The SONIC Research Group

An Intro to the Science of Networks in Communities (SONIC) research group

WebScience Webinar | 01-11-2012

Brooke Foucault | Sophia Sullivan | Toshio Murase | Hugh Devlin | Willem Pieterson

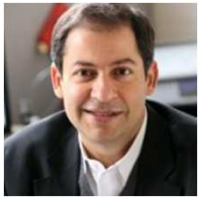
NORTHWESTERN UNIVERSITY

webscience TRUST

SONIC

advancing the science of networks in communities

People of Sonic



Noshir Contractor
Director

Manager

Assistant

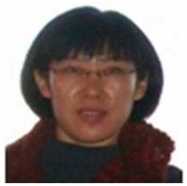
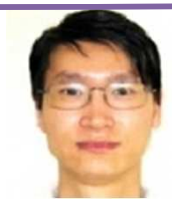
Faculty



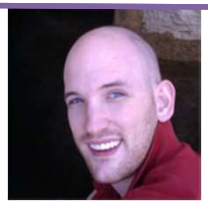

Post Doctoral Researchers



Software Developers


Research Technologists/Assistants

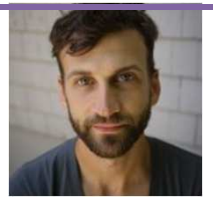



Graduate Student Researchers







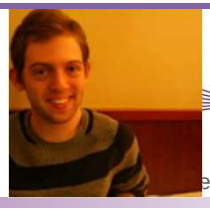


Undergraduate Student Researchers








What do we do?

- SONIC advances social network theories, methods, and tools to understand and meet the needs of communities.
- SONIC develops techniques to study and improve networks
- SONIC researchers model, assess, validate, and enable the emergence of social and knowledge networks
- SONIC helps communities discover their existing networks, diagnose network's health and improve their effectiveness.

What do we do?

Four Contexts:

- Science and Engineering Teams
- Business Contexts
- Virtual Worlds
- Societal Justice Issues

Relevance for WebScience:

The Web is the largest human information construct in the history. The Web is transforming society. In order to understand what the Web is, engineer its future and ensure its social benefit we need a new interdisciplinary field that we call Web Science

Today's program

Four presentations:

- Brooke Foucault
  Virtual Worlds
- Sophia Sullivan
  Hypergraps
- Toshio Murase, PhD.
  Teams {GroupScope}
- Hugh Devlin, PhD.
  Semantic Recommendations

WebScience 2012

Sonic organizes the WebScience2012 conference in Evanston (Chicago): June 22-24, 2012.

See www.websci12.org

Virtual Worlds Exploratorium

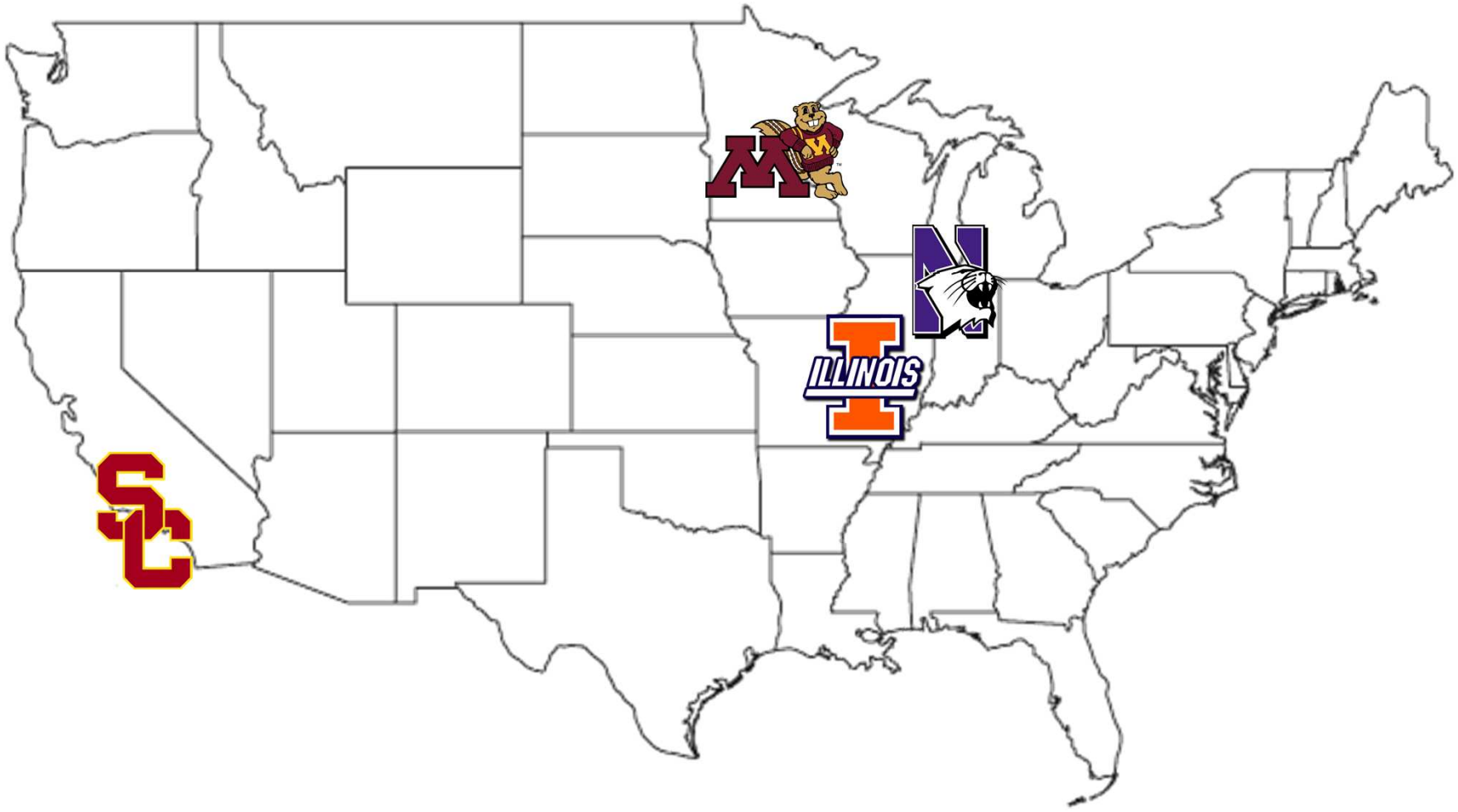
Studies of Network Behavior in Virtual Worlds

Brooke Foucault Welles
Ph.D. Candidate
Science of Networks in Communities (SONIC) Lab

NORTHWESTERN UNIVERSITY

This research was supported by grants from the National Science Foundation, the Army Research, the Air Force Research Institute, and Northwestern University.

SONIC
advancing the science of networks in communities



NORTHWESTERN
UNIVERSITY

SONIC
advancing the
science of networks in communities

Project Aim: Use virtual worlds as a platform to theoretically extend and empirically model the dynamics of group behaviors.

•Substantive Questions:

- What can interaction in virtual worlds tell us about interaction in the offline world, and vice versa?
- To what extent do online behaviors map to corresponding behaviors in the offline world?
- Can behavior observed in virtual worlds be used to predict characteristics of users in the offline world?

•Methodological Questions:

- How do we extract valid and meaningful behavioral data from logs of online behavior?
- How do we assemble networks from data that were not collected for network analysis?
- How do we clean, limit and sample behavioral trace data?

Data

- Log files of user behavior several virtual worlds
- 50-100 variables per game:
  - Account information (create date, usage minutes)
  - User attribute information (age, country, gender)
  - User behavior information (combat activity, items purchased)
  - Social interaction information

    (friendship, guild membership)
- Survey responses linked to player accounts

Sample Research Questions

- Does virtual space constrain and predict group interaction as physical space does in the offline world? [Yes, unless people ride dragons or teleport a lot.]
- Do groups of online criminals (gold farmers) organize similarly to offline criminals? [Yes, gold farmers are a lot like drug dealers.]
- Can we predict users' offline genders based on the characteristics of their online avatars? [Yes, quite reliably.]
- How do individual, dyadic, and network pressures influence the emergence of friendship ties in virtual worlds? [Pretty much the same way they do in the offline world.]

Selected Papers

From Strangers to Friends

Foucault Welles, B. & Contractor, N. (2011). From Strangers to Friends Online: A Mixed-Methods Investigation of Friendship Formation on the Internet. *Paper presented at the National Communication Association 97th Annual Convention.* New Orleans, LA, USA. **Top 4 Paper Selection in Human Communication Technology Division,** *Manuscript Under Review.*

Foucault Welles, B., Van Devender, A. Contractor, N. (2010). Is a "Friend" a Friend?: Comparing the Structure of Online and Offline Friendship Networks. Paper presented at *2010 International Sunbelt Social Network Conference (XXX).* Riva del Garda, Trento, Italy.

Foucault Welles, B., Van Devender, A., & Contractor, N. (2010). *Is a "Friend" a Friend? Investigating the Structure of Friendship Networks in Virtual Worlds. Paper presented at the Conference on Human Factors in Computing Systems (CHI), Atlanta, GA.*

Foucault, B., Zhu, M., Huang, Y., Atrash, Z., & Contractor, N. (2009). *Will you be my friend? An exploration of adolescent friendship online in Teen Second Life. Paper presented at the 59th Annual Conference of the International Communication Association (ICA2009), Chicago, IL, Manuscript Under Review.*

Other VWE Papers

Ahmad, M. A., Keegan, B., Srivastava, J., Williams, D., & Contractor, N. (2011). Trust Amongst Rogues? A Hypergraph Approach for Comparing Clandestine Trust Networks in MMOGs. *Paper presented at the International Conference on Weblogs and Social Media*, Barcelona, Spain.

Ahmad, M. A., Keegan, B., Srivastava, J., Williams, D., & Contractor, N. (2009). Mining for Gold Farmers: Automatic Detection of Deviant Players in MMOGs. Paper presented at the Symposium on Social Intelligence and Networking, IEEE Conference on Social Computing, Vancouver, BC.

Castronova, T., Williams, D., Shen, C., Ratan, R., Xiong, L., Huang, Y., & Keegan, B. (2009). As real as real? Macroeconomic behavior in a large-scale virtual world. *New Media & Society,* 11(5).

Foucault Welles, B., Shim, K. J., Ratan, R., Kennedy, T. L. M., Contractor, N., Srivastava, J., & Williams, D. (2011). *Disambiguating Age, Gender and Skill: An Exploration of Online Chat Behaviors Among MMOG Players. Paper presented at the International Sunbelt Social Network Conference (XXXI), St. Pete Beach, FL, USA.*

Keegan, B., Ahmad, M. A., Williams, D., Srivastava, J., & Contractor, N. (2011). *Sic Transit Gloria Mundi Virtuali? Promise and Peril at the Intersection of Computational Social Science and Online Clandestine Organizations. Paper presented at the 3rd International Conference on Web Science, Koblenz, Germany.*

Keegan, B., Ahmad, M. A., Williams, D., Srivastava, J., & Contractor, N. (2011). Mapping Gold Farming Back to Offline Clandestine Organizations: Methodological, Theoretical, and Ethical Challenges. Paper presented at the The Game Behind the Video Game: Business, Regulation, and Society in the Gaming Industry, New Brunswick, NJ.

Keegan, B., Ahmad, M. A., Williams, D., Srivastava, J., & Contractor, N. (2011). Using P/ERGMs to Map Online Clandestine Behavior to Offline Criminal Activity. Paper presented at the Sunbelt XXXI, St. Petersburg, FL.*

Keegan, B., Ahmad, M. A., Srivastava, J., & Contractor, N. (2010). *Dark Gold: Statistical Properties of Clandestine Networks in Massively Multiplayer Online Games. Paper presented at the IEEE Conference on Social Computing, Minneapolis, MN.*

Huang, Y., Shen, C., Williams, D., and Contractor, N. (2009). Virtually There: Exploring Proximity and Homophily in a Virtual World. Paper presented at the the Symposium on Social Intelligence and Networking, Vancouver, Canada.

Huang, Y., Zhu, M., Wang, J., Pathak, N., Shen, C., Keegan, B., & Contractor, N. (2009). The Formation of Task-Oriented Groups: Exploring Combat Activities in Online Games. Paper presented at the The 2009 IEEE International Conference on Social Computing (SocialCom-09), Vancouver, Canada.

Mahmassani, H. S., Chen, R.B., Huang, Y., Williams, D., and Contractor, N. (2010). Time to Play? Activity Engagement in Multiplayer Online Role-Playing Games. *Transportation Research Record,* 2010(2).

Ratan, R., Chung, J. E., Shen, C., Williams, D., Foucault, B., & Poole, M. S. (2009). *Schmoozing and Smiting: Trust and Communication Patterns in an MMO. Paper presented at the 59th Annual Conference of the International Communication Association (ICA2009), Chicago, IL, USA.*

Using hypergraphs to gain new insights into social networks

Sophia Sullivan

Mengxiao Zhu

Alina Lungeanu

This research was supported by grants from the National Science Foundation (#NSF-IIS 0729505) and the Army Research Institute (#W91WAW-08-C-0106).

NORTHWESTERN UNIVERSITY

SONIC

advancing the science of networks in communities

What is a hypergraph?

- A generalized version of a graph G = (V, E) in which edges can involve any number of node

Example:

, , , , , }

{, }, {, }, {,, }, {}}

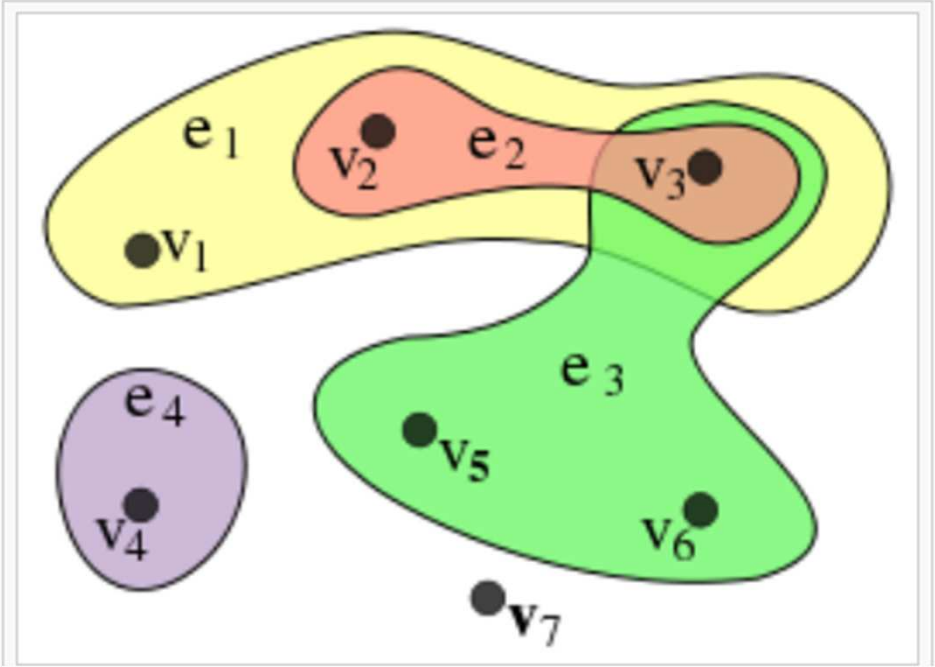


Image source: Wikipedia

Why use hypergraphs to represent network data?

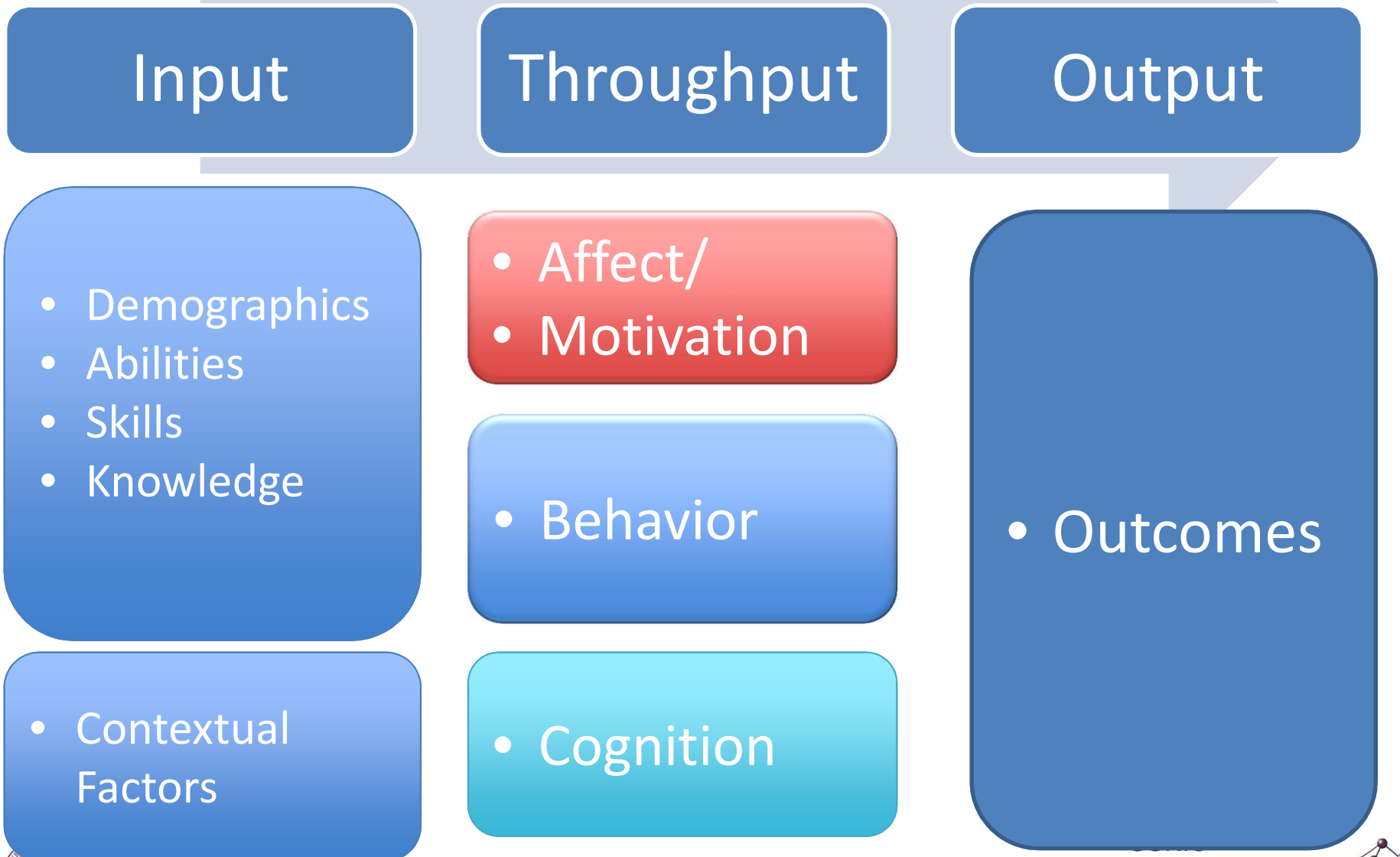
- Frequently, interactions involve more than two entities
- Sometimes it is also useful to include information of more than two types
- Examples:
  - Collaboration networks (Alina)
  - Teams
  - Questing partners

Current work

- What more can we learn from representing data as hypergraphs?
- Centrality in hypergraphs
  - Betweenness centrality of a hyperedge
  - Closeness centrality of a hyperedge
- Clustering in hypergraphs (Mengxiao)
  - High clustering in hyperedges may indicate insignificance in the network


GROUPSCOPE
TOSHIO MURASE
TONY VASHEVKO

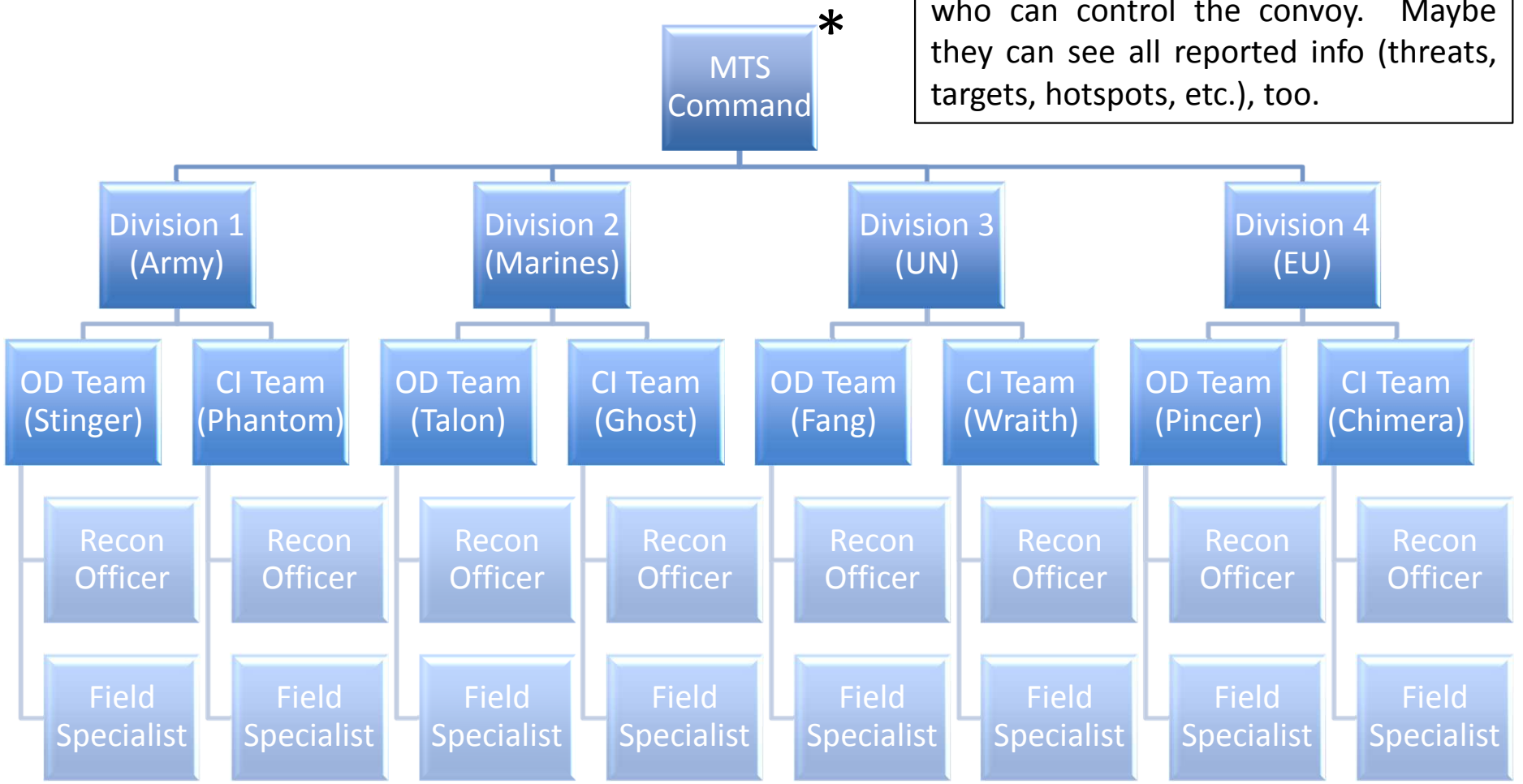
Collective Process



McGrath, 1984

New MTS Composition

*MTS command is a person (or group) who can control the convoy. Maybe they can see all reported info (threats, targets, hotspots, etc.), too.



Expert Recommendation based on Social Drivers, Social Network Analysis, and Semantic Data Representation

Maryam Fazel-Zarandi, Hugh J. Devlin, Yun Huang, Noshir Contractor

Fazel-Zarandi, M., Devlin, H. J., Huang, Y. and Contractor, N. Expert recommendation based on social drivers, social network analysis, and semantic data representation. In *Proceedings of the Proceedings of the 2nd International Workshop on Information Heterogeneity and Fusion in Recommender Systems* (Chicago, Illinois, 2011). ACM, 2011.

Our Approach

- Recommending collaborations is *proposing social ties*
  - Many published studies fail to acknowledge or explicitly identify the **social theories** and **generative mechanisms** that motivate their research (Monge and Contractor 2001)
- The **Multi-theoretical, Multi-level (MTML)** analytic framework provides a coherent, overarching framework for integrating conceptual, theoretical, and empirical work.
  - Comprehends both individual and social **relational attributes** and the evolving nature of social networks over time.

This research was supported by grants from the National Science Foundation (#NSF-IIS 0729505) and the Army Research Institute (#W91WAW-08-C-0106).

Recommendation Heuristics Driven by Motivation

Colloquial Term	MTML Theory	Network of Relations	Importance (centrality measure)	Node Attributes
Most Qualified	Self Interest	Agent-artifact relations (e.g., citation)	In-degree within the network of concern	Measures of qualification (e.g., # of publications)
Friend-of-a-Friend	Balance	Agent-agent relations (e.g., collaborations)	Distance (e.g., # of geodesics)	
Birds of a Feather	Homophily			Measures of similarity (e.g., gender)
Social Exchange	Social Exchange	Agent-agent relations		Measures of tie strength
Follow the Crowd	Contagion	Agent-agent relations (e.g., collaborations, citations)	In-degree within the network of concern	

NORTHWESTERN UNIVERSITY

This research was supported by grants from the National Science Foundation (#NSF-IIS 0729505) and the Army Research Institute (#W91WAW-08-C-0106).

SONIC
advancing the science of networks in communities

Conclusion and Future Work

- Design of flexible expert recommender systems featuring **personalization** of the recommendation based on user motivation

- Future work:
  - Improving Expert Selection
    - Combining different heuristics
    - Using **p*/ERGM models**
  - Improving Expert Identification
    - Structural matching using **taxonomy** of topics
  - User study

NORTHWESTERN UNIVERSITY

This research was supported by grants from the National Science Foundation (#NSF-IIS 0729505) and the Army Research Institute (#W91WAW-08-C-0106).

SONIC
advancing the science of networks in communities

Thanks!

- Visit us: sonic.northwestern.edu