had backed him to the hilt when others wrinkled their noses. But with a pair of nominations announced on November 23rd he rang the changes. He named Nikki Haley, the Indian-American governor of South Carolina, to be his ambassador to the United Nations, and Betsy DeVos, a billionaire Republican benefactress, as his education secretary. As *The Economist* went to press, he was also reported to have invited Ben Carson, a retired neurosurgeon whom he defeated in the Republican primaries, and who is black, to be his secretary of housing and urban development.

Economist, Nov 26th 2016

But “Teams of Rivals” are not always succesful ….

www.hbr.org

Competent Jerks, Lovable Fools, and the Formation of Social Networks

by Tiziana Casciaro and Miguel Sousa Lobo

Tasks don't always come before Teams

Journal of Applied Statistics
Vol. 32, No. 5, 461–474, July 2005

Routledge

The Most-Cited Statistical Papers

THOMAS P. RYAN* & WILLIAM H. WOODALL**

*National Institute of Standards and Technology, Gaithersburg, Maryland, USA, **Department of Statistics, Virginia Tech, Blacksburg, Virginia, USA

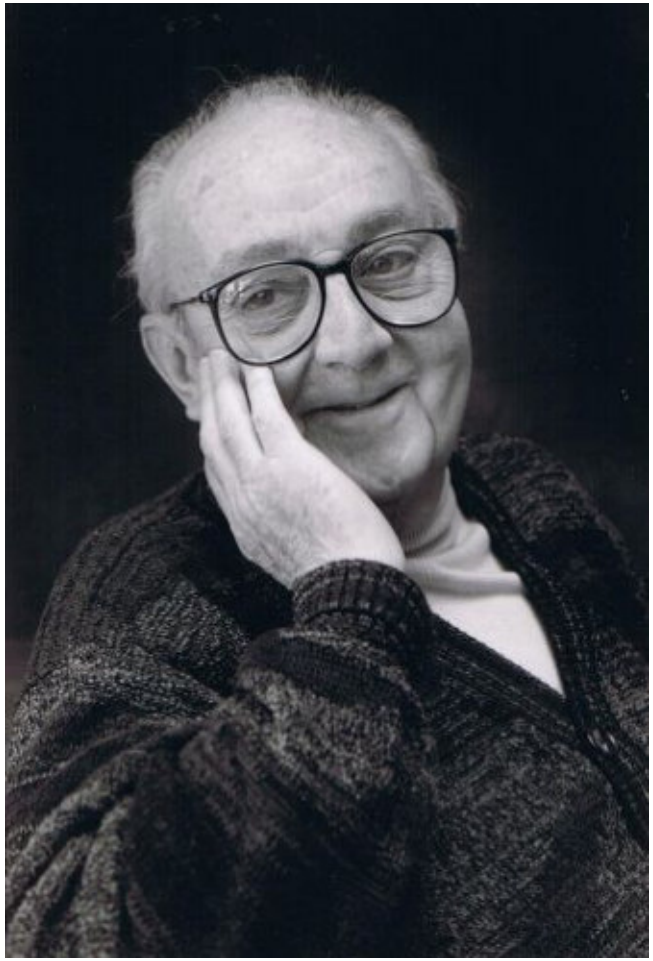
(19) With 2,529 citations (120 per year),

Box, G. E. P. & Cox, D. R. (1964) An analysis of transformations, *Journal of the Royal Statistical Society, Series B*, 26, pp. 211–243 (discussion pp. 244–252).

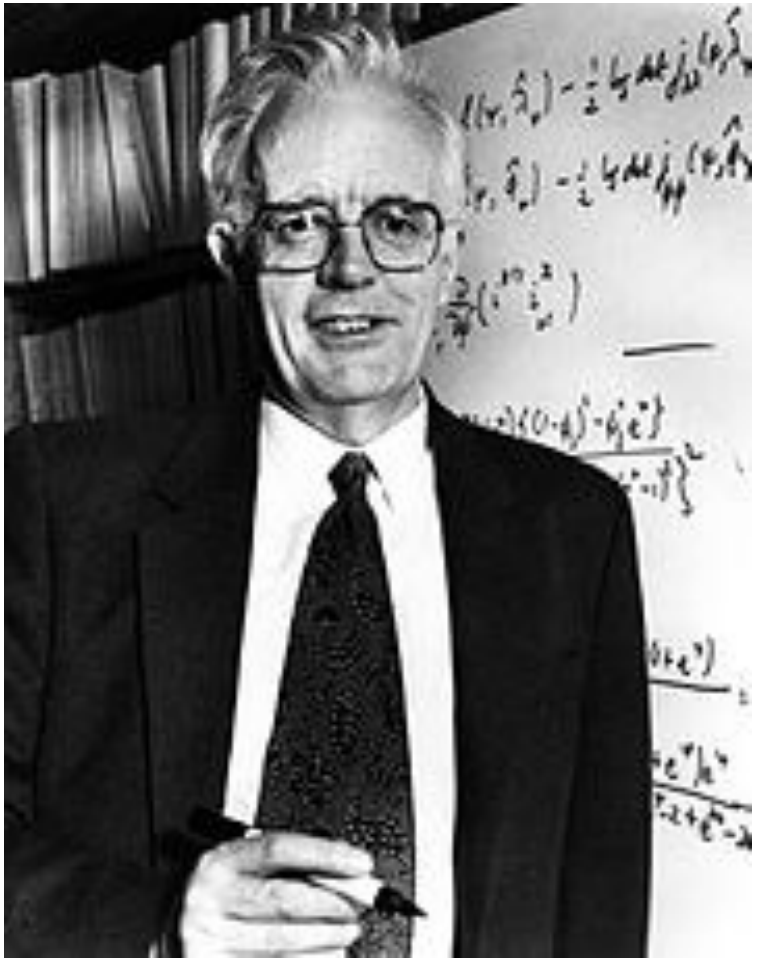
DeGroot (1987) provided some interesting background on this paper from an interview with Professor Box. Box recounted, for example, that he and Cox were on a committee of the Royal Statistical Society and several people suggested that they collaborate. Their motivation and the idea of the paper sprung, to some extent, from the similarities of their family names.

Box & Cox (1964) presented a very useful family of power transformations that have typically been used to transform the dependent variable in a regression model so as to try to meet the assumptions of homoscedasticity and normality of the error terms. The right side of the model can then be transformed in the same manner so as to retrieve the quality of the fit before the dependent variable was transformed.

DeGroot, M. H. (1987) A conversation with George Box, *Statistical Science, 2*, pp. 239 – 258



George Box



David Cox

ROYAL GALLERY OF ILLUSTRATION,
14, REGENT STREET.
EVERY EVENING (EXCEPT SATURDAY) AT 8.
THURSDAY & SATURDAY AFTERNOONS AT 3.
COX AND BOX.
ADMISSION 1/- & 2/-
STALLS 3/- STALL CHAIRS 5/-
WRITTEN BY F. C. BURNAND,
COMPOSED BY ARTHUR S. SULLIVAN.

An Analysis of Transformations

By G. E. P. Box and D. R. Cox

University of Wisconsin *Birkbeck College, University of London*

[Read at a RESEARCH METHODS MEETING of the SOCIETY, April 8th, 1964, Professor D. V. LINDLEY in the Chair]

SUMMARY

In the analysis of data it is often assumed that observations $y_1, y_2, \ldots, y_n$ are independently normally distributed with constant variance and with expectations specified by a model linear in a set of parameters $\boldsymbol{\theta}$. In this paper we make the less restrictive assumption that such a normal, homoscedastic, linear model is appropriate after some suitable transformation has been applied to the y's. Inferences about the transformation and about the parameters of the linear model are made by computing the likelihood function and the relevant posterior distribution. The contributions of

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Journal of the Royal Statistical Society (1964)

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Multi-theoretical Multilevel (MTML) Motivations for Team Assembly

- Theories of self-interest
- Theories of social and resource exchange
- Theories of mutual interest and collective action
- Theories of contagion
- Theories of balance
- Theories of homophily
- Theories of proximity

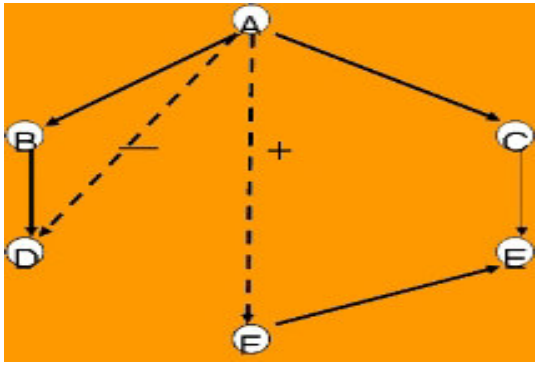
Sources:

Contractor, N. S., Wasserman, S. & Faust, K. (2006). Testing multi-theoretical multilevel hypotheses about organizational networks: An analytic framework and empirical example. *Academy of Management Review*.

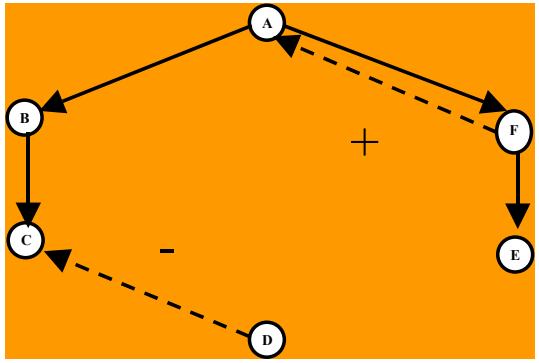
Monge, P. R. & Contractor, N. S. (2003). *Theories of Communication Networks*. New York: Oxford University Press.

Contractor, N. S. (2012). Contractor, N. (2013). Some assembly required: leveraging network science to understand and enable team assembly. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *371*(1987), 20120385–20120385.

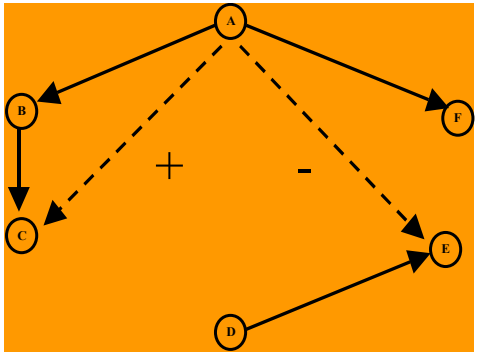
“Structural signatures” of MTML
Motivations for Team Assembly



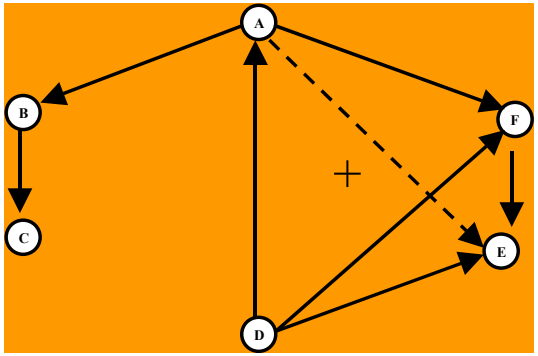
Theories of Self interest



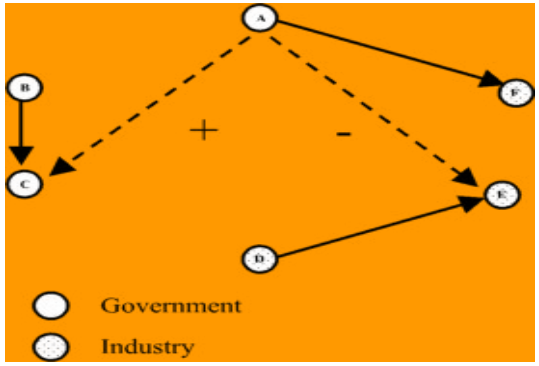
Theories of Exchange



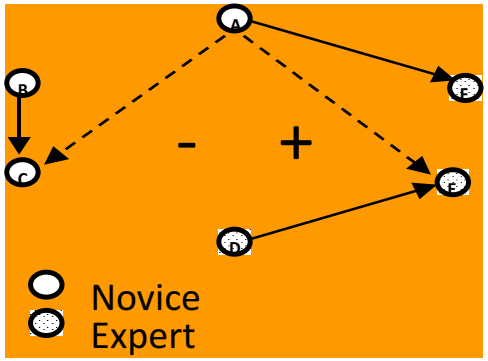
Theories of Balance



Theories of Collective Action



Theories of Homophily



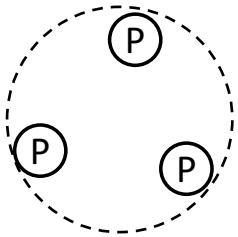
Theories of Cognition

Statistical “MRI” for Structural Signatures

- p*/ERGM: Exponential Random Graph Models
- Statistical “Macro-scope” to detect structural motifs in observed networks
- Move from exploratory to confirmatory network analysis to understand multi-theoretical multilevel motivations for why we create social and information networks

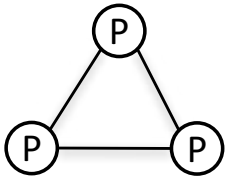
Three Levels of Influence on Team Assembly

Compositional Level



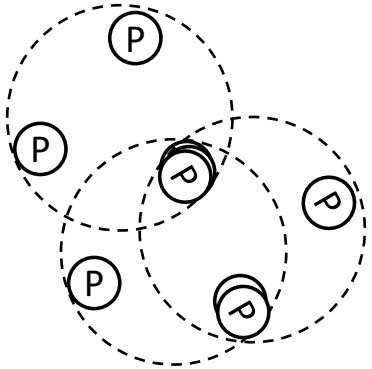
(a) Team as a collection of individuals

Relational Level



(b) Team as individuals and relations

Ecosystem Level



(c) Ecosystem of teams

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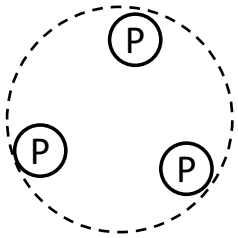

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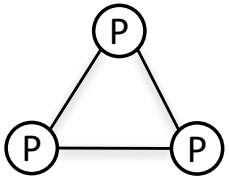

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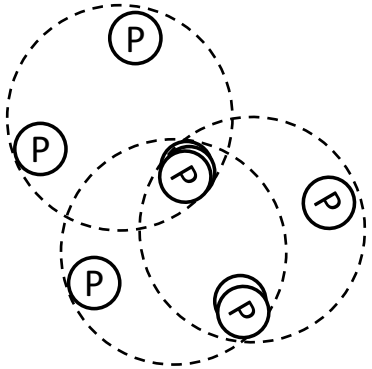
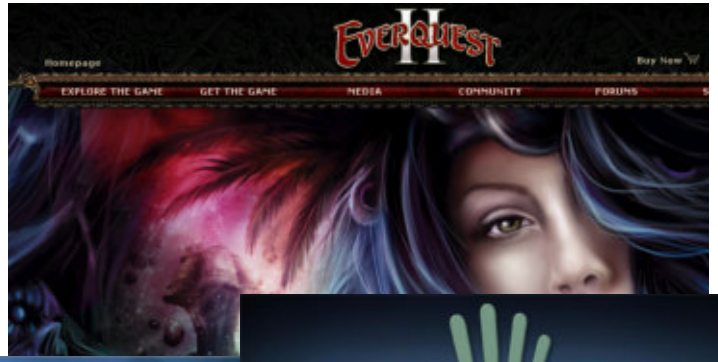
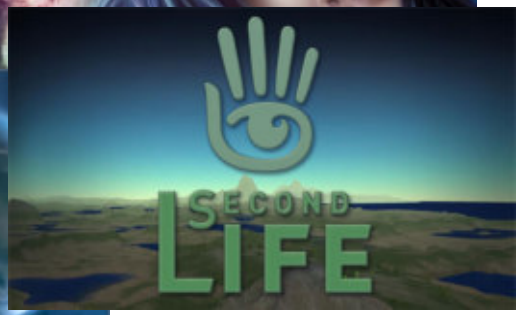


(c) Ecosystem of teams

Virtual World Exploratorium
Examples of “Leadership’s online labs”





vwobservatory.org

Reeves, B., Malone, T. W., & O'Driscoll, T. (2008). Leadership's online labs. *Harvard Business Review*, *86*(5), 58–66.

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Our Dataset

- Data from a popular Massively Multiplayer Online Role Playing Game (MMORPG) EverQuest II (EQ2)
  - Fantasy based game
  - Server-side records
  - Player attributes, activities, and relations
  - Focus on Combat Teams
  - Players are “nested” within teams

http://everquest2.station.sony.com/screenshots.vm

Combat Groups in EverQuest II

- Difficult combat tasks require collaboration of multiple players and assembly of combat groups
- From 2006-08-27 to 2006-09-11 on Antonia Bayle Server
  - 8,423 players
  - 46,393 groups
  - 9,436,741 combat related records

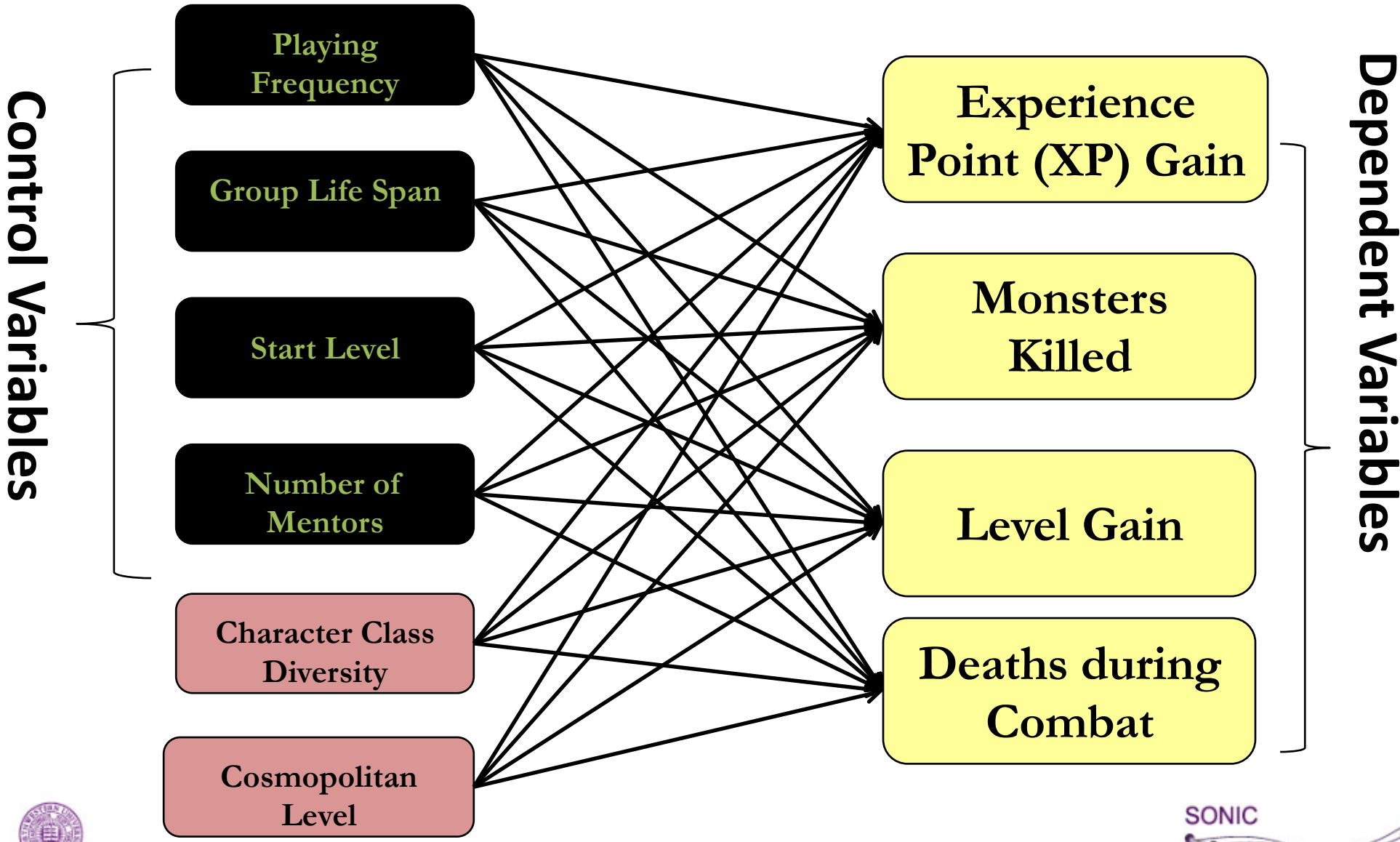
http://everquest2.station.sony.com/screenshots.vm

What makes a team successful?

- **Team Diversity**
  - Four character classes in the game: Fighter, Mage, Scout and Priest, each having a different role in a group
  - Measure Group Diversity: Blau's Index

- **Team member's cosmopolitan level**
  - Group members being involved in multiple different groups

Effects of Team Attributes on Performance Measures



Regression Analysis Results on Combat Groups of Four Players

	XP	Monsters	Level Gain	Deaths
Constant	-20939.926**	-3.376 (.361)	.717**	4.011**
Frequency	-1553.494 (.105)	4.127**	-.010 (.816)	.601**
Life Span	736.797**	1.174**	.015**	.063**
			3**	-.050**
			2**	-.647**
Diversity	20819.998**	14.342**	.726**	-1.873 (.095)
Member Cosmo.	30.254 (.612)	-.025 (.698)	-.010**	-.032**
R^2	.000	0.821	0.371	0.244
F	595.213 (p=.000)	1368.793 (p=.000)	176.071 (.000)	96.274 (.000)

Diversity helps the groups to achieve more.

Members being cosmopolitan doesn't help with gains but helps to avoid loss.

** indicates significant results at .01 level

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Three Levels of Influence on Team Assembly

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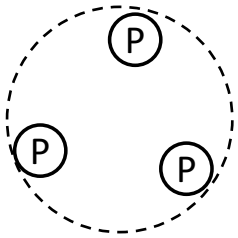

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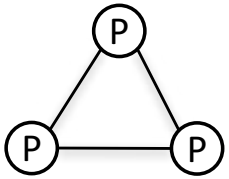
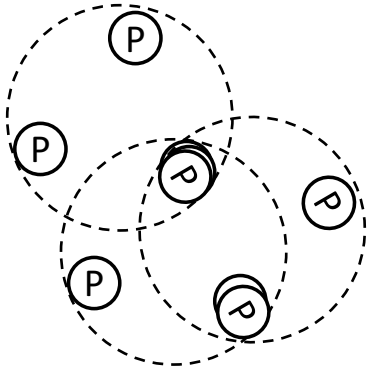


(b) Team as individuals and relations

Ecosystem Level



(c) Ecosystem of teams

Data Set

- 1,103 grant proposals submitted to NSF (both awarded and un-awarded)
- 2 interdisciplinary programs
- 3-year period
- 2,186 PIs and Co-PIs

Who submits proposals?

- Individuals are *more* likely to submit proposals with their co-authors.

- Individuals are *more* likely to submit proposals with those they cite

Who submits *successful* proposals?

- Individuals are *more* likely to submit *successful* proposals with their co-authors.

- Individuals are *less* likely to submit successful proposals with those they cite

Team Assembly in Online Environments

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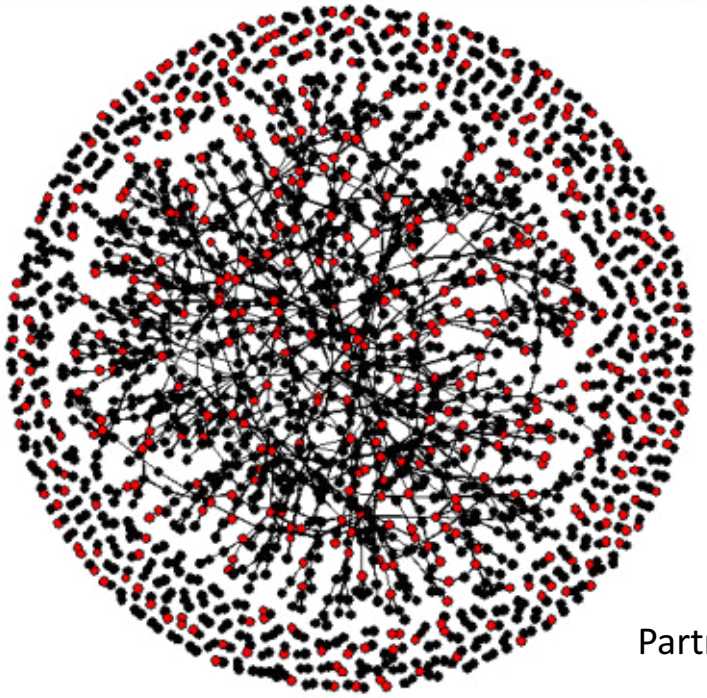
Data Description

3140 players from Aug 25 to Aug 31 2006, in Antonia Bayle

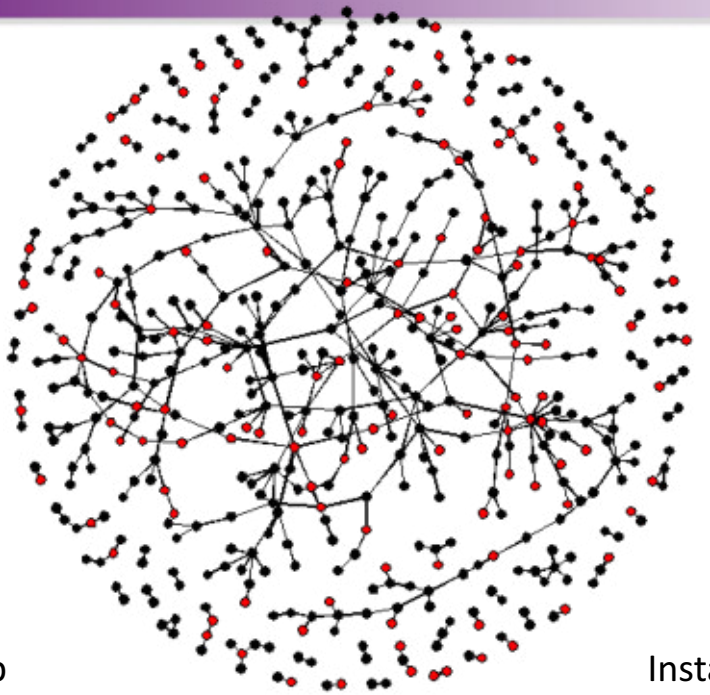
2998 US, 142 CA ; 2447 male, 693 female

- Demographic information
  - Gender, age, and account age (years played Sony games)
  - Zip code, state, and country

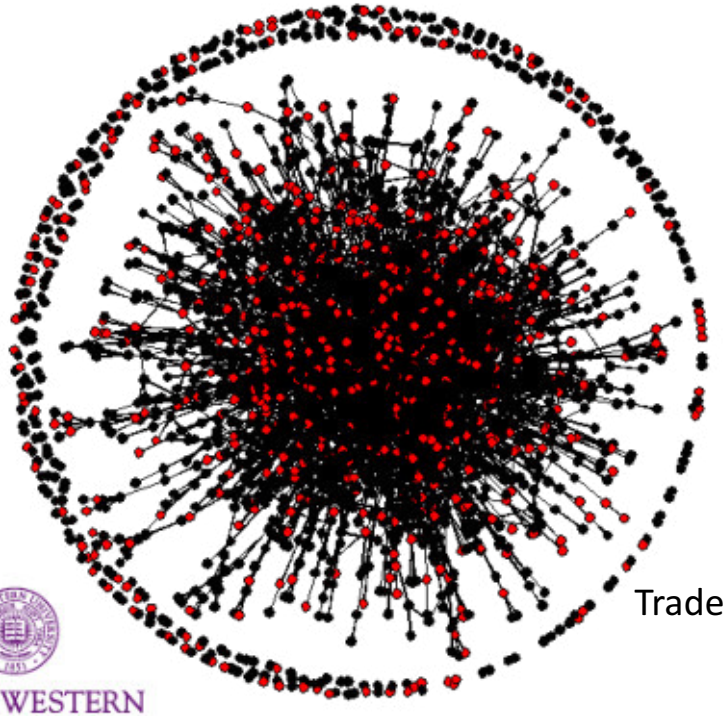
Black: male
Red: female



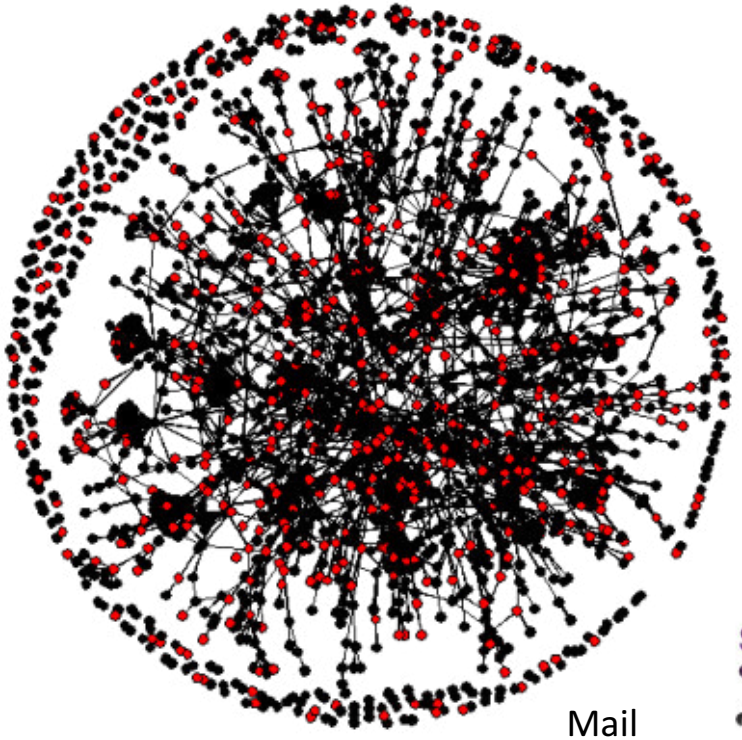
Partnership



Instant messaging



Trade



Mail

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Results

Selectivity and transitivity (friend of a friend) exists in all online relations.

Homophily of age and game experience is supported in all four relations.

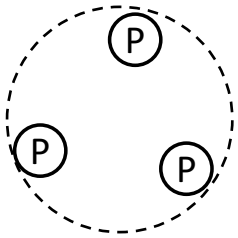
Distance matters but short distances are more important. Individuals living within 50 Km are 22.6 times more likely to be partners than those who live between 50 and 800 Km.

Time zones impacts gaming and trading but not IM and mail. Individuals in the same time zone are 1.25 times more likely to be game partners than the individuals with one hour difference (but no time zone effect for

Gender homophily is not supported for all relations and female players are more likely to interact with the male players.

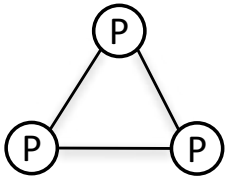
Three Levels of Influence on Team Assembly

Compositional Level



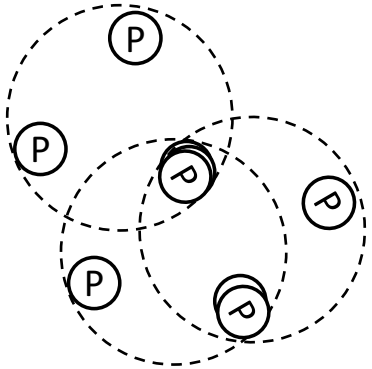
(a) Team as a collection of individuals

Relational Level



(b) Team as individuals and relations

Ecosystem Level



(c) Ecosystem of teams

Ecosystem Influences on Team Assembly

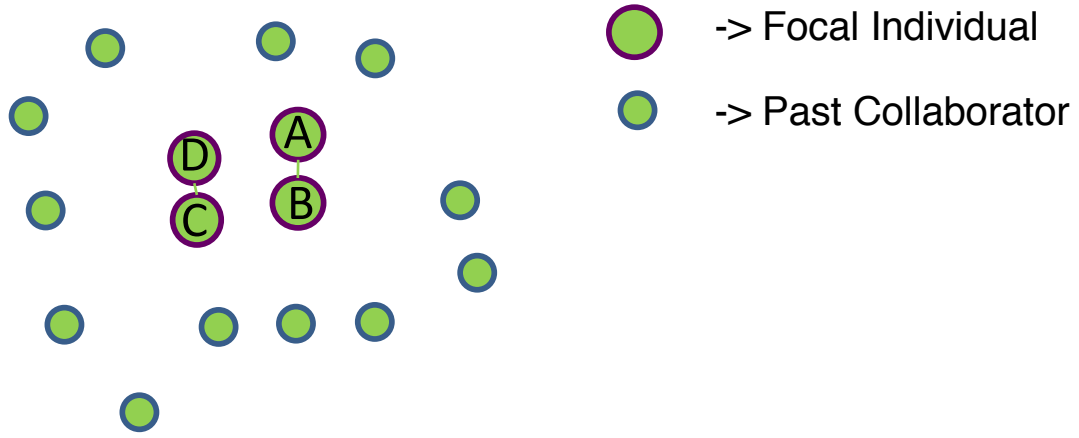
- Scientific breakthroughs are increasingly occurring in TEAMS.
  - Wuchty, Jones, & Uzzi (2007)
- We understand certain mechanisms that relate to team effectiveness after teams are assembled…

But what leads scientists to self-assemble into teams??

Are there certain driving forces in the environment that lead to team assembly?

Scientific Ecosystem

- Teams do not assemble in a "vacuum"
- Teams emerge from networks of prior collaborations in a particular space
  - An "ECOSYSTEM"



Scientific Ecosystem

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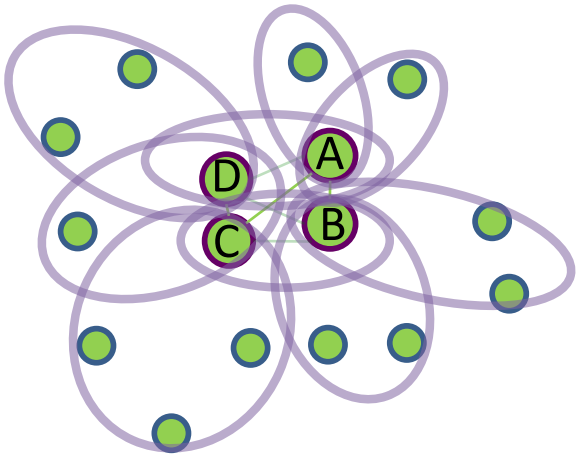

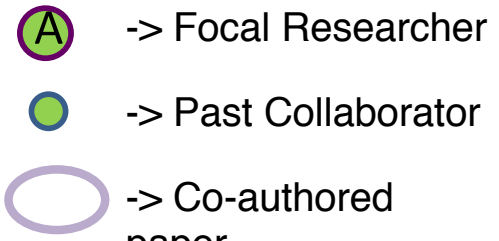

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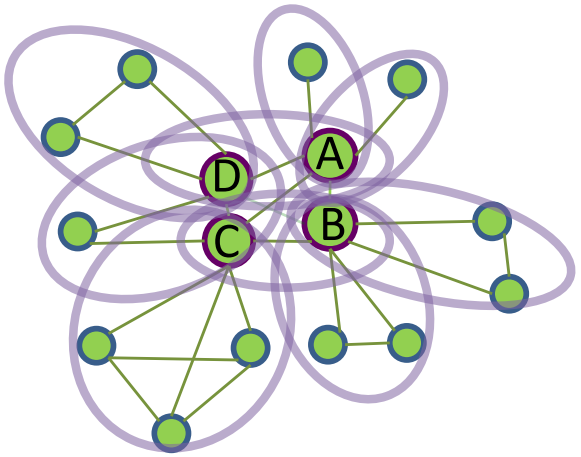

-> Team Member

-> Past Collaborator

-> Co-authored paper

-> Link based on Co-authorship

Scientific Ecosystem

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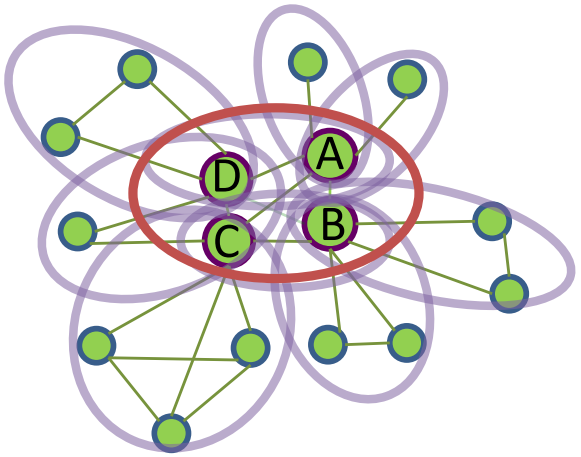


-> Team Member

-> Past Collaborator

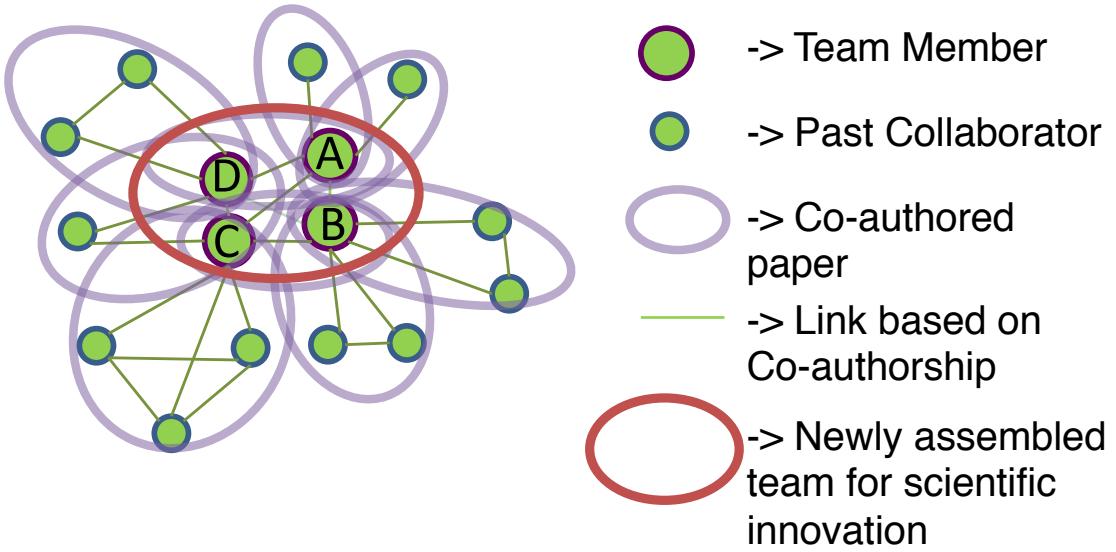
-> Co-authored paper

-> Link based on Co-authorship

-> Newly assembled team for scientific innovation

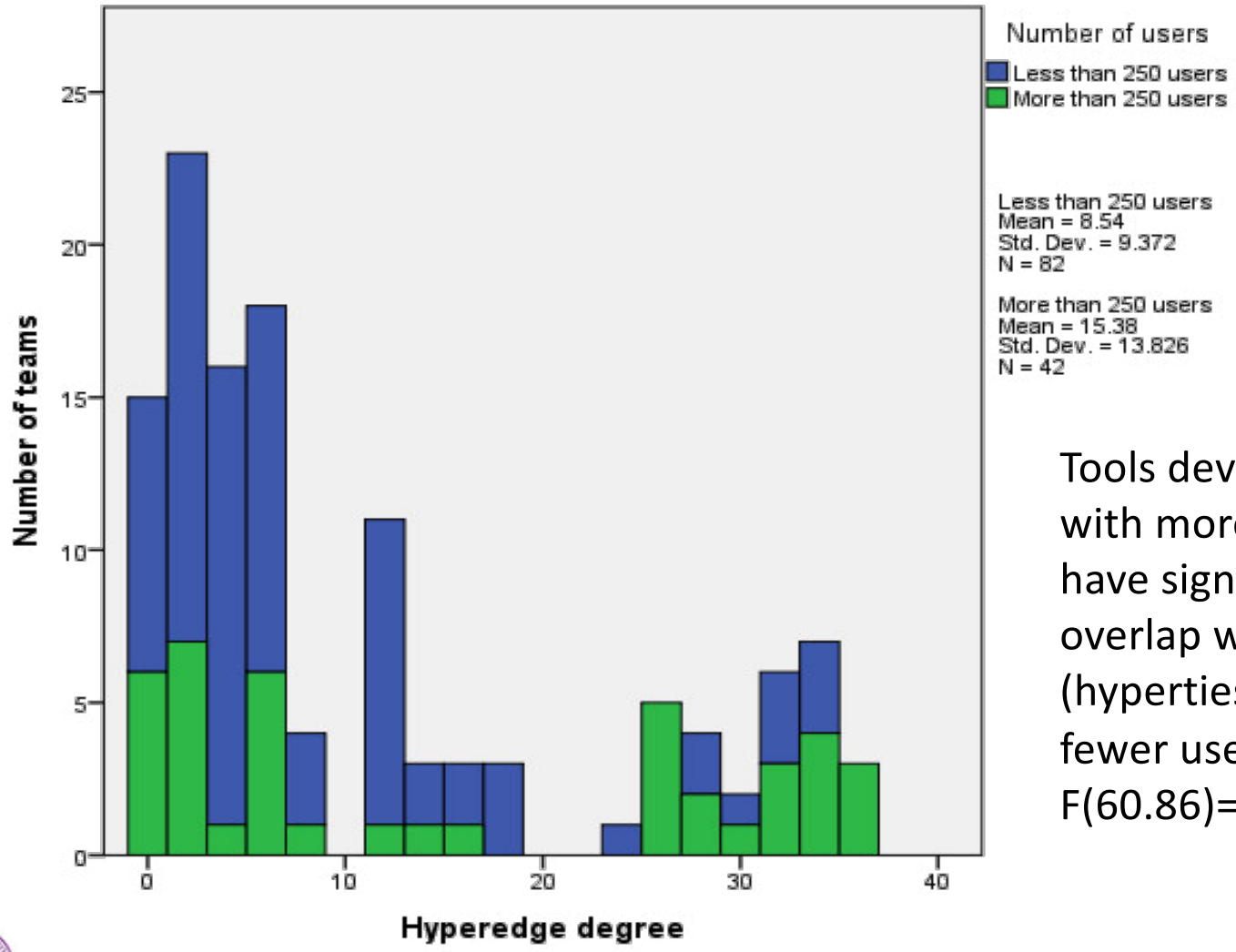
Scientific Ecosystem as Antecedent of Team Assembly and Performance

- Teams do not assemble in a "vacuum"
- Teams emerge from networks of prior collaborations in a particular space
  - An "ECOSYSTEM"



- Are there certain characteristics of the scientific ecosystem that lead to team assembly?
- Do variations in these ecosystem characteristics predict team performance?

Ecosystem influence on nanoHUB Team Assembly



Tools developed by teams with more than 250 users have significantly more overlap with other teams (hyperties) than tools with fewer users $F(60.86)=-2.89$, $p=0.005$.

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NASA - INERTIA

(*Identifying Novel Elements Related To Interruption Attributes*)

We are investigating how astronauts can efficiently and effectively switch between teams, tasks, and tools aboard the ISS (*International Space Station*) and during long-distance space exploration missions

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NASA - CREWS

(*Crew Recommender for Effective Work in Space*)

Long distance space exploration requires a team that can do the job and handle the stressors of these extreme missions. We are building an agent based model to help choose the an optimal composition of team members to go on NASA's Mars mission!

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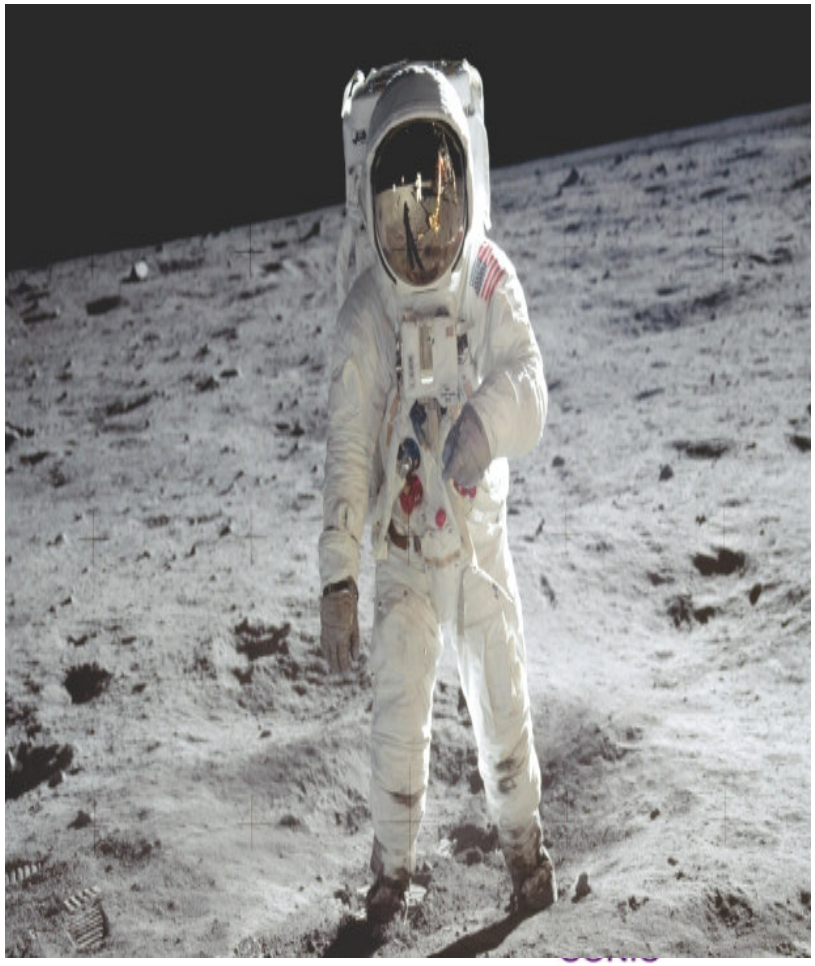
NASA - SCALE
(*Shared Cognitive Architecture for Long-Term Exploration*)

Among the significant team challenges NASA will face on a future mission to Mars is the need to maintain shared mental models. We are investigating and developing training methods for team cognition in long distance space exploration missions.



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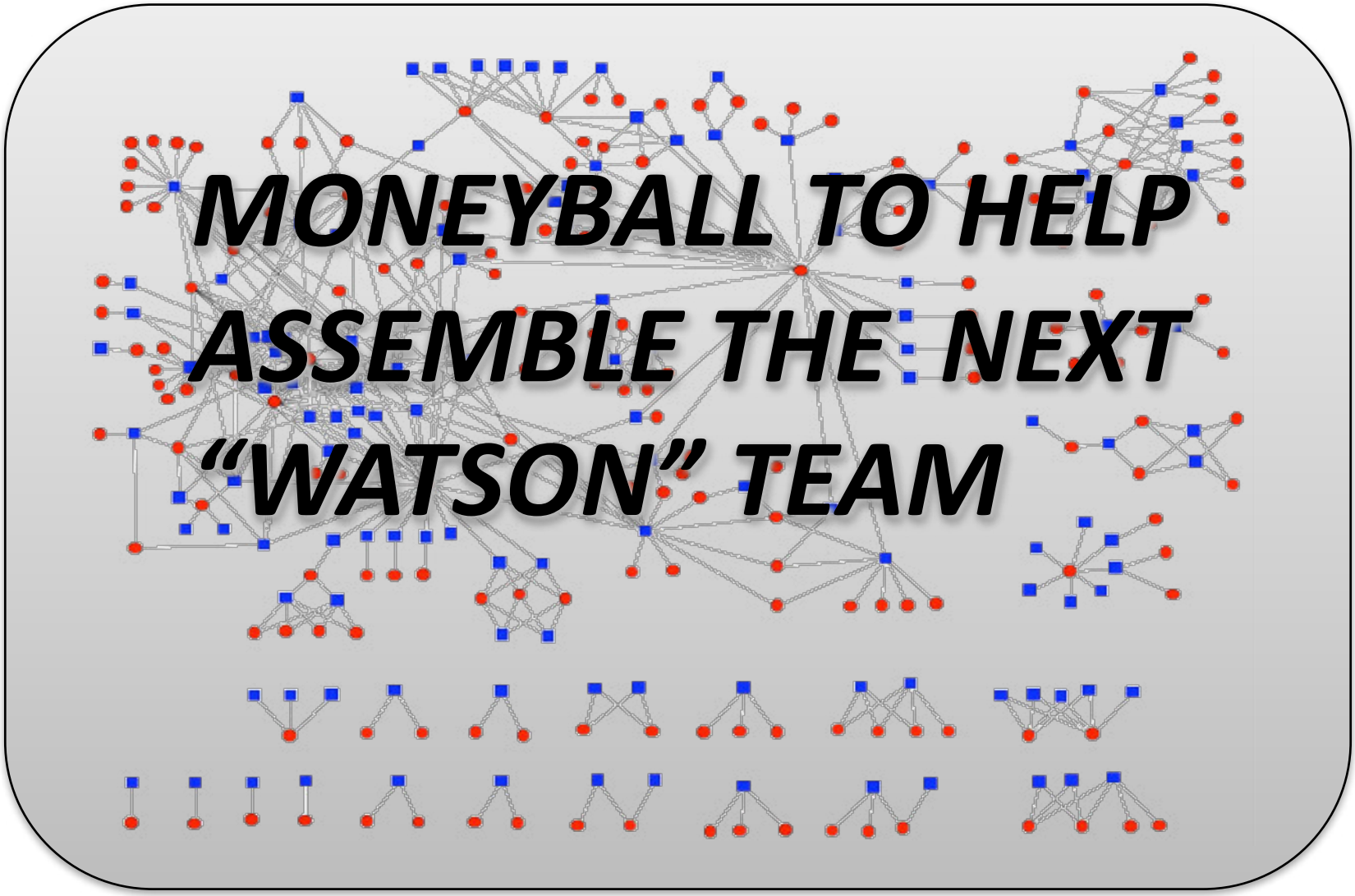
From Understanding to Enabling Team Assembly Or ….



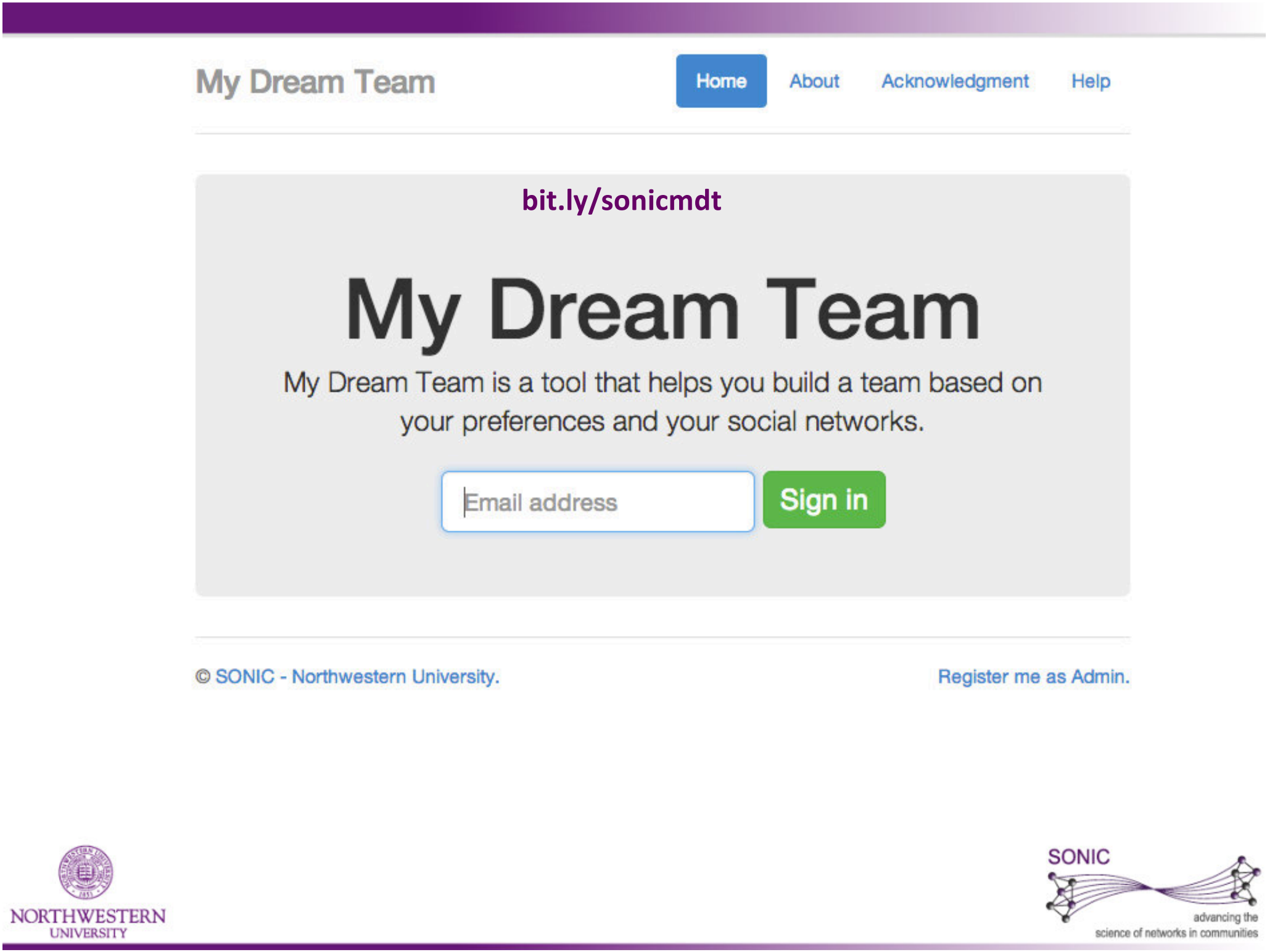
"Your goal shouldn't be to buy players. Your goal should be to buy

.

In order to buy wins, you need to buy runs." (Bakshi & Miller, 2011).

Demo

- My Dream Team Builder
- NU Dream Team



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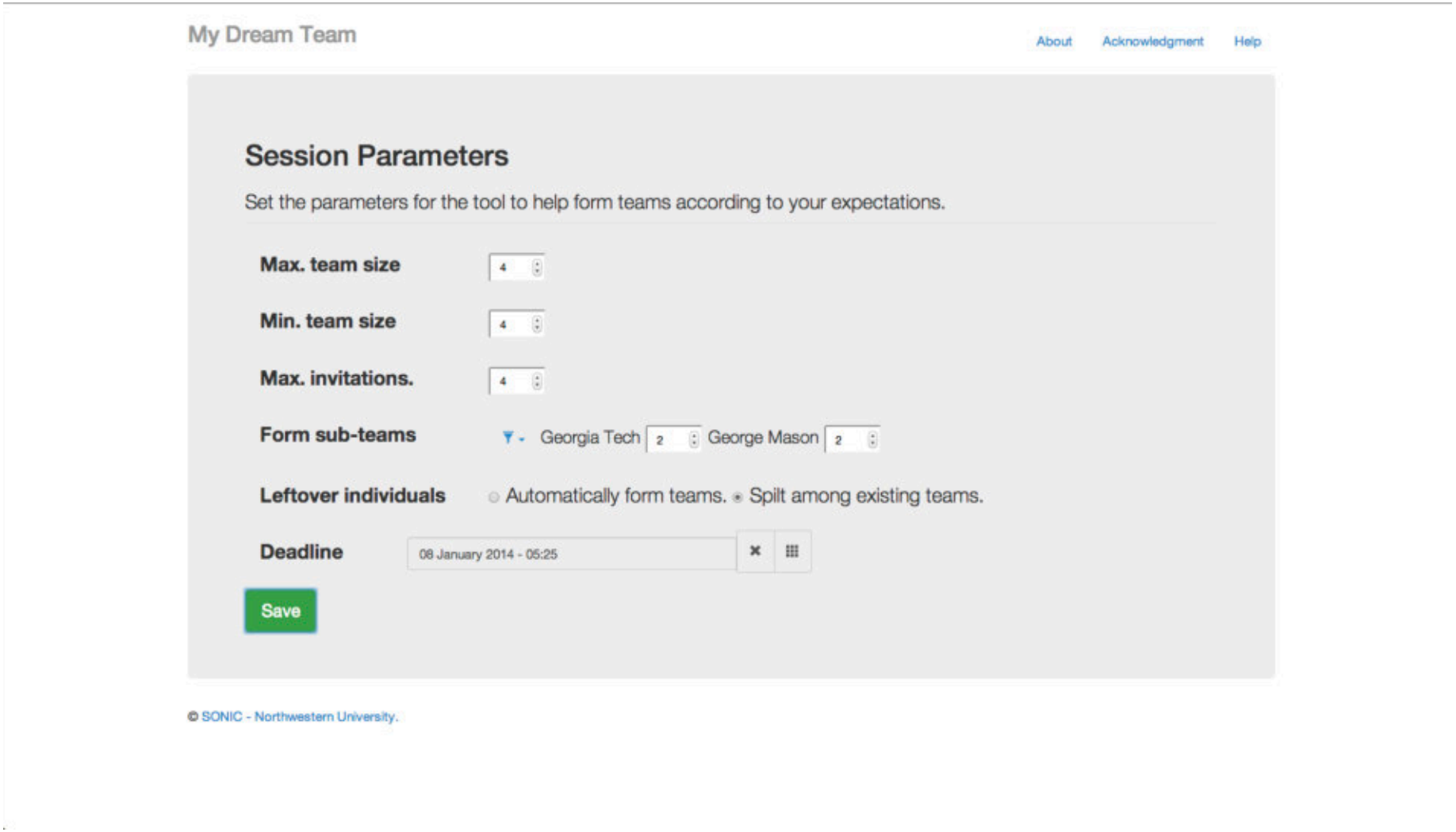
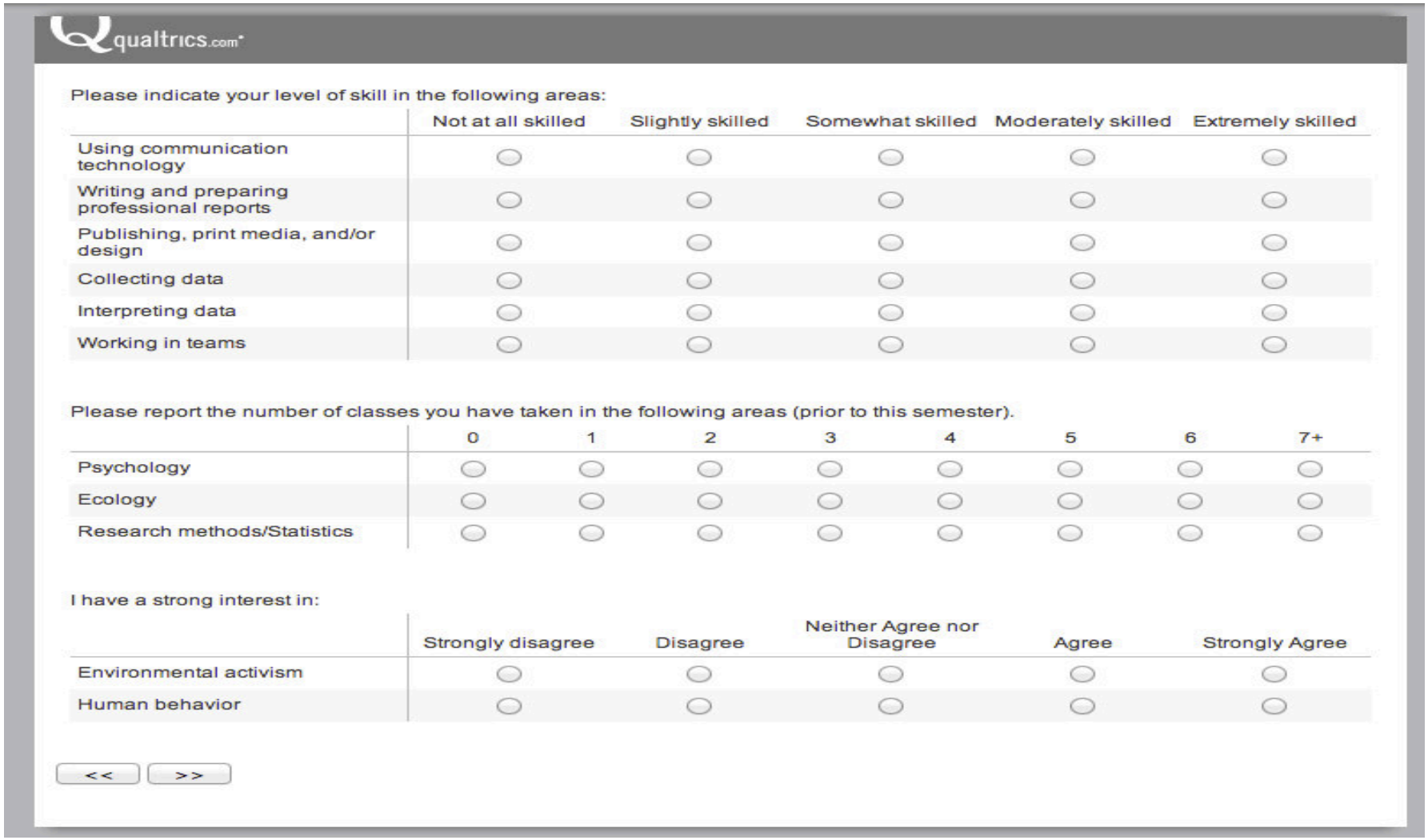
The Admin Page



The Premeasure



qualtrics.com

Please indicate your level of skill in the following areas:

	Not at all skilled	Slightly skilled	Somewhat skilled	Moderately skilled	Extremely skilled
Using communication technology	○	○	○	○	○
Writing and preparing professional reports	○	○	○	○	○
Publishing, print media, and/or design	○	○	○	○	○
Collecting data	○	○	○	○	○
Interpreting data	○	○	○	○	○
Working in teams	○	○	○	○	○

Please report the number of classes you have taken in the following areas (prior to this semester).

	0	1	2	3	4	5	6	7+
Psychology	○	○	○	○	○	○	○	○
Ecology	○	○	○	○	○	○	○	○
Research methods/Statistics	○	○	○	○	○	○	○	○

I have a strong interest in:

	Strongly disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Environmental activism	○	○	○	○	○
Human behavior	○	○	○	○	○

<< >>

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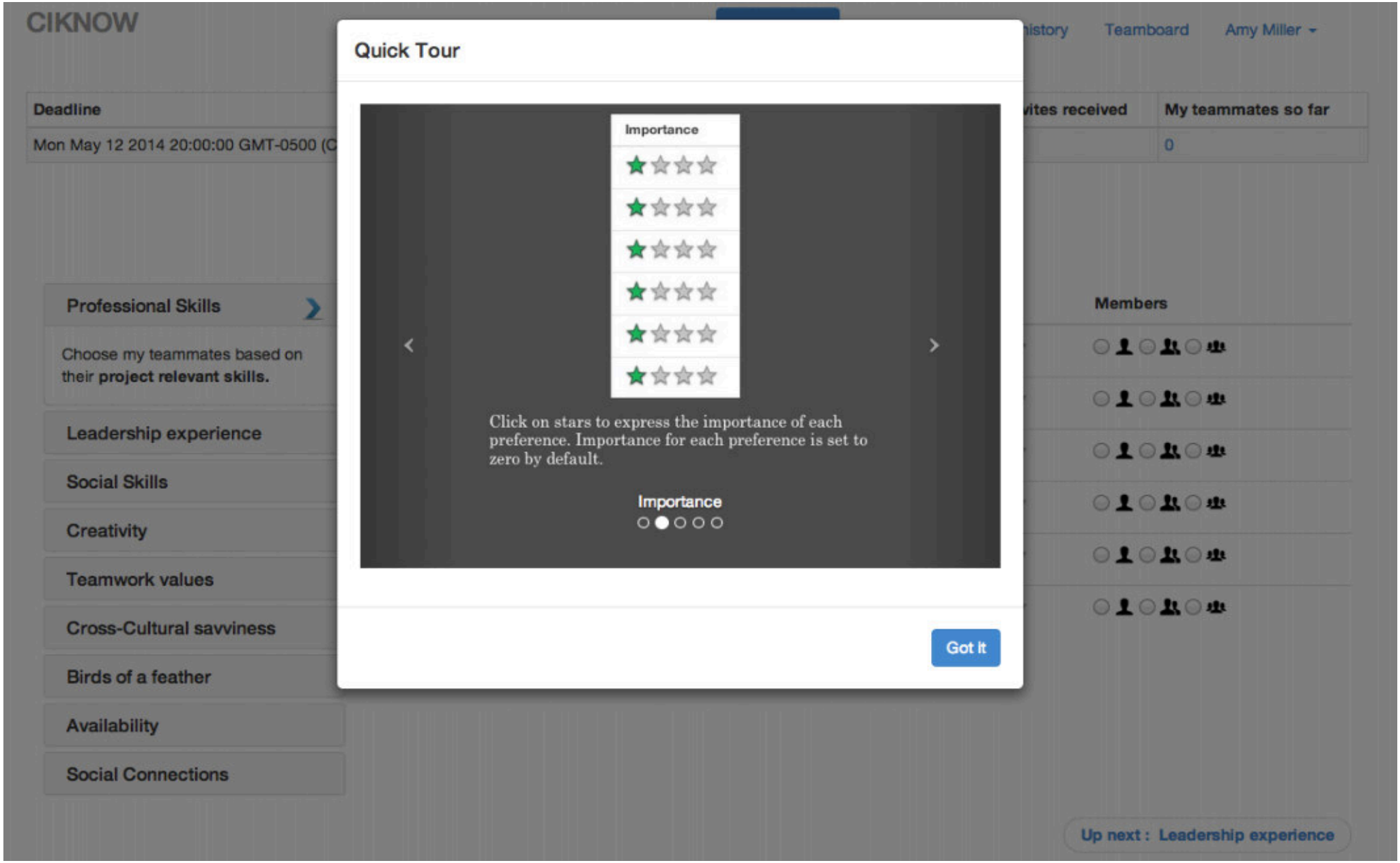
Who on this list do you know? Check all that apply.

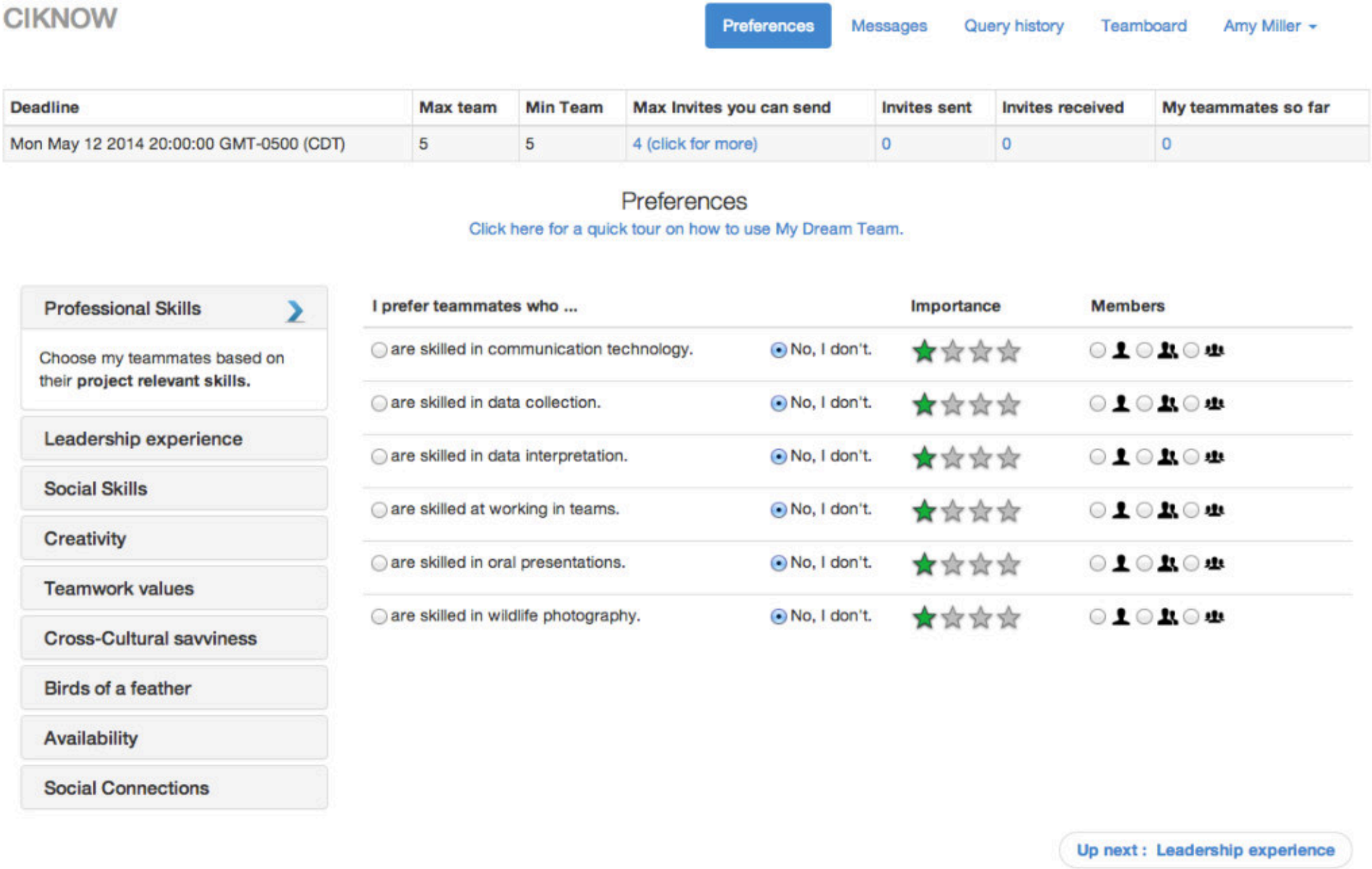
- Alex O'Connor
- Alexander Leavitt
- Alexandra Bezozo
- Alison Foreman
- Alyssa Monserrate
- Alyssa Toombs
- Amier Naji
- Amy Villasenor
- Andrew Fang
- Andy Wilbourn
- Angela Thomas
- Anna Crouch
- Anna Stenstrom
- Aren Alvarez
- Ariana Daftarian
- Ashley Fischer
- Ashley Longnecker
- Ashwinn John
- Austin Gunnarson
- Austin Ringwelski
- Banafsheh Shoai
- Caitlin Beeghly
- Cameron Jones
- Catharina Son
- Chad Reed
- Charles Bryant
- Christa Peet
- Claire Homrich
- Daniel Dufresne
- Danielle Redmond
- David Reid
- Dhruv Nayar
- Elaine Nguyen
- Emily Davis
- Gaetan Germain
- Garrett Smith
- Gemariah Valencia
- Geoving Gerard
- Gian Di Carlo
- Graham Wright
- Gregory O'Neal
- Haley Landis
- Han Sung Park
- Harley Topor
- Harrison Galloway
- Hayley Drosky
- Hendry Sugianto
- Hyeon-Hui Cho
- Isabella Carbonell
- Isabella Dolor
- Ishwarya Venkatachalam
- Jacob Yamaki
- Jake Zemke
- Jane Neiswander
- Jaudale Banks
- Jessica Shimko
- Jesus Gonzalez
- John Verrone
- Jorge Juarez
- Joseph Knipe
- Joshua Skow
- Julia Cochran
- Julia Rapoport
- Jung Mok
- Kaj Niegmann
- Karim Amirali
- Katherine Blask
- Keith Cavanaugh
- Keith Pickering
- Kevin Chen
- Kirby Jackson
- Kyle Olson
- Laura Matalenas
- Lee Frazer
- Lien Nguyen
- Marc Gebeily
- Marc Huet
- Marcus Mitchell
- Maria Botelho
- Mark Lowder
- Mary-Ann Ionascu
- Michael Hartle
- Michael Valdes
- Michelle Johnson
- Mingming Hu
- Mmuoma Iromuanya
- Morgan Foreman
- Nayomi Mitchell
- Oluwaseyi Gbadegesin
- Raymond Hua
- Rayna Berinhout
- Richard Bordianu
- Richard Sanger
- Roxanne Jijina
- Ryan McCurdy
- Samera Ahmad
- Samir Jain
- Sara Srivastav
- Sarah Brady
- Sarah Childs
- Sarah Nay
- Scott Vermeyen
- Shahista Jiwani
- Shakeel Bhamani
- Shalaka Patel
- Shirley Kim
- Sri Devi Nammalwar
- Sunju Kang
- Taeho Koh
- Taylor Cheek
- Tristan Hackman
- Veronica Rubinsztain
- William Carter
- William Kuzia
- Yoojin Joung
- Zachary Mason

Quick Tutorial



Set Your Teammate Preferences (Queries)

bit.ly/sonicmdt



Professional Skills

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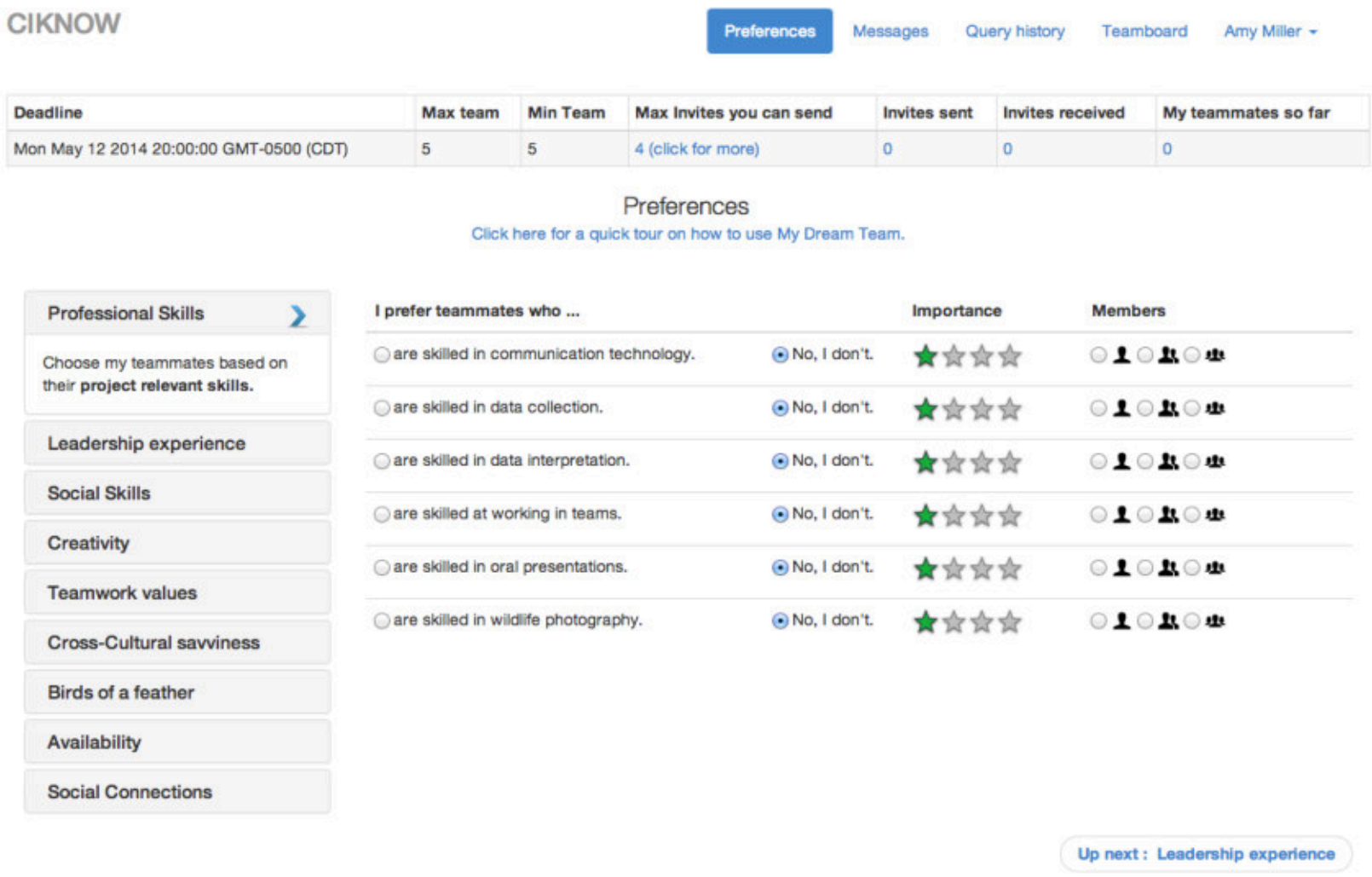
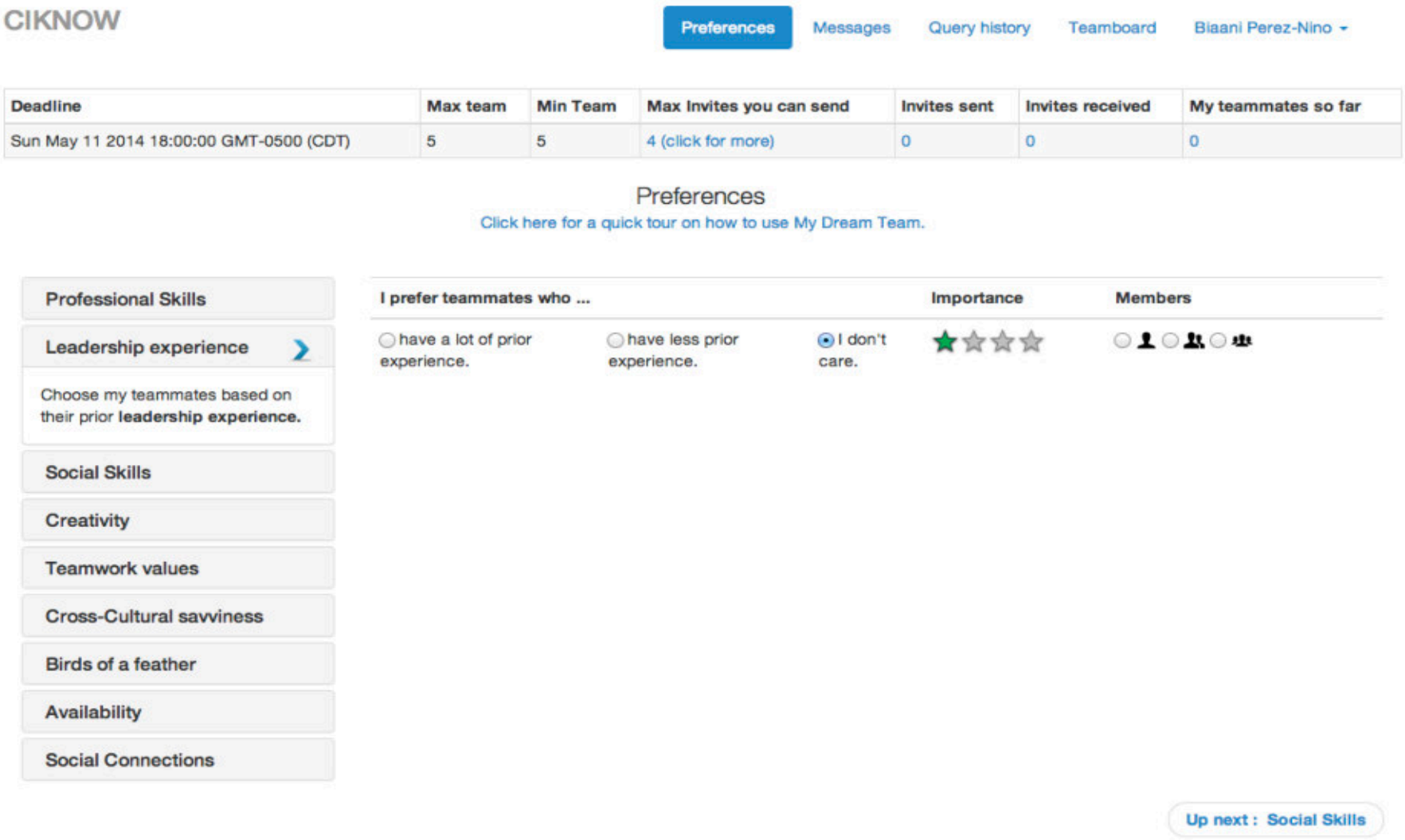


Leadership Experience

bit.ly/sonicmdt



Social Skills

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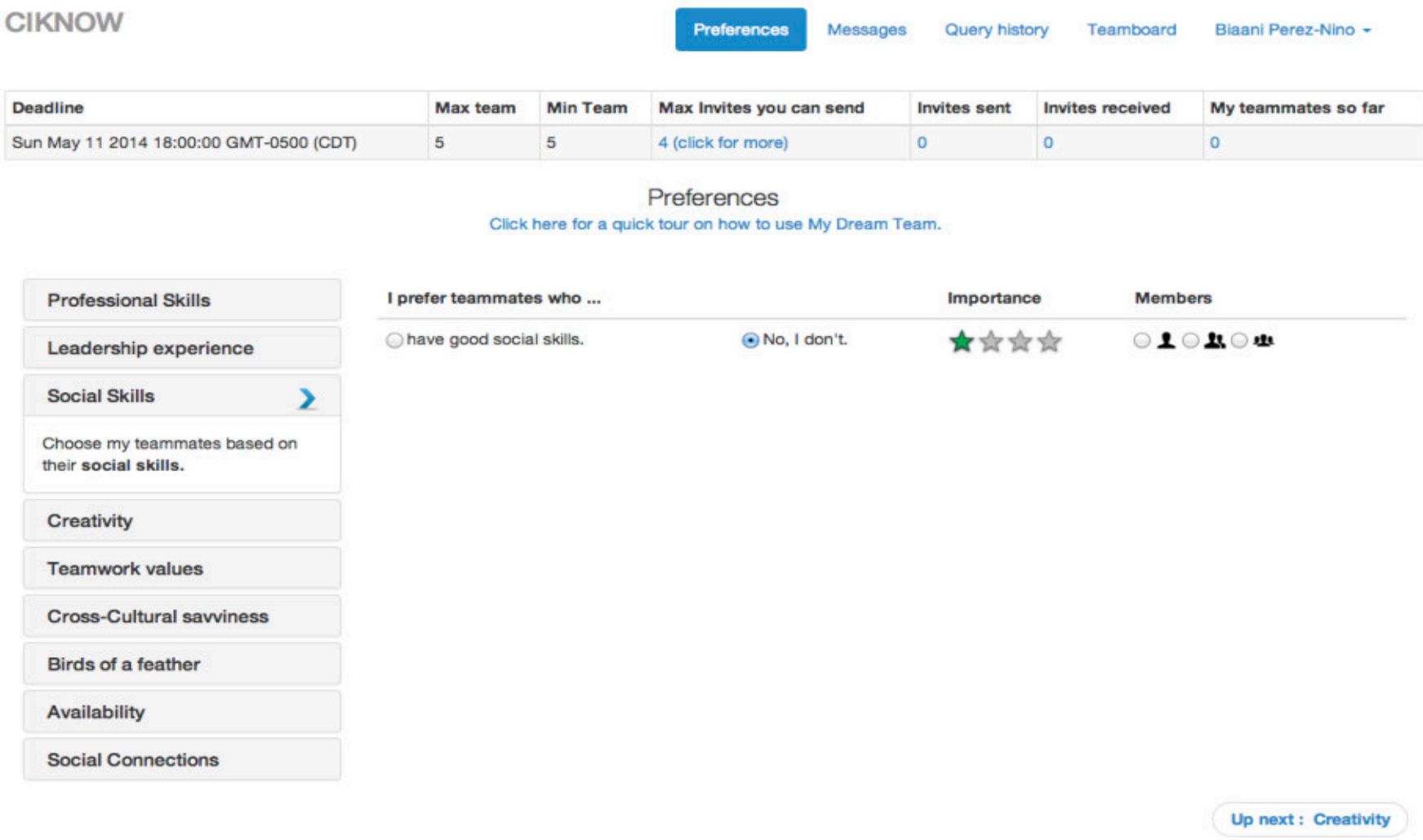

Creativity

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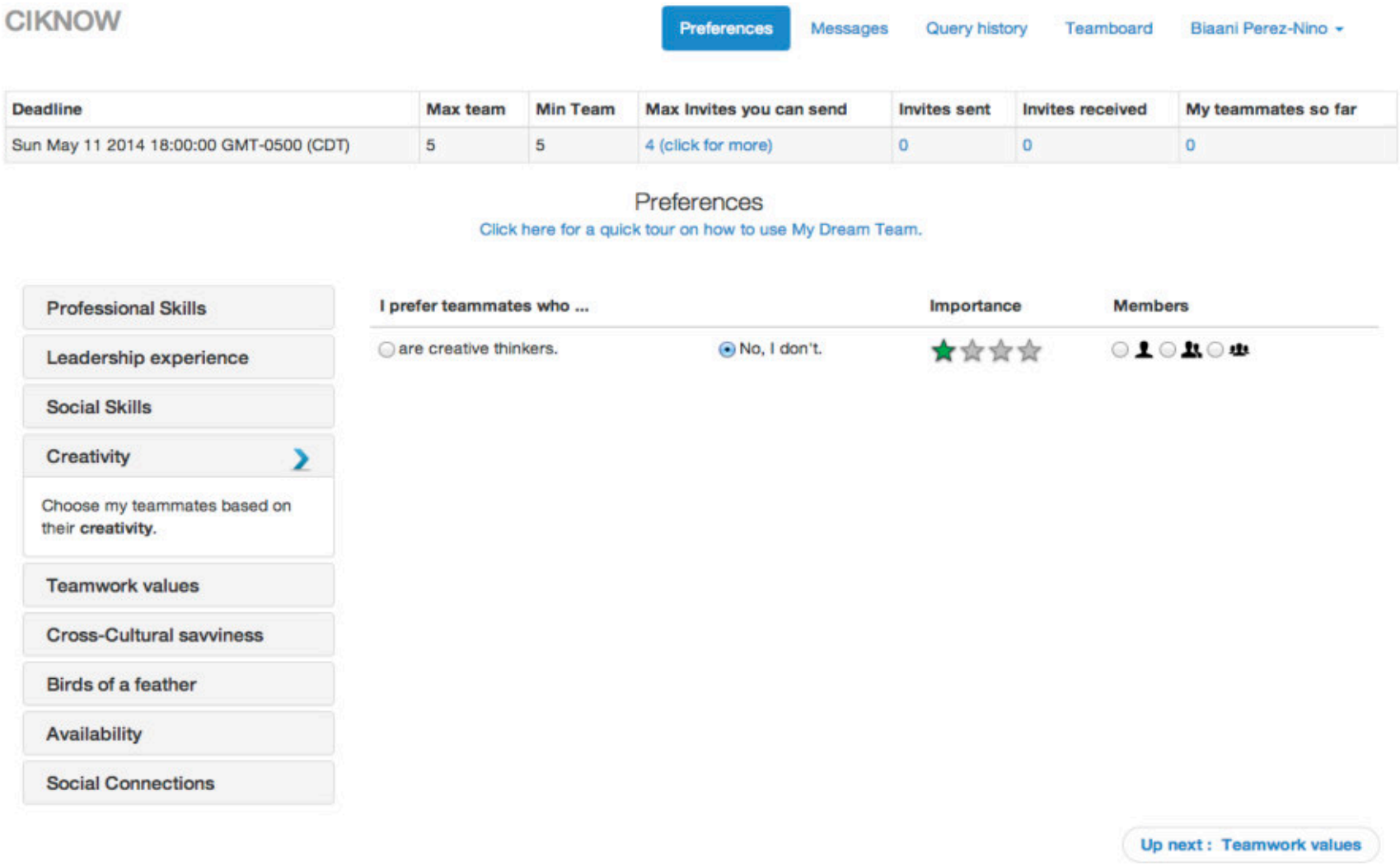
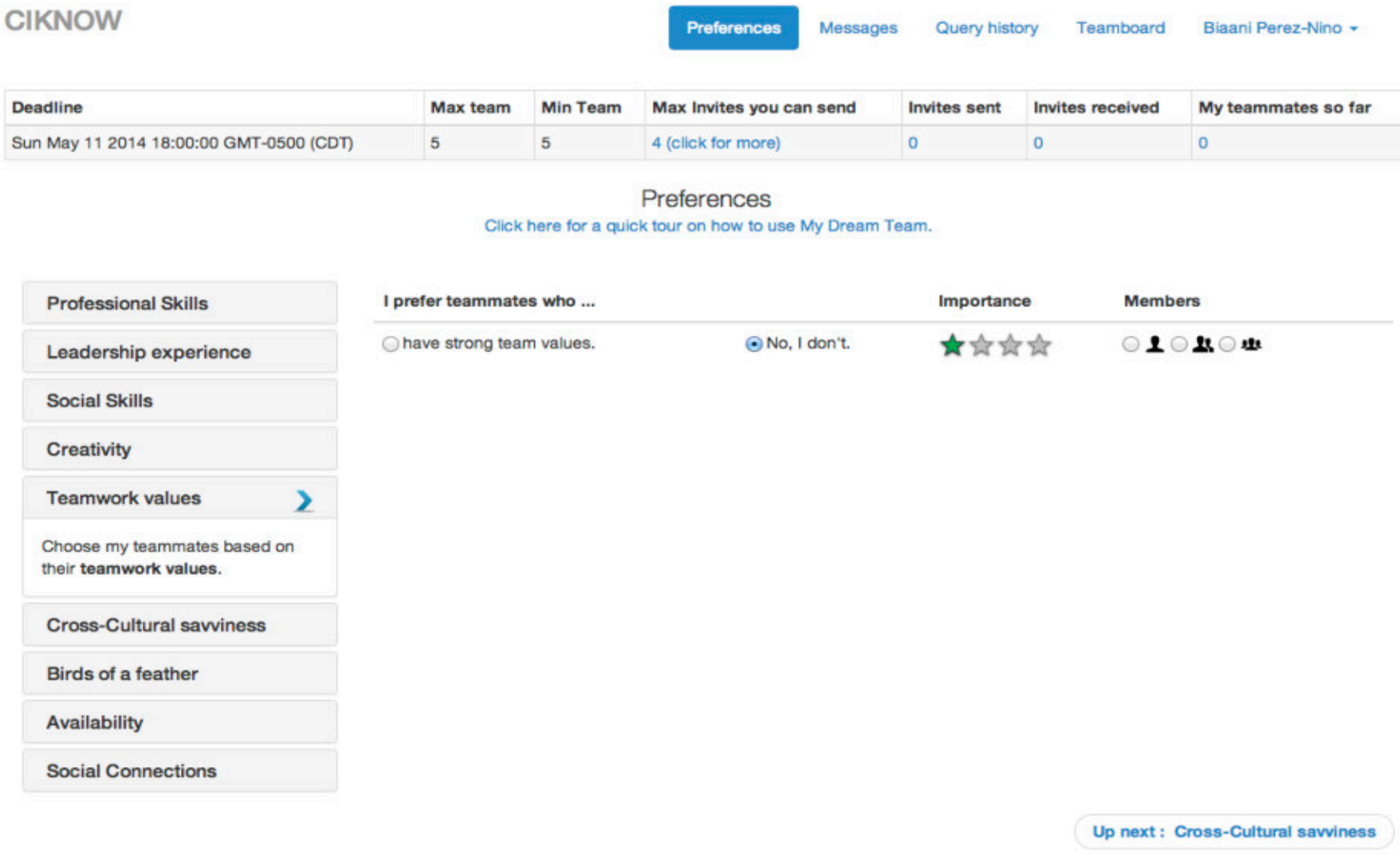


Teamwork Values

bit.ly/sonicmdt



Intercultural Sensitivity

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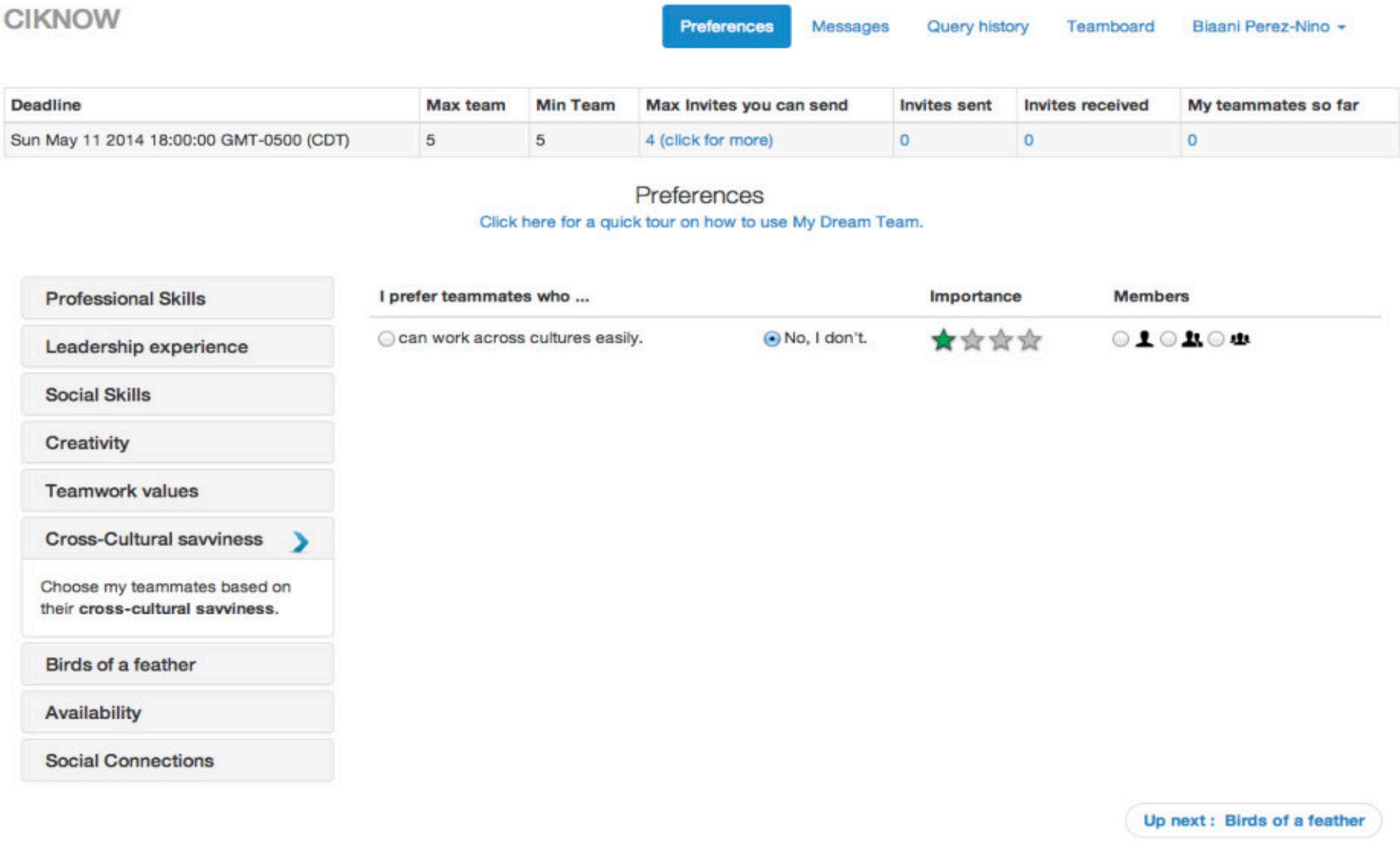

Homophily – Heterophily

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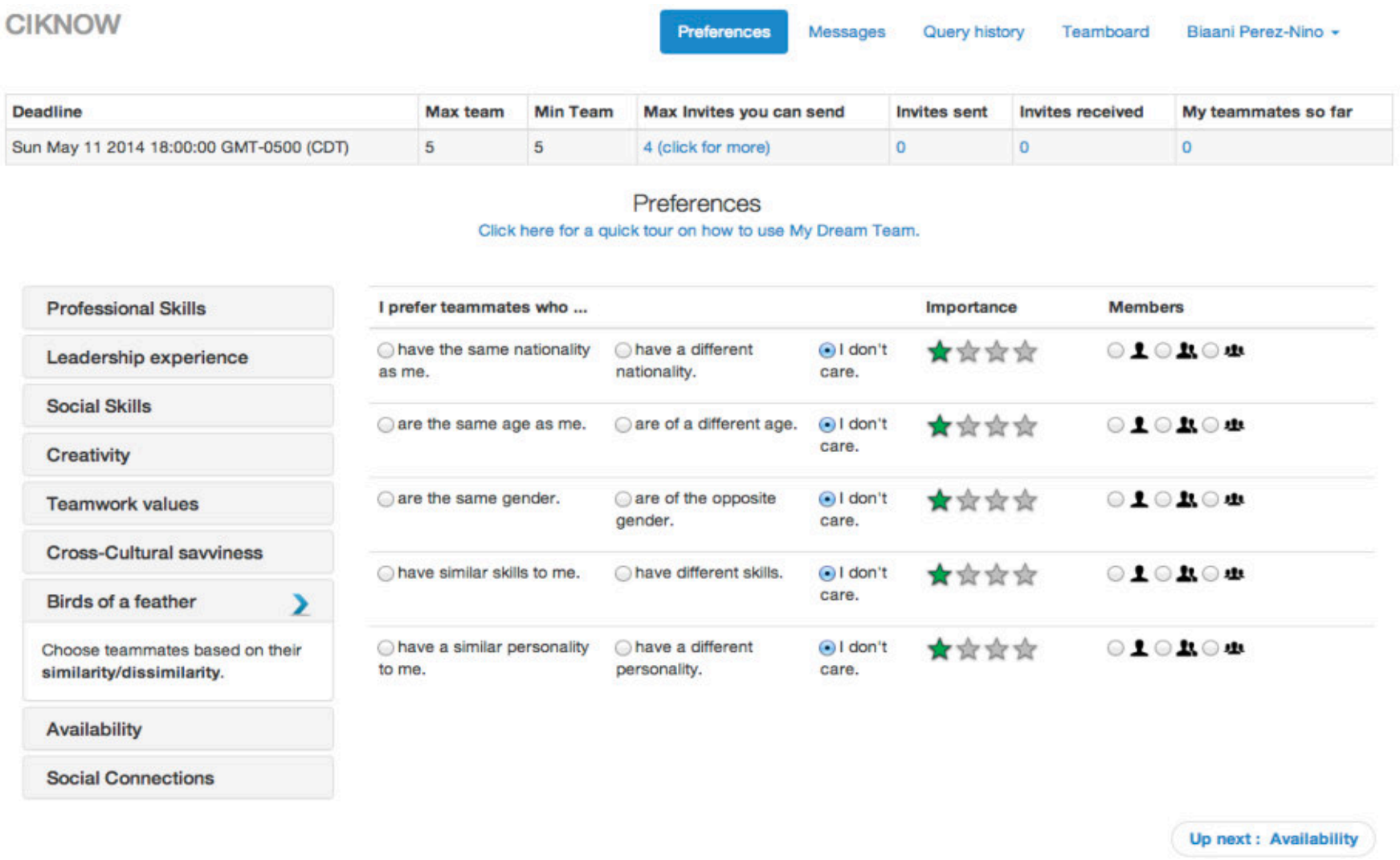

Availability

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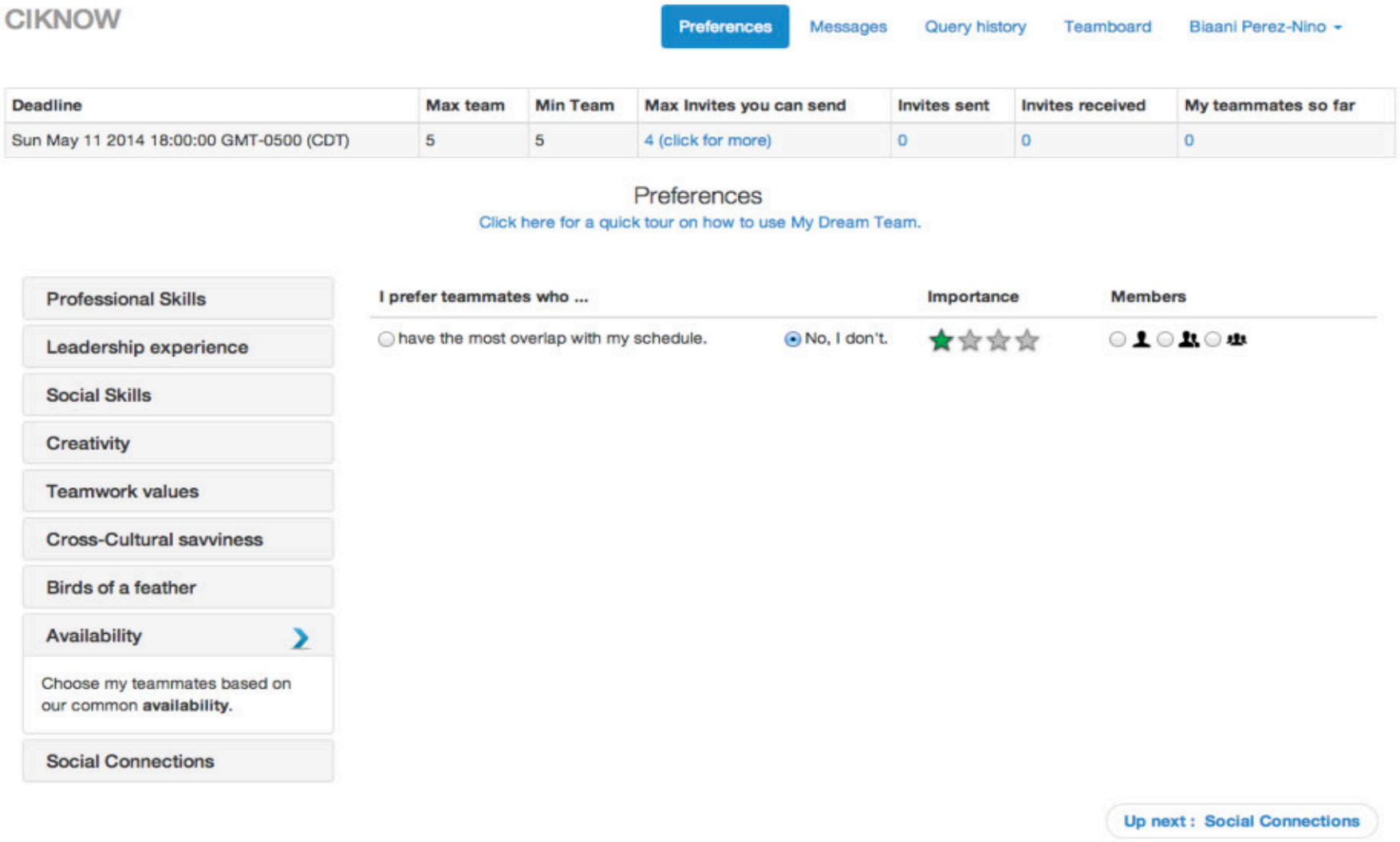

Social Networks

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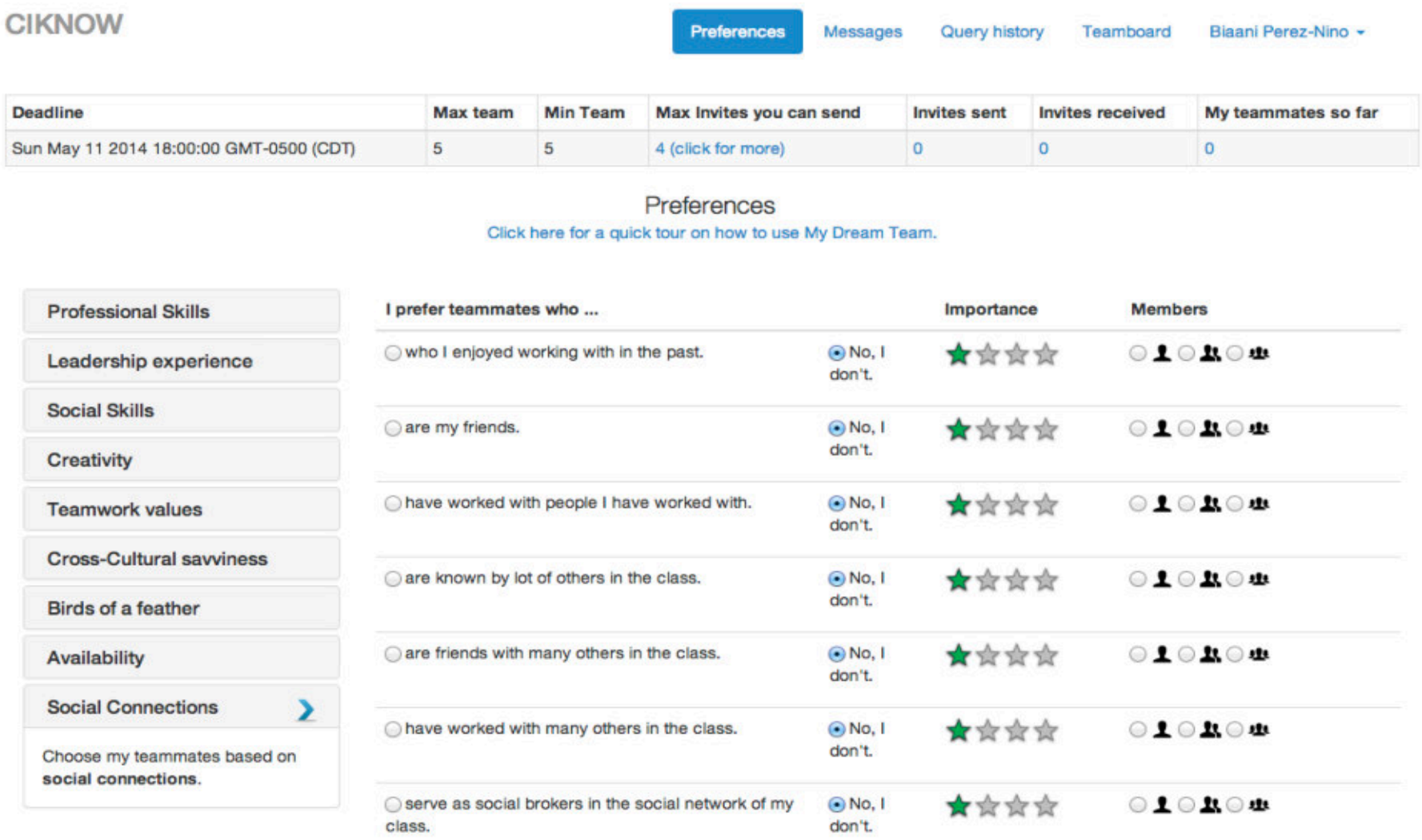

View Teammate Recommendations

bit.ly/sonicmdt

CIKNOW

Preferences Messages Query history Teamboard Amy Miller

Deadline	Max team	Min Team	Max Invites you can send	Invites sent	Invites received	My teammates so far
Mon May 12 2014 20:00:00 GMT-0500 (CDT)	5	5	4 (click for more)	0	0	0

Recommendations

All

Tashiana Osborne — 100%

Throughout my undergraduate studies, I have become even more passionate about earth and atmospheric sciences, especially in a world facing global-scale climatic changes. I am inspired to explore, research, share, and help protect Earth's true beauty. I look forward to connecting with others as I finish the final year of my hydrology/meteorology double major.

Tashiana Osborne —

Profile
Evaluate
Team
Invite

Jennifer Egert — 99%

I am a very outgoing person, I enjoy being around people as much as possible and interacting with as many people as I can to learn as much about various subjects, values and points of view. I enjoy leading people and influencing them with ideas.

Jennifer Egert —

Profile
Evaluate
Team
Invite

Matt Ribarich — 95%

I'm from the desert grasslands of Southern Colorado. I like human culture and music and plants and animals and learning about all that. Sometimes I'm serious and others I don't take much seriously. I'm usually pretty relaxed but sometimes I act strange, for fun. I like being outside but I also like being indoors. There's other stuff I can't think of.

Matt Ribarich —

Profile
Evaluate
Team

Review Profiles of Potential Teammates

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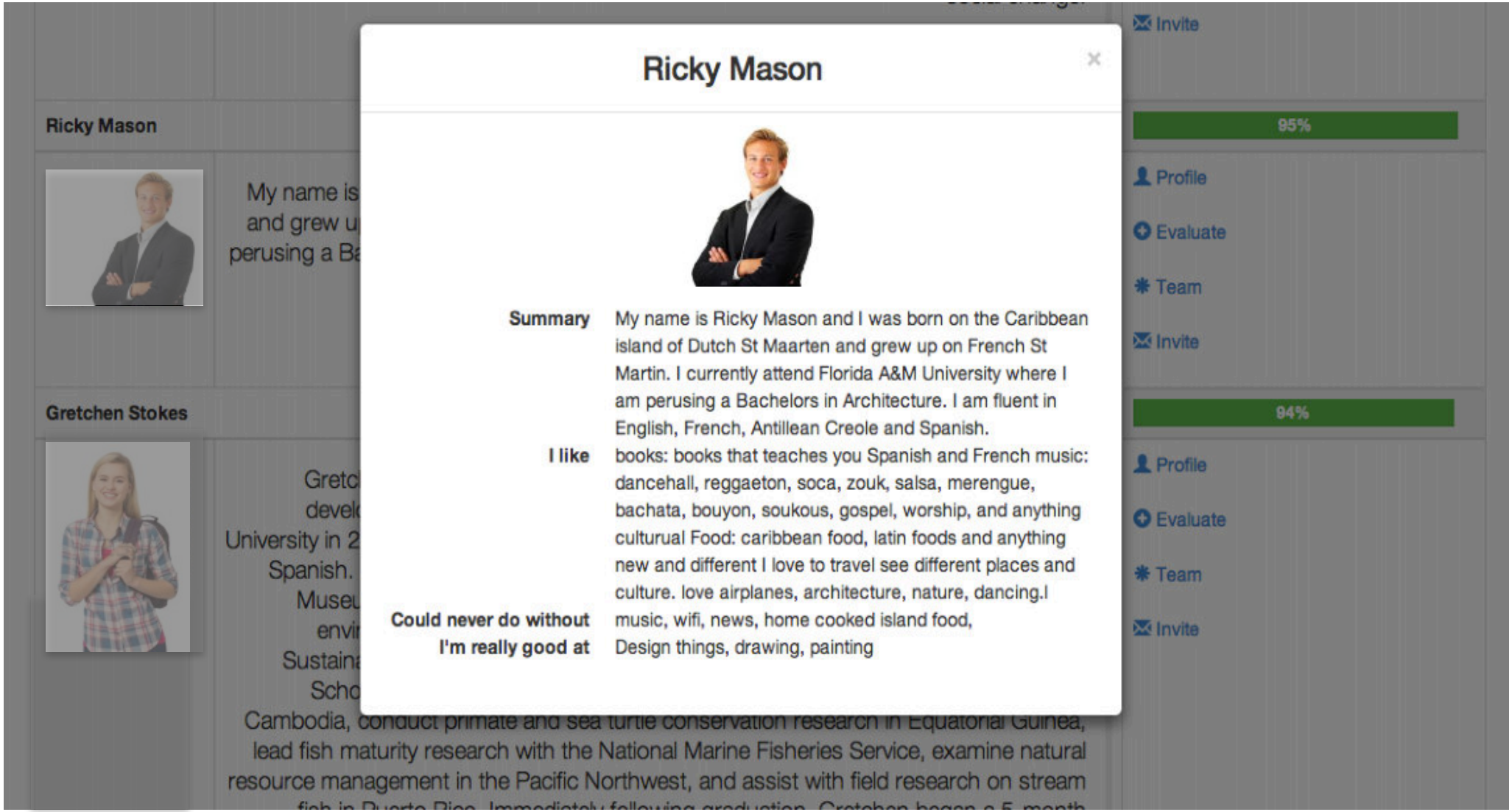
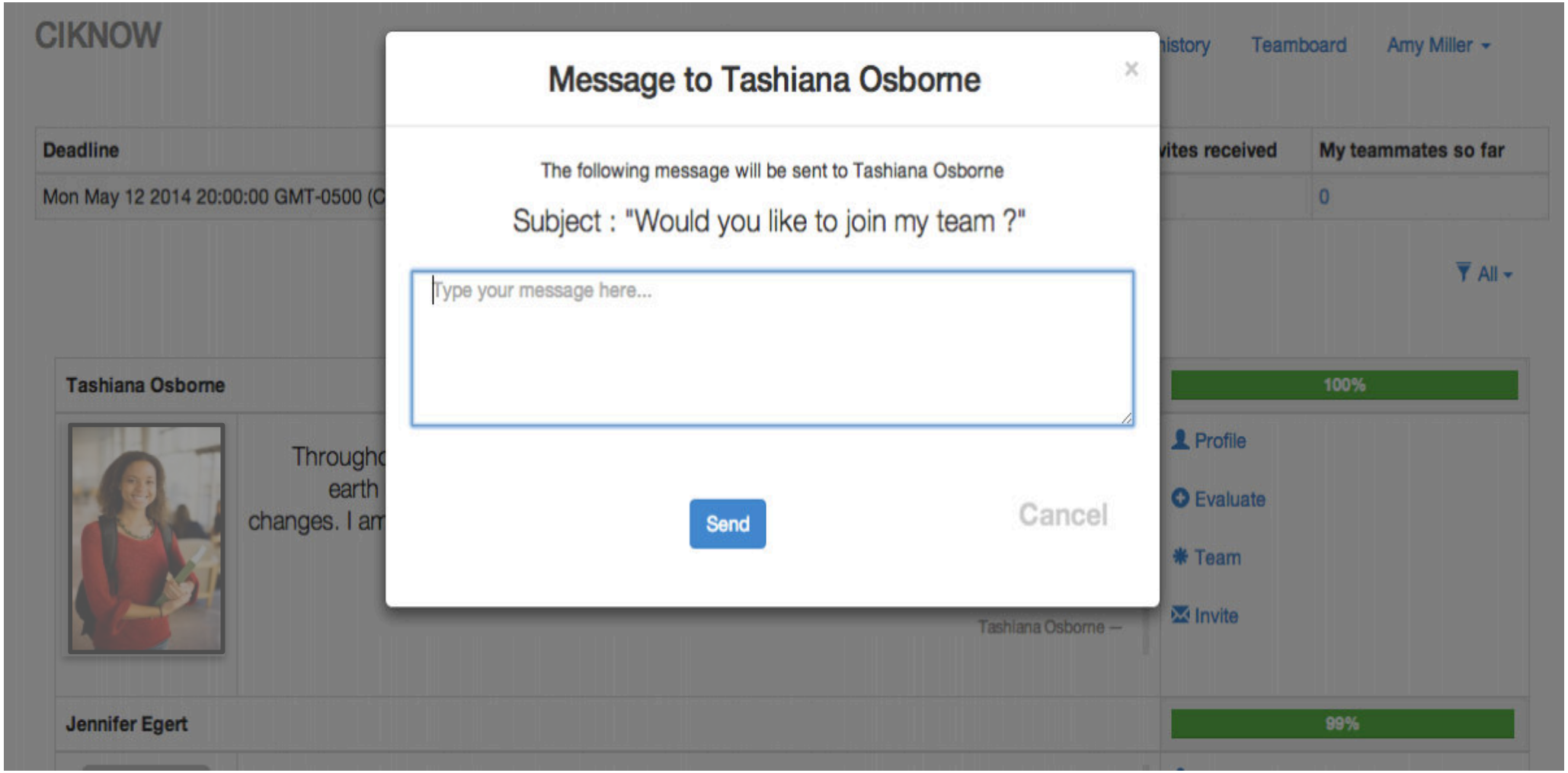


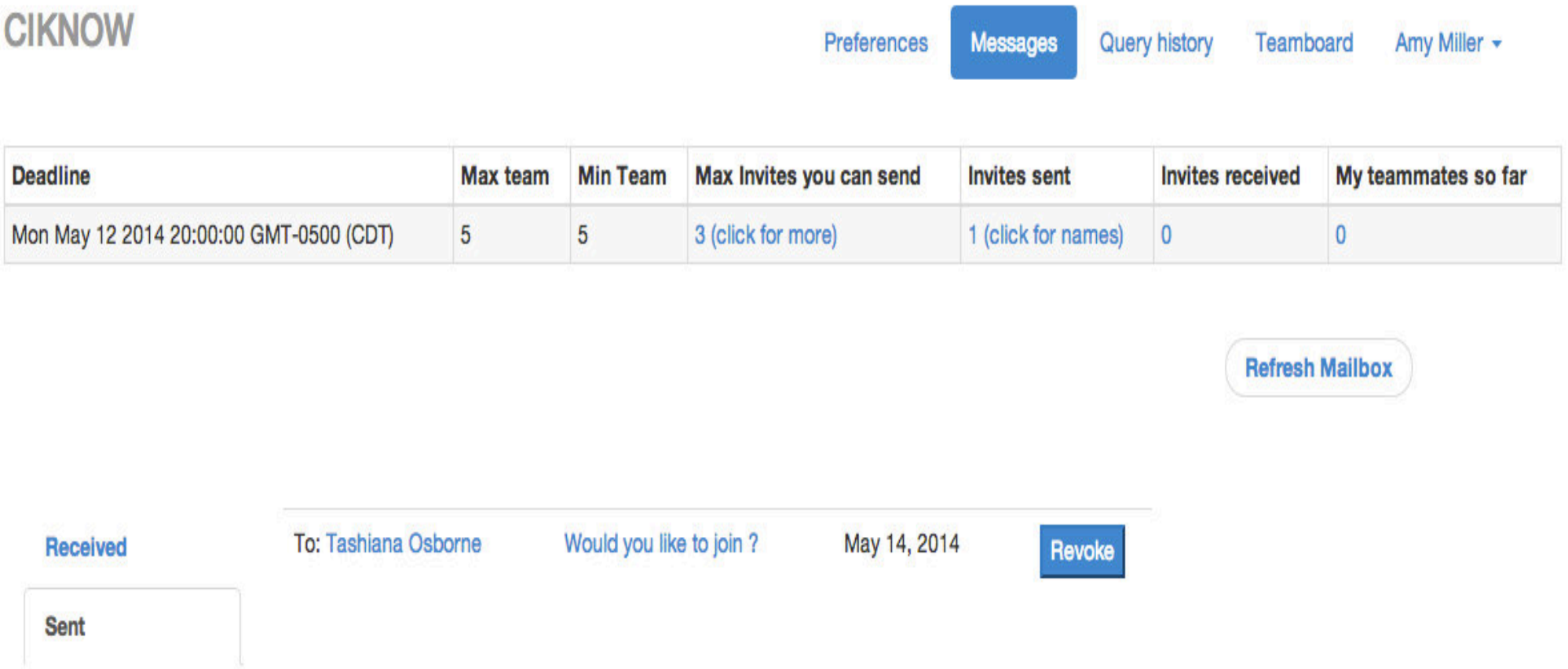
Send Teammate Invitations

bit.ly/sonicmdt



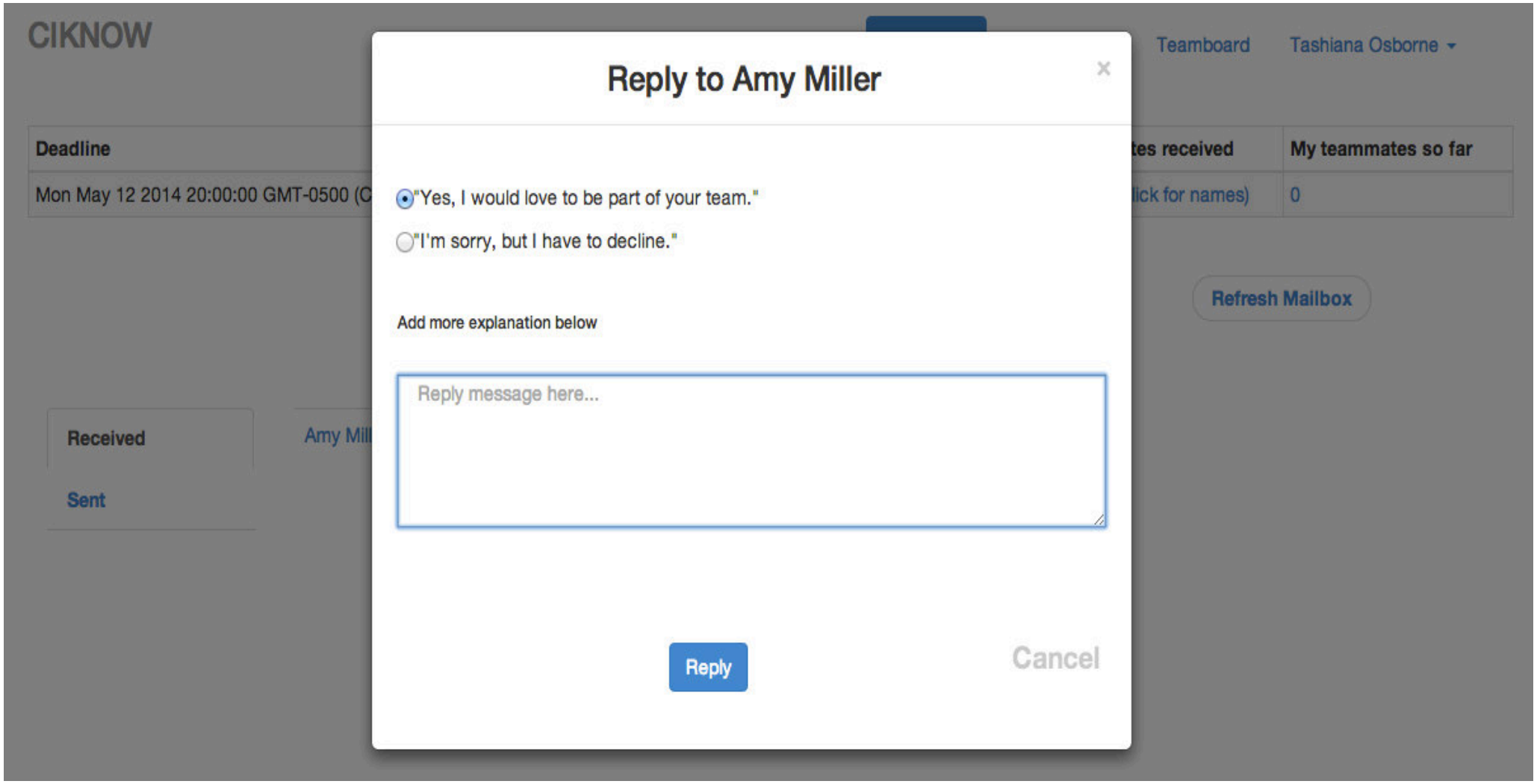
Review Inbound Invitations

bit.ly/sonicmdt



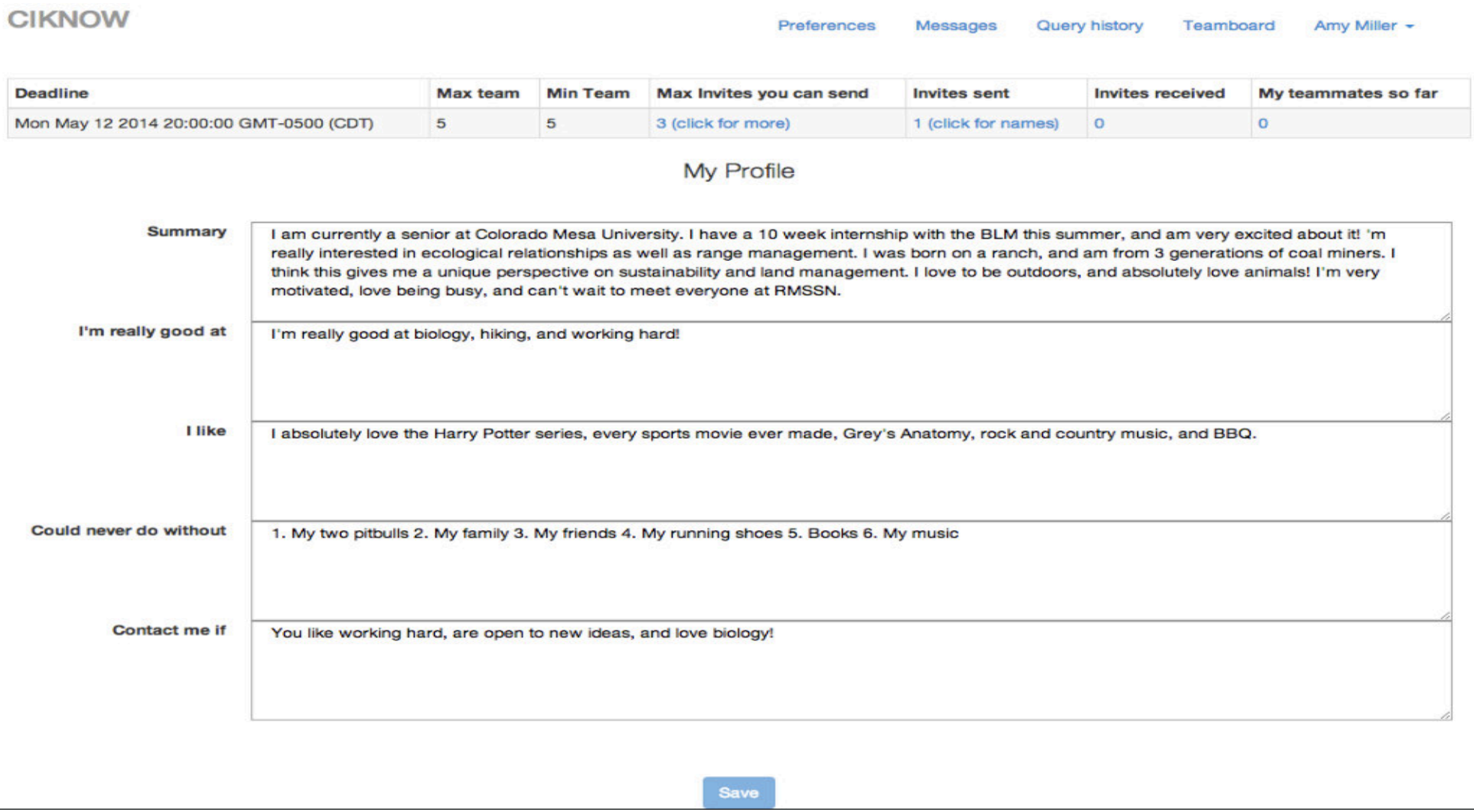
Reply to Inbound Invites

bit.ly/sonicmdt



Not Getting Any Invites?
Polish Your Profile

bit.ly/sonicmdt



Find a Better Team? Breakup

bit.ly/sonicmdt

CIKNOW

Preferences Messages Query history Teamboard Amy Miller

Deadline	Max team	Min Team	Max Invites you can send	Invites sent	Invites received	My teammates so far
Mon May 12 2014 20:00:00 GMT-0500 (CDT)	5	5	3 (click for more)	1 (click for names)	0	0

Leave Team

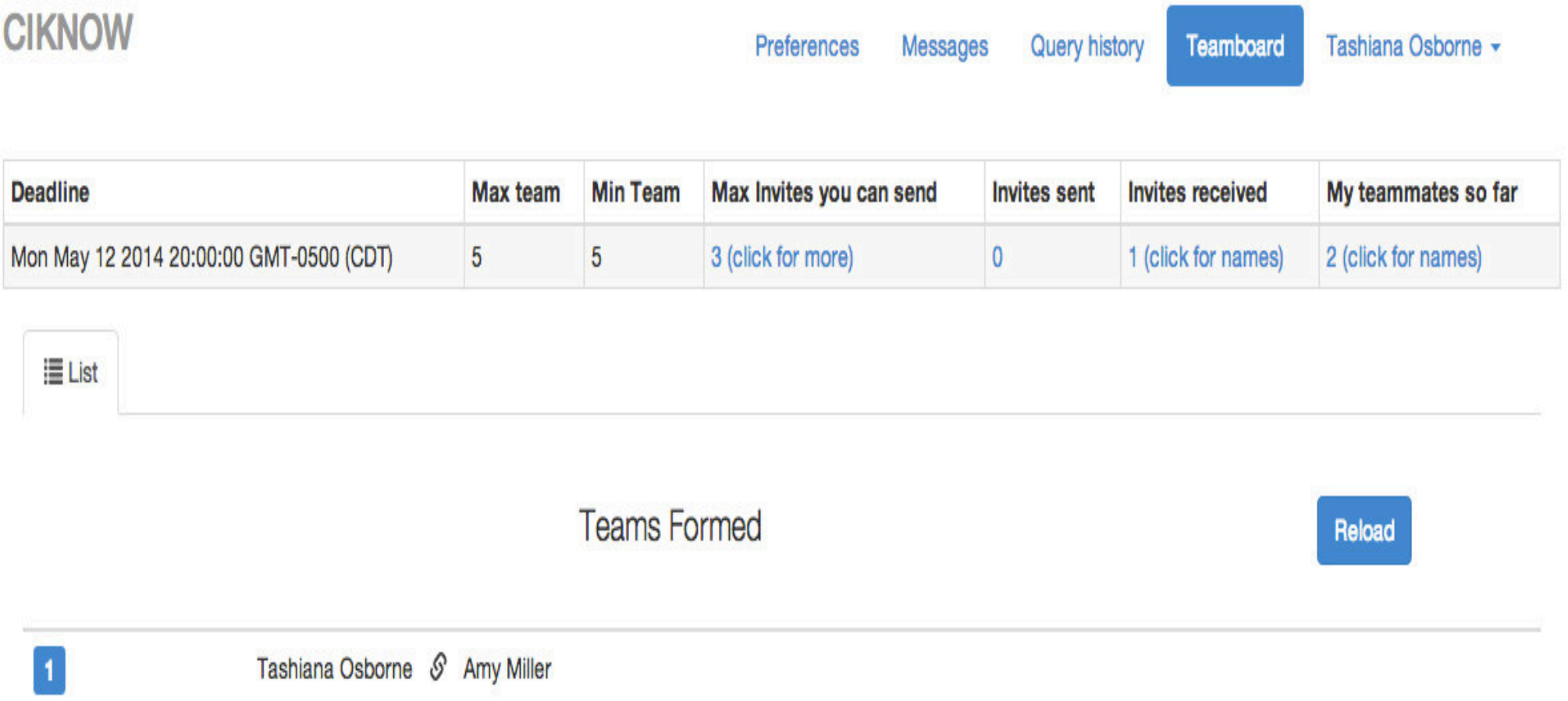
- (•) I am not happy with my current team.
- ( ) I think I can do better with new team.
- ( ) Other.

Please tell us why you want to leave your current team (won't be shared with any of your current team members.)

Leave

Monitor the Situation: The Team Board

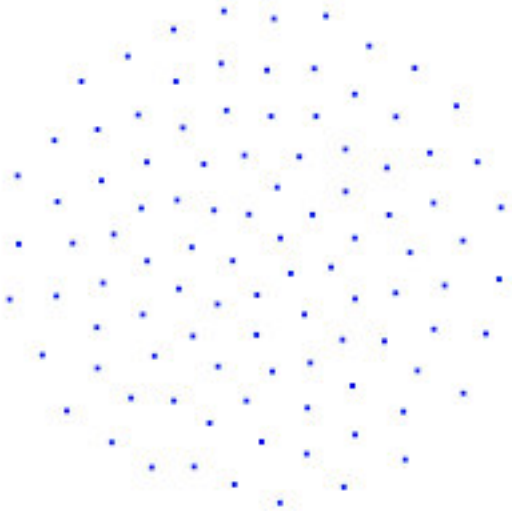
bit.ly/sonicmdt



Give 95 Students the chance to form teams using the tool…

Give 95 Students the chance to form teams using the tool…

Which factors will they consider when choosing teammates?



Will the tool help them routinize existing tendencies to consider "surface level" characteristics?

Surface Level Characteristics

Gender
Race
Ethnicity
Age

Or

Will the tool make the “invisible” “deep level” characteristics more visible?

Deep Level Characteristics

Expertise
Skills
Leadership Interest & Ability
Personality Traits
Attitudes

Team formed using the Tool

14

Blended teams

10

Instructor assigned team

6

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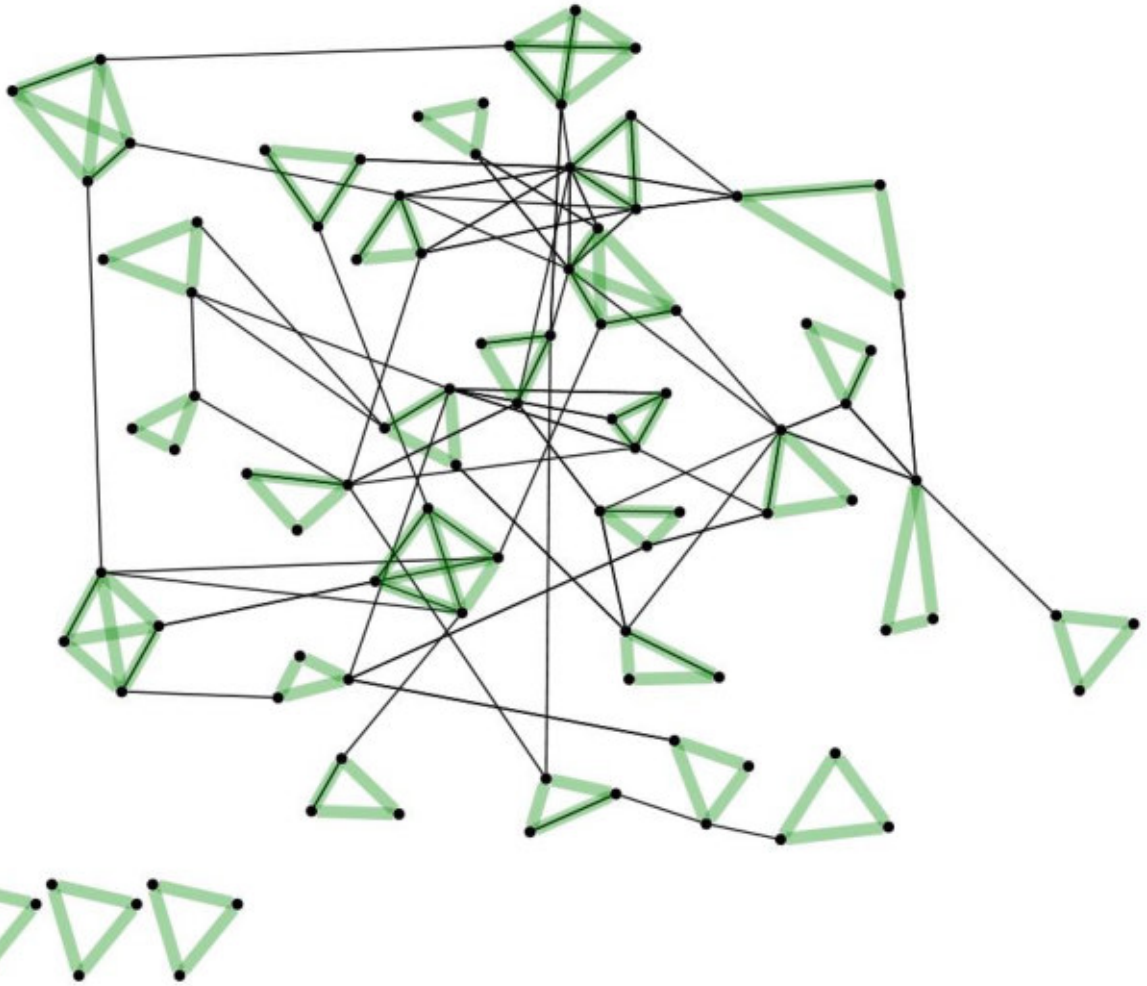
Do people choose teammates who they enjoyed working with in the past?



Individual

Team

Enjoyed Working Together in the Past

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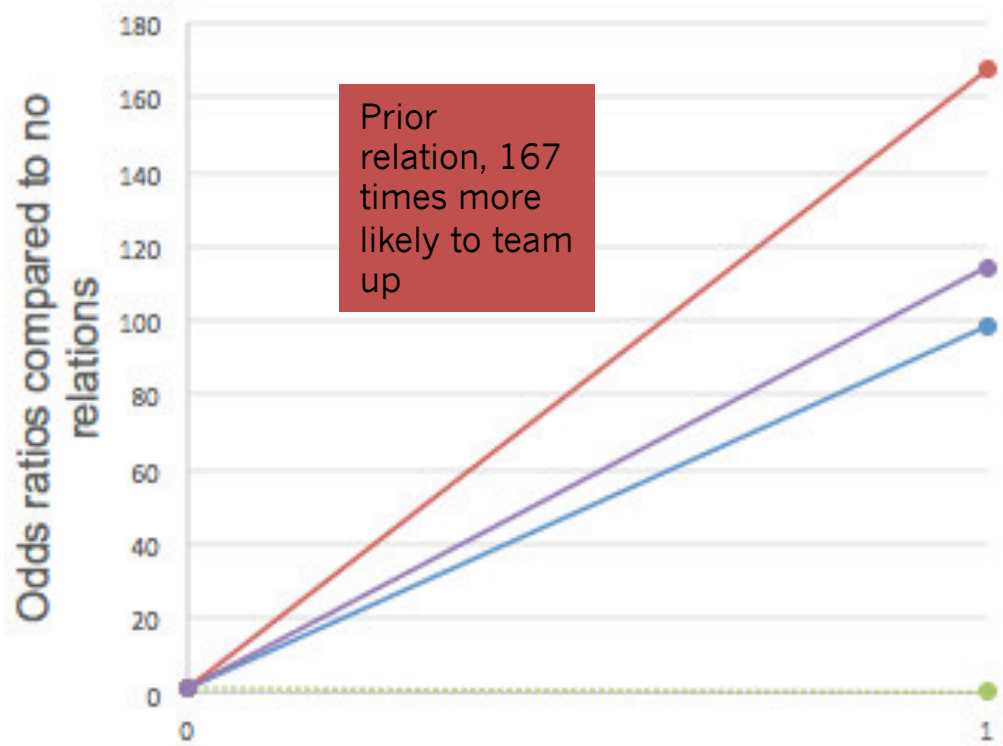
Using the Tool Increased the Reliance on Prior Collaborators



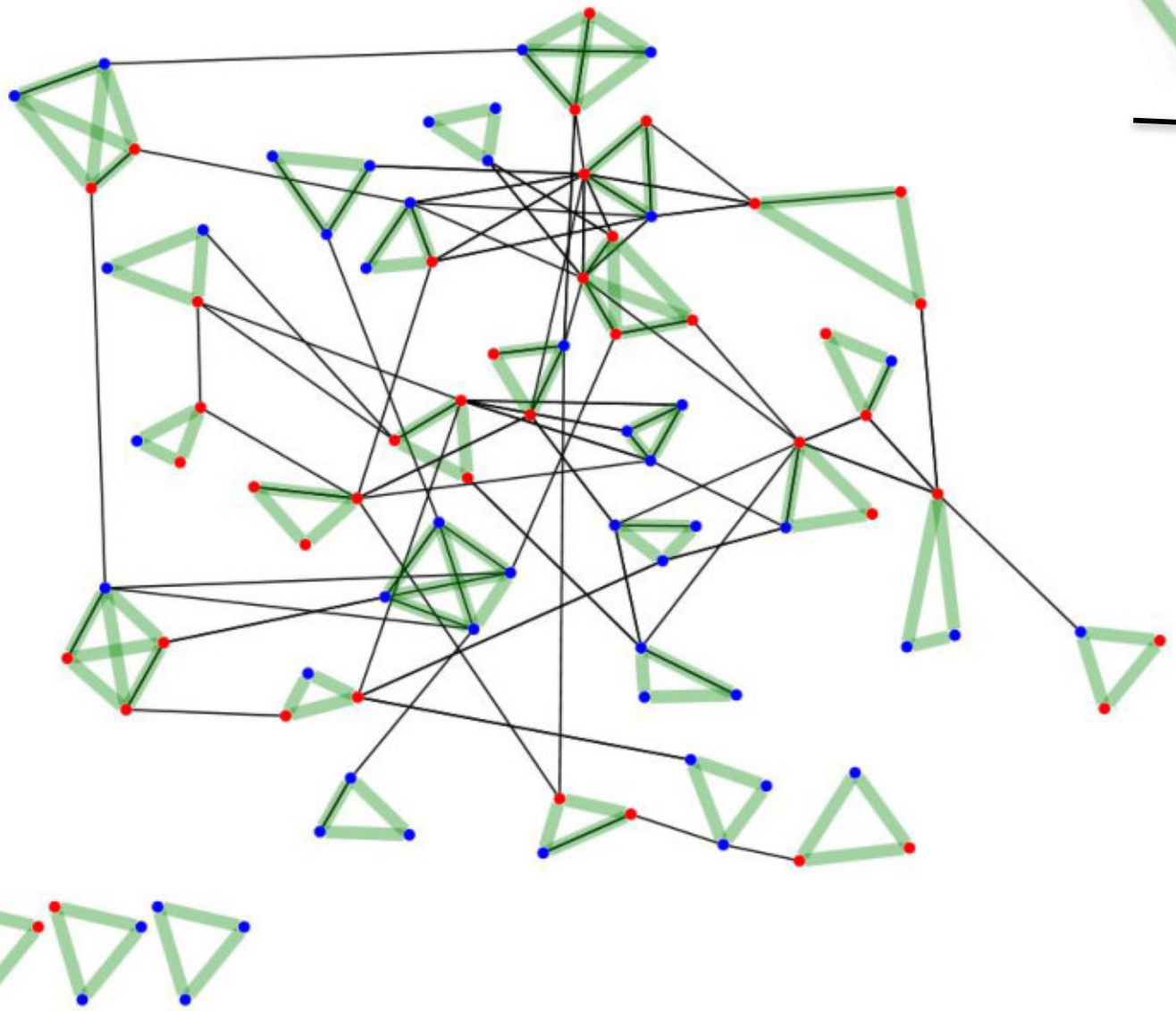
Tool — Odds Ratio: 167.3*

Blended — Odds Ratio: 114.4*

Everyone — Odds Ratio: 98.5*

Instructor — Odds Ratio: .04

Do people choose teammates of the same gender?



Individual

Team

Enjoyed Working Together in the Past

Males

Females

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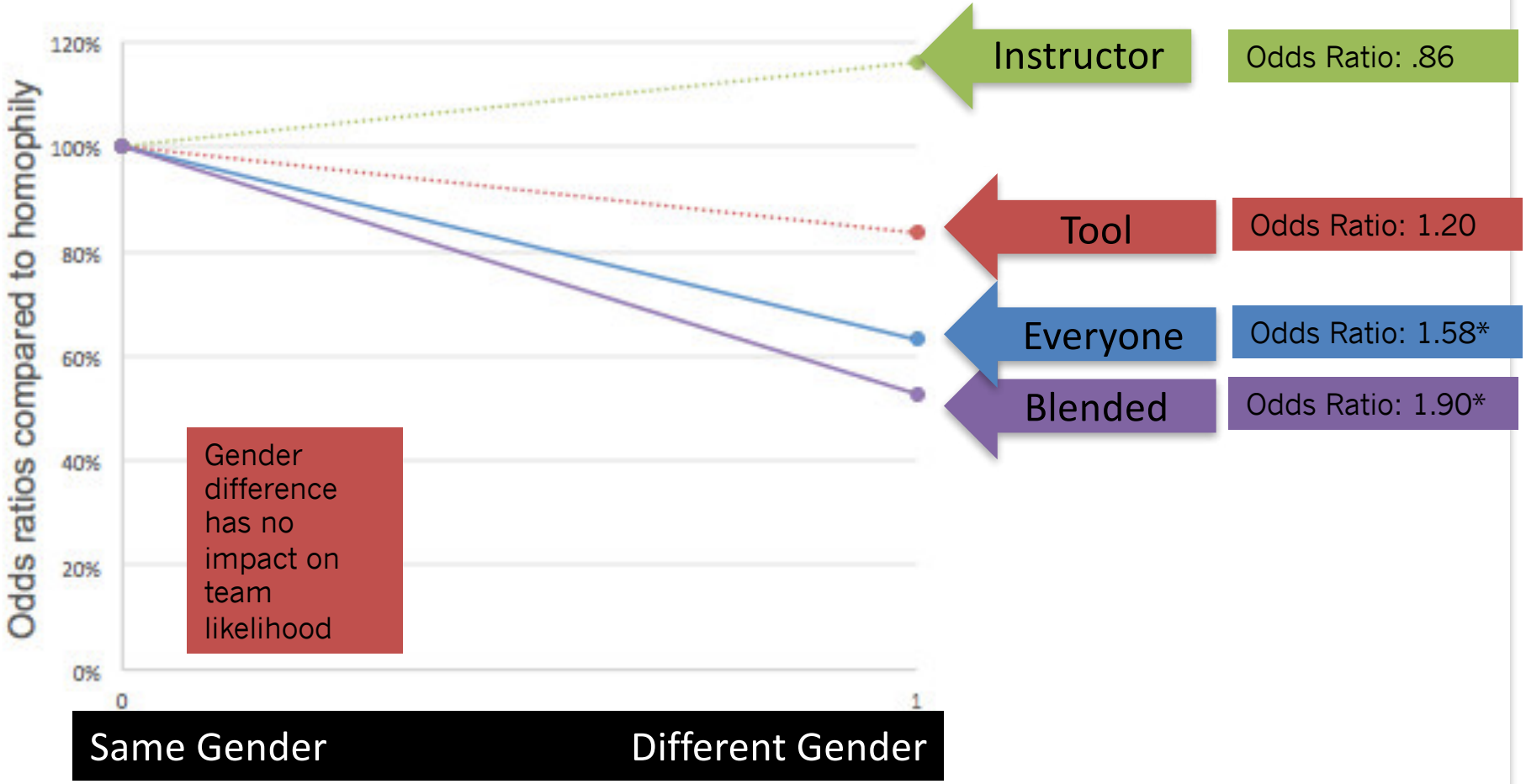
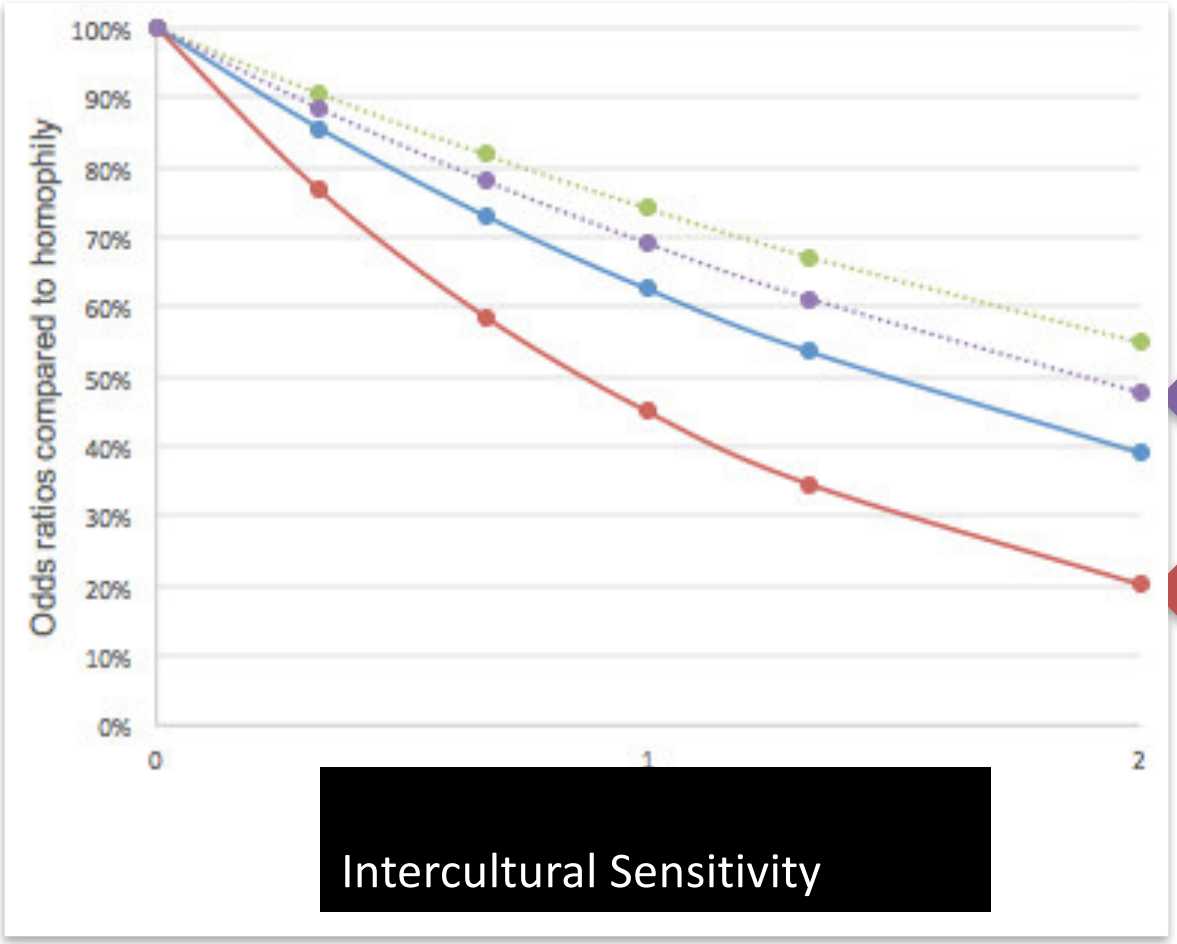
Using the Tool Eliminated Gender Homophily



Plots the odds ratio

Using the Tool Enabled Attitude Homophily



Instructor — Odds Ratio: .74

Blended — Odds Ratio: .69

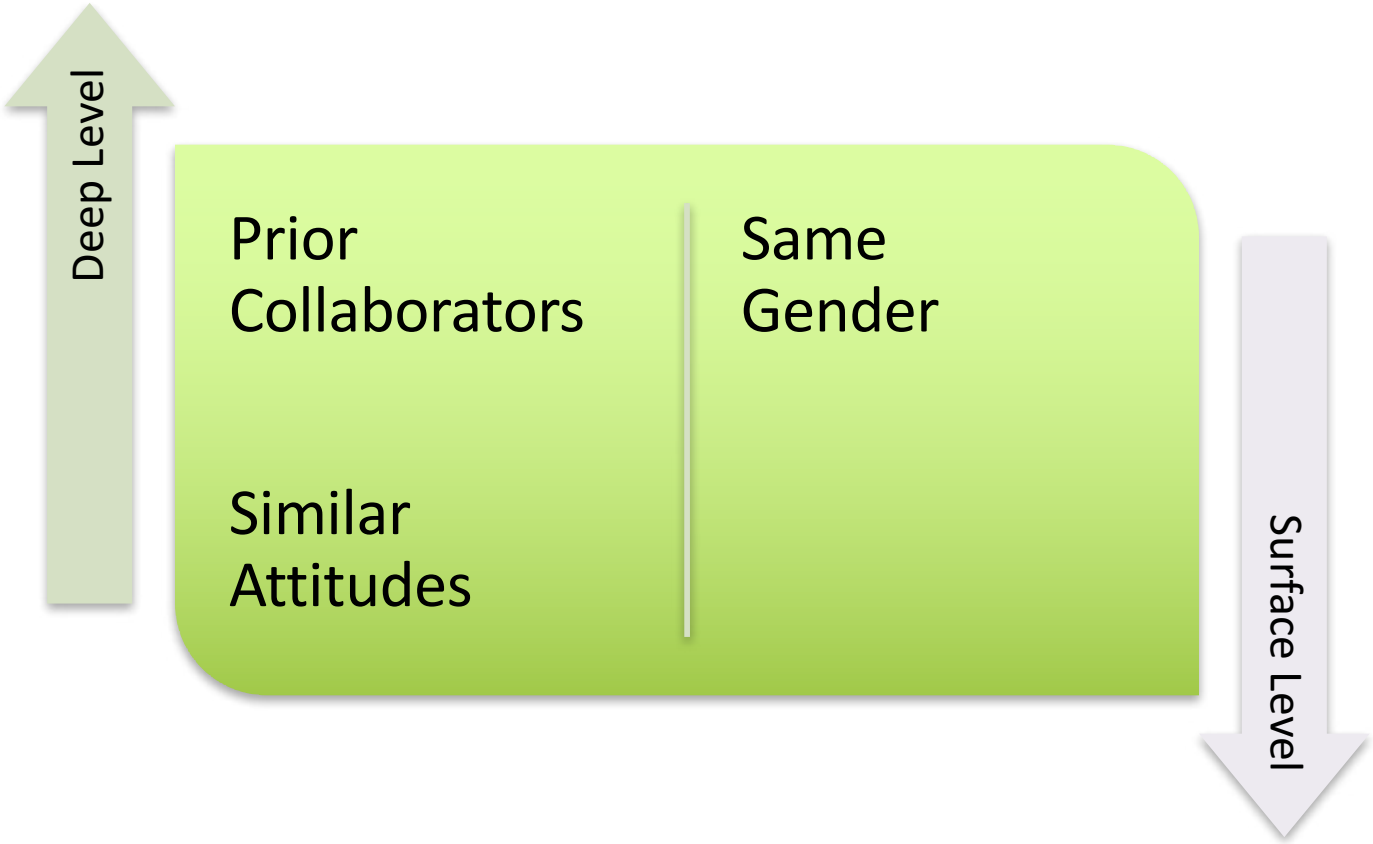
Everyone — Odds Ratio: .63

Tool — Odds Ratio: .45*

1 unit attitude difference, 0.45 x less likely to team up

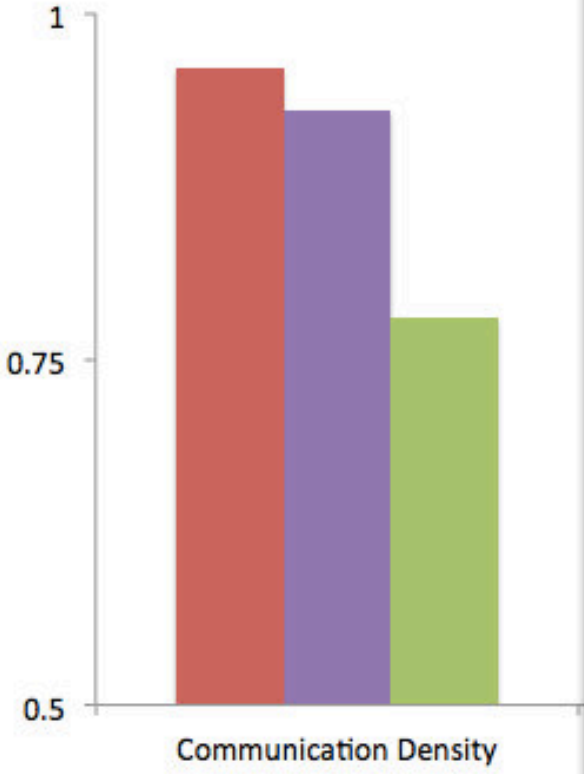
Plots the odds ratio

New Rules of Attraction



How Does Assembly Affect Team Functioning?

Teams formed online communicated more



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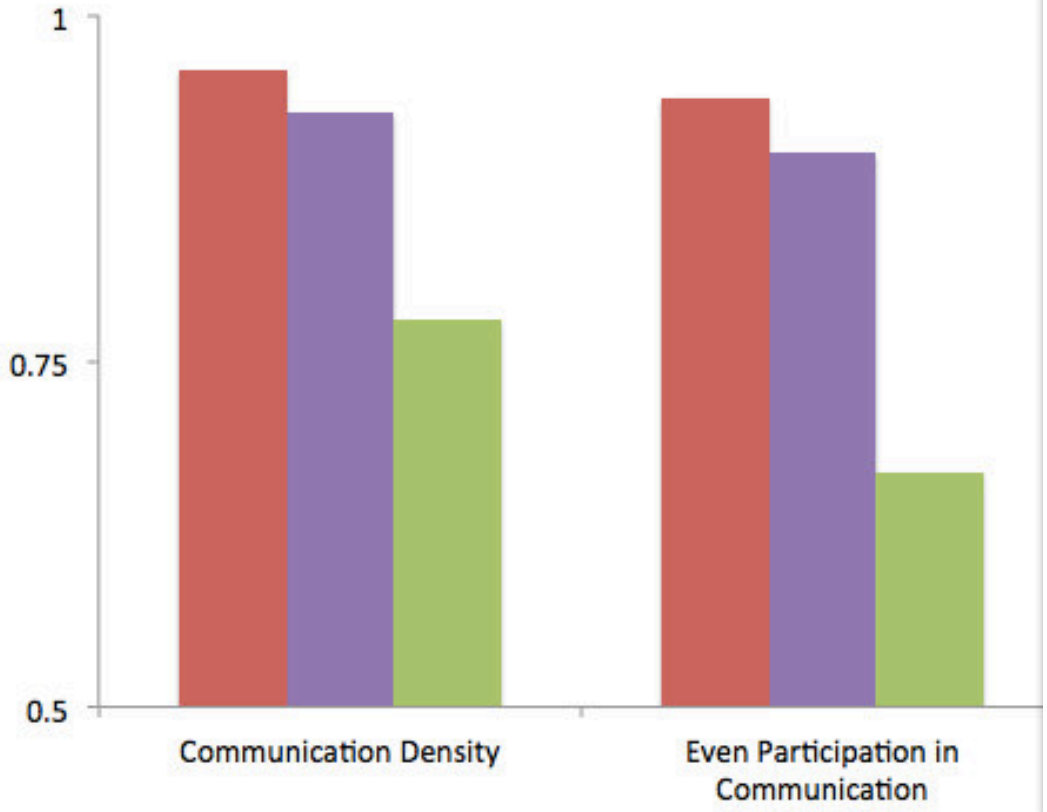
Teams formed in the tool communicated more evenly



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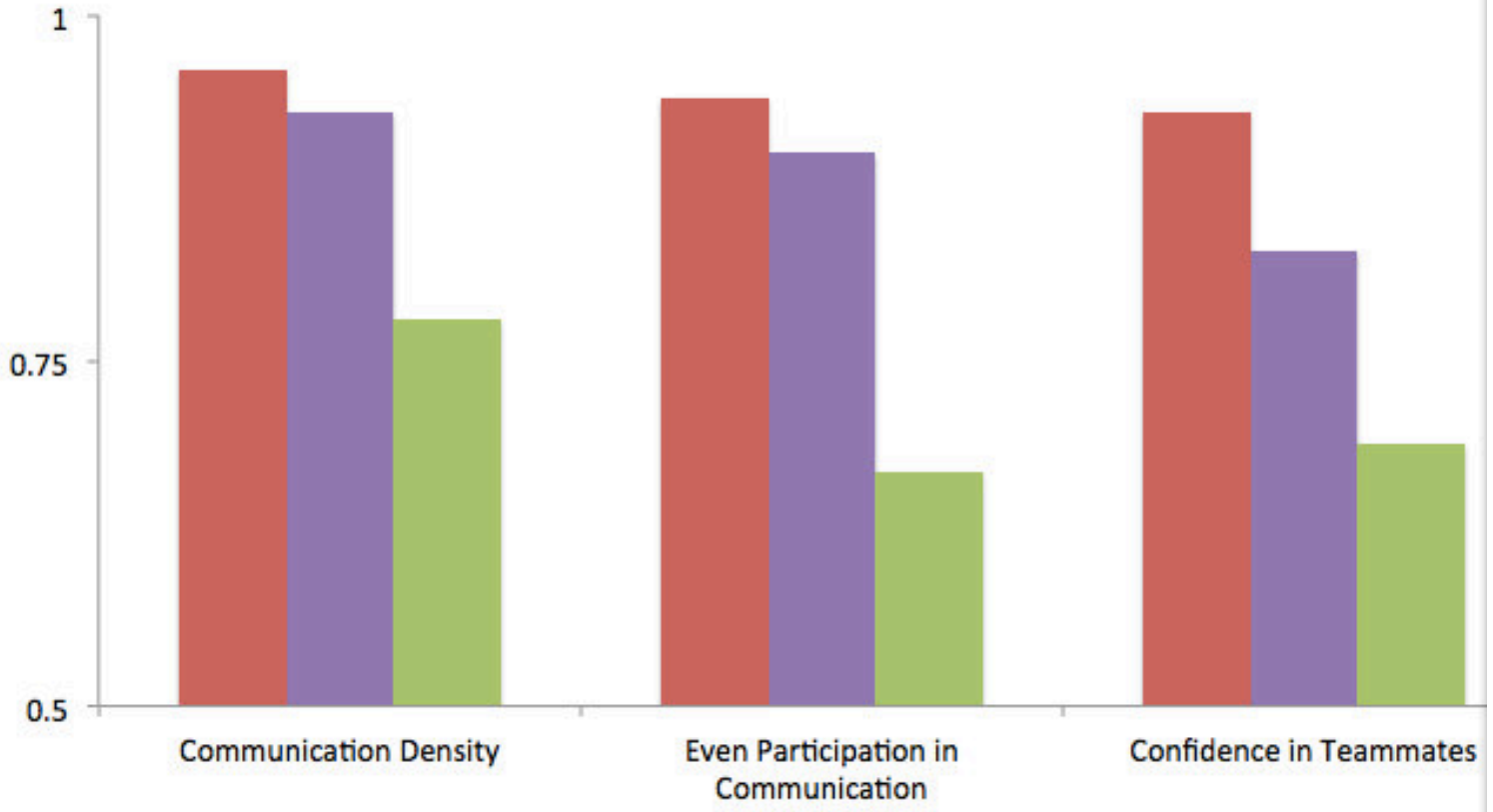
Teams formed in the tool were more confident in one another's abilities



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For more information on
My Dream Team:

Email: nosh@Northwestern.edu

bit.ly/sonicmdt

How did the this challenge benefit from computational social science?

- Harvesting tracts of behavioral network data about coauthorship and citation data among large scientific communities
- Utilizing computationally intensive algorithms to confirm hypotheses about structural signatures associated innovation.
- Developing tools to assist individuals with team assembly that also collaterally provide large amounts of data to explore at scale the heretofore unobserved process of the sequencing of assembling of teams

Theory:
Questions we thought we couldn't answer…

- Disaster Response
  - How do multi-organization networks emerge in response to a disaster?
  - How do we monitor and design interventions to make them more effective?

- Accelerating Innovation
  - What are the network factors that influence the assembly of innovative teams?
  - How do we design a "dream team" builder to optimize their assembly?

- Scaling up Global Health Solutions
  - What are the network factors that determine who influences whom and how in order to scale up the adoption of health solutions?
  - How do we utilize this knowledge to design sequencing strategies that optimize the speed and scope of scale-up at minimal cost?

Scale Up Global Family Health Solutions in Bihar, India
Combining ***who*** to influence with ***how*** to influence

Collaborators:

Leslie DeChurch & Michelle Shumate,

Northwestern University

Paul Leonardi

UCSB

Larry Prusak,

Consultant, Knowledge Management

Wolfgang Munar, Ethan Wong, Deb Bhattacharya

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Cord cleansing:
Overall neonatal mortality

Group	Deaths	Births	NMR	RR	95% CI
CHX	72	4924	14.6	**0.76**	**0.55-1.04**
Soap&H_2O	98	5107	19.2	1.00	0.76-1.31
Dry Care	98	5082	19.3	1.00	-

Mullany et al. Lancet 2006; 367:910-918.

Key Assumption

Scaling up family health solutions from "innovation districts" to "scale-up district" requires integration of appropriate:

1. Social influence strategies
2. Central "Touch points" and
3. Media channels

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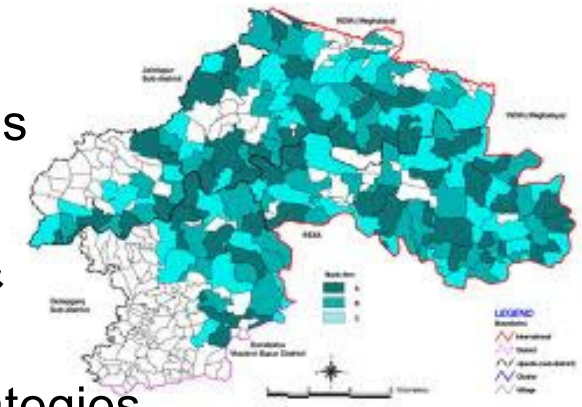
Study Procedures

- **D**iscover the attitudes and current knowledge-sharing networks of among over 16,000 government employees responsible for implementing family health solutions

- Build the analytical framework that **d**iagnoses and **d**esigns the scale up of family health solutions

- Key Variables:
  - Advice and Information sharing network ties
  - Current and preferred media preferences
  - Adoption Readiness (Likelihood to Adopt & Likelihood to be Influenced by others)
  - Disposition to different social influence strategies



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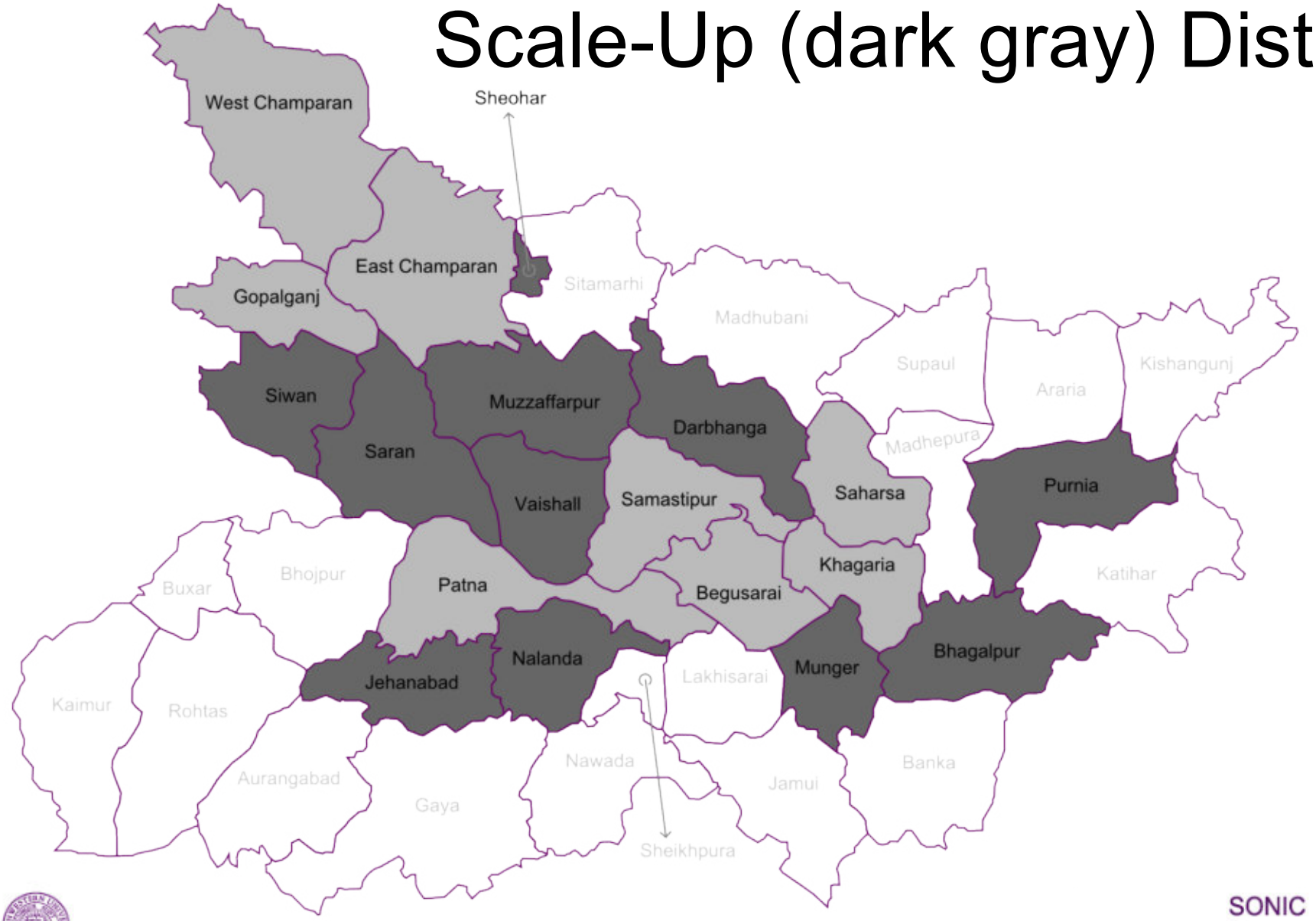
Innovation (light gray) & Scale-Up (dark gray) Districts



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Integrating social networks and human social motives to achieve social influence at scale

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[a]Departments of Industrial Engineering and Management Sciences, Communication Studies, and Management and Organizations, Northwestern University, Evanston, IL 60208; and [b]School of Psychology, Georgia Institute of Technology, Atlanta, GA 30332

Edited by Dietram A. Scheufele, University of Wisconsin–Madison, Madison, WI, and accepted by the Editorial Board August 7, 2014 (received for review February 3, 2014)

The innovations of science often point to ideas and behaviors that must spread and take root in communities to have impact. Ideas, practices, and behaviors need to go from accepted truths on the part of a few scientists to commonplace beliefs and norms in the minds of the many. Moving from scientific discoveries to public good requires social influence. We introduce a structured influence process (SIP) framework to explain how social networks (i.e., the structure of social influence) and human social motives (i.e., the process of social influence wherein one person's attitudes and behaviors affect another's) are used collectively to enact social influence within a community. The SIP framework advances the science of scientific communication by positing social influence events that consider both the "who" and the "how" of social influence. This framework synthesizes core ideas from two bodies of research on social influence. The first is network research on social influence structures, which identifies who are the opinion leaders and who among their network of peers shapes their attitudes and behaviors. The second is research on social influence processes in psychology, which explores how human social motives such as the need for accuracy or the need for affiliation stimulate behavior change. We illustrate the practical implications of the SIP framework by applying it to the case of reducing neonatal mortality in India.

saving changes in attitude and behaviors the challenges faced in communicating that science remain formidable. We return to the case of CHG later. First, we advance the notion of a structured influence process (SIP) that builds on two influential, but for the most part distinct, intellectual approaches to transform scientific discoveries into societal breakthroughs by changing people's attitudes and behaviors.

The SIP Framework

The SIP framework explains how social networks (i.e., the structure of social relations) and human social motives (i.e., the process of social influence that occurs when the actions of one person or group prompt changes in others' actions) can be used to enact social influence within a community. Such a framework has important implications for advancing the science of scientific communication. This framework builds on core ideas from two areas of social science. The first is research on social networks, which explores how individuals' network of contacts shape their attitudes and behaviors. The second is research on social influence within psychology, which explores how basic human social motives stimulate attitude and behavior change. Whereas both areas are concerned with social influence, they have taken very different perspectives. Synthesizing these perspectives, as we

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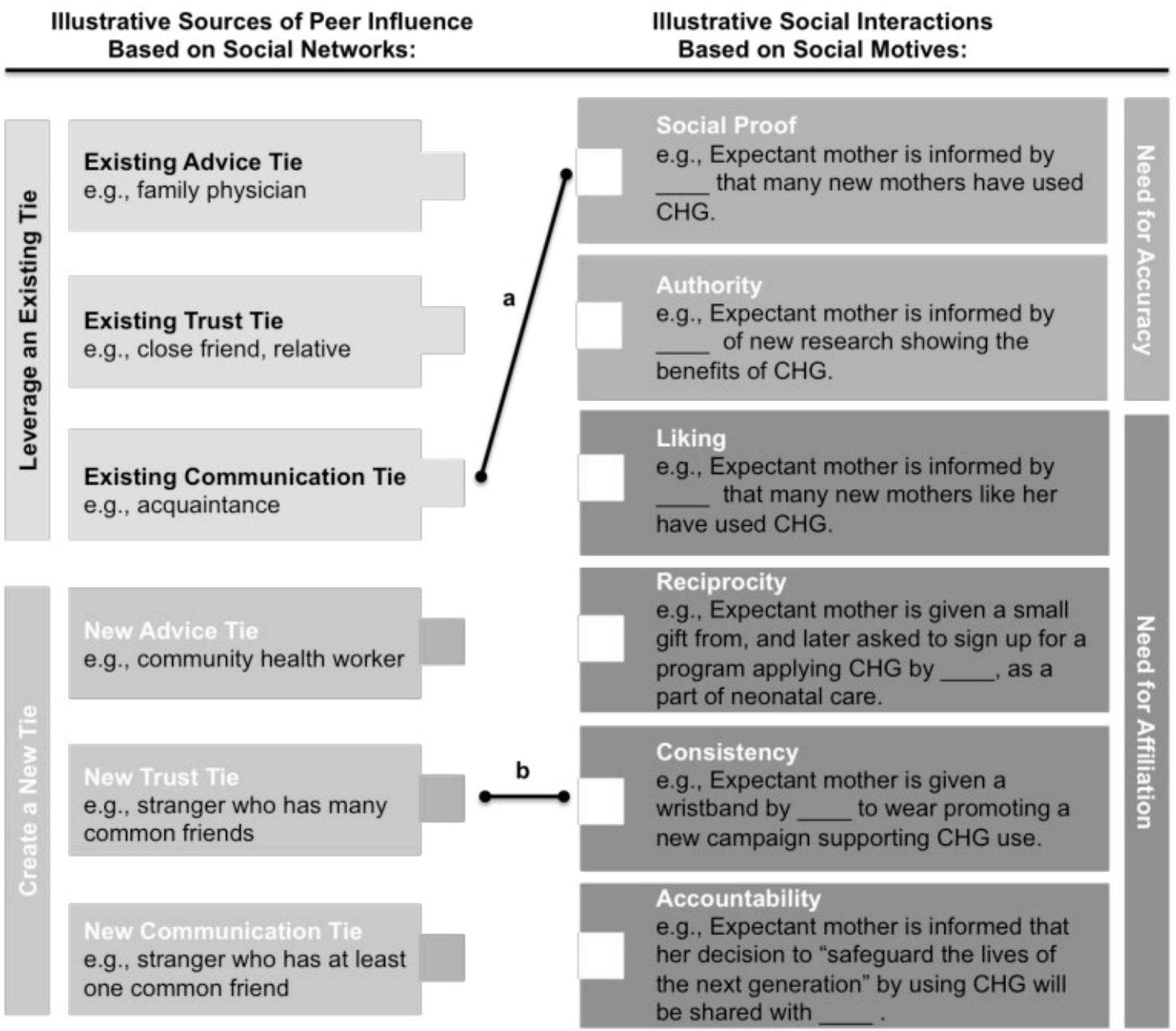

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Demo of Dashboard for Technology Support Unit (TSU) of CARE India to support decisions about WHO to influence and HOW to influence for scaling up family health innovations

http://bit.ly/tsudashboard

Password: tsuindia

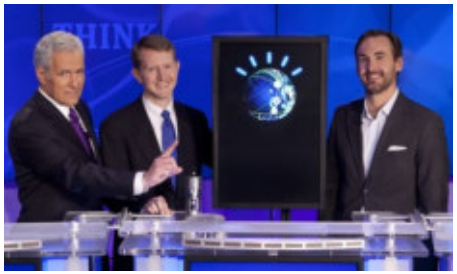
How did this challenge benefit from computational social science?

- The use of computational modeling techniques to optimize sequencing of scale up utilizing data from 16,000 health workers in government, NGOS at the state, district and block levels.
- Provide decision support for who should say what to influence whom.
- Revise optimization sequencing based on scale up response in the field

Three Grand Societal Challenges & Computational Social Science

- Disaster Response: Katrina

- Accelerating Innovation: Watson



- Scaling up Global Health Solutions: Ananya

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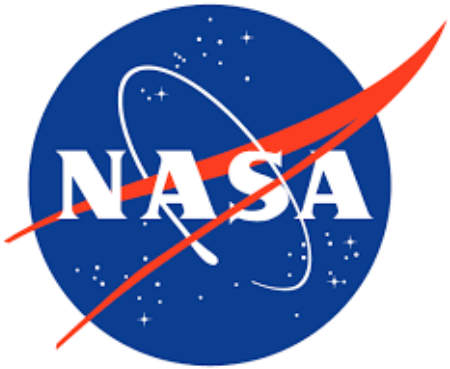
Key Takeaway

- We are in the midst of a perfect storm for leveraging Computational Social Science to understand and address grand societal challenges because of recent developments in:
  - *Theories*: Theoretical advances to address fundamental questions about existing and emerging socio-technical phenomena
  - *Methods*: Advances in creating "ensemble" methodologies based on theory-driven, data-driven and computational modeling analytic strategies
  - *Data*: Developments that provide the technological capability to capture, store, fuse, and query large tracts of behavioral data
  - *Computational infrastructure*: The surge in cloud computing and petascale computing that are critical to face the computational challenges in observing and analyzing these data

Acknowledgements