From Disasters to WoW:
Enabling Knowledge Networks in 21st Century Organizational Forms

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Key Takeaway: Distinct roles of network visualization to ….

- … help network members discover, diagnose, and design their networks
- … help network researchers for exploratory network analysis
- … help network researchers for confirmatory network analysis
WHY DO WE CREATE, MAINTAIN, DISSOLVE, AND RECONSTITUTE OUR COMMUNICATION AND KNOWLEDGE NETWORKS?
Social Drivers:
Why do we create and sustain networks?

- 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
- Theories of co-evolution

Sources:
“Structural signatures” of MTML

Theories of Self interest
Theories of Exchange
Theories of Balance

Theories of Collective Action
Theories of Homophily
Theories of Cognition
Unraveling the “Structural Signatures”

The observed network is one realization of the many possible random realizations of the network.

Confirmatory Network Analysis: The questions of interest in statistical modeling is whether the observed network exhibits the theoretically hypothesized structural tendencies.
A contextual “meta-theory” of social drivers for creating and sustaining communities

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Challenges of empirically testing, extending, and exploring theories about networks … until now
The capturing of massive amounts of digitalized information about human behavior (especially relational behavior)

+ 

The capacity to manipulate those data

= 

New insights into collective human behavior

Source: David Lazer available at http://www.ksg.harvard.edu/netgov/files/talks/docs/05_07_07_seminar_Lazer_computational_social_science.pdf
Projects Investigating Social Drivers for Communities

Science Applications
- CLEANER: Collaborative Large Engineering & Analysis Network for Environmental Research (NSF)
- CP2R: Collaboration for Preparedness, Response & Recovery (NSF)
- TSEEN: Tobacco Surveillance Evaluation & Epidemiology Network (NSF, NIH, CDC)

Societal Justice Applications
- Cultural & Networks Assets In Immigrant Communities (Rockefeller Program on Culture & Creativity)
- Economic Resilience NGO Community (Rockefeller Program on Working Communities)

Business Applications
- PackEdge Community of Practice (P&G)
- Vodafone-Ericsson “Club” for virtual supply chain management (Vodafone)

Entertainment Applications
- World of Warcraft (NSF)
- Everquest (NSF, Sony Online Entertainment)
- Second Life (Linden Labs)
MTML meets XML

- Theorizing the creation, maintenance, dissolution and reconstitution (CMDR) of network linkages between people, sensors, data setsstreams, documents, and visual-analytic tools – extending “small-world” or “scale–free” dynamics

- Testing theoretical propositions about existing network configurations using unprecedented digital trace data

- Developing network recommender systems to assist members’ navigation of multidimensional networks

- Testing theoretical propositions about potential network reconfigurations by assessing members’ use (or non-use) of network recommendations.
Digital Harvesting

Bios, titles & descriptions

Personal Web sites
Google search results

Web of Science Citation

CATPAC

AutoMap

UBERLINK

uberlink

issuecrawler

IKNOW

Inquiring Knowledge Networks on Web

NETDRAW

CI-KNOW Analyses and Visualizations

Multidimensional Networks in CI (Cyberinfrastructure)
Multiple Types of Nodes and Multiple Types of Relationships
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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
- Areas affected: Bahamas, South Florida, Cuba, Louisiana (especially Greater New Orleans), Mississippi, Alabama, Florida Panhandle, most of eastern North America

Map source: http://hurricane.csc.noaa.gov/
Data and picture source: http://en.wikipedia.org/wiki/Hurricane_Katrina/
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.
- 
- 

Automatic 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 by the Automated Learning Group at NCSA.
Time Slice 1: 8/23 to 8/25/2005

Florida is the Topic of the Conversation

Petroleum Network formed Early
Time Slice 1 to 2

ARC

SAL

FEMA

Shelter

TX

KY

AL

LA

Gov Bush

FL

Power

FP&L

Military

TX

AL

LA

NO
Time Slice 3: 8/28 to 8/29/2005

[Graph showing connections between various entities and locations such as Gov Bush, FEMA, Power, Shelter, ARC, TX, FL, NC, LA, MS, and NO. ]
Time Slice 3 to 4
Time Slice 4: 8/30 to 8/31/2005

ARC

FEMA

Shelter

TX

MS

LA

NO

FL

Power

FP&L

NC

AL Power

National Guard

AL Power

S & R

National Guard

NC

FP&L

AL Power

National Guard

TX

GA

FL

LA

MS

NO

S & R

ARC

Shelter
Time Slice 5: 9/1 to 9/2/2005
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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TobIG Demo
FDA declares nicotine a drug (13 July 1995)

Period with a Lack of Nicotine Research in Dataset (NVSS)
Papers Per Year in Dataset (NVSS)
Cascade from Mitch Zeller (NVSS)
WoW:
Massively Multiplayer Online Role Playing Game
Rise of WoW

MMOG Active Subscriptions 18.0
120,000+

Source: http://www.mmogchart.com/
Goals of WoW Community

- Teams perform diverse quests within the game environment, typically varying in length from one hour to several days, with the goal of achieving an objective, gaining resources, and increasing experience.

- Exploiting, Bonding & Swarming
## Contextualizing Goals of WoW

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### Mapping *Goals* to Theories: WoW Gaming Community

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Methods and Analysis

- SIENA - *Simulation Investigation for Empirical Network Analysis*

- Statistical estimation of models for longitudinal social networks according to the dynamic, actor-oriented model of Snijders and van Duijn (1997), Snijders (2001), and Snijders (2005).

Information Retrieval - Time Three
Density of Communication Ties Decreases over Time
Unraveling the “Structural Signatures”

- Incentive for creating a WoW link with someone
  
  $= -1.08 \text{ (cost of creating a link)} \ [\text{Self-interest}]$
  + 0.29 \text{ (benefit of reciprocating)} \ [\text{Exchange}]$
  + 3.07 \text{ (benefit for being a friend of a friend)} \ [\text{Balance}]$
  + 0.04 \text{ (benefit of connecting to an expert)} \ [\text{Cognition}]$

*All coefficients significant at 0.05 level*
Summary

- Theories about the social motivations for creating, maintaining, dissolving and re-creating social network ties in multidimensional networks

- Development of cyberinfrastructure/Web 2.0 provide the technological capability to capture relational metadata needed to more effectively understand (and enable) communities.

- Computational modeling techniques to model network dynamics in large-scale multi-agent systems

- Exponential random graph modeling techniques to empirically validate the local structural signatures that explain emergent global network properties

- Visualization tools and techniques to enable members discover, diagnose, and design their networks.
SONIC Research Team Members

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