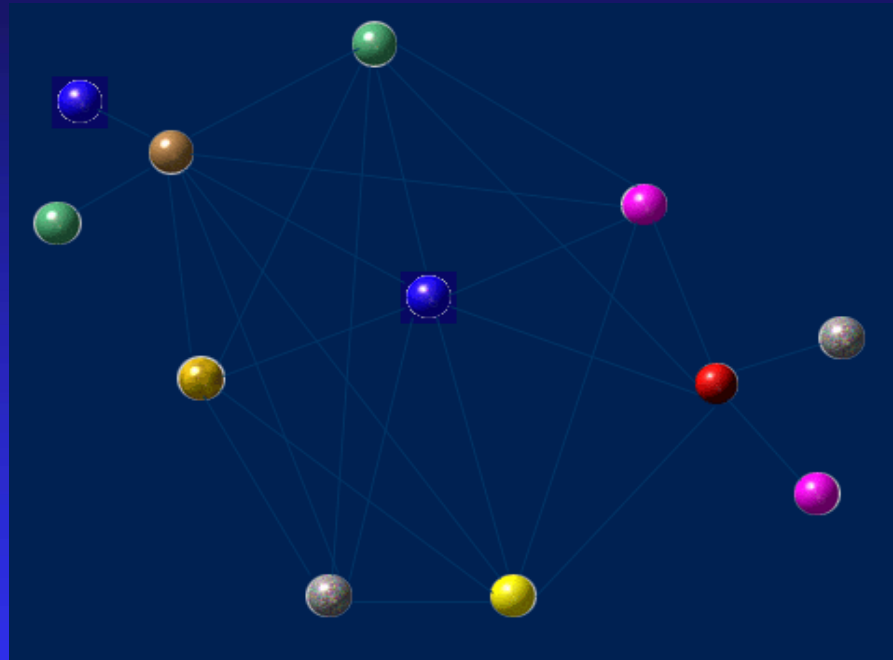


Coevolution of knowledge networks and 21st century eGov cyberinfrastructures



Noshir Contractor

Professor, Departments of Speech Communication & Psychology

Director, Age of Networks Initiative, Center for Advanced Study

Director, Science of Networks in Communities - 

National Center for Supercomputing Applications

University of Illinois at Urbana-Champaign

nosh@uiuc.edu

Lovegety



1. Turn on power & set MODE with MODE button. You can confirm the MODE you chose as the red indicator blinks.
2. Lamp blinks when (someone with) a Lovegety for the opposite sex set under the same MODE as yours comes near.
3. FIND lamp blinks when (someone with) a Lovegety for the opposite sex set under different mode from yours comes near. May try the other MODES to “GET” tuned with (him/her) if you like.

Aphorisms about Networks

■ Social Networks:

◆ Its not what you know, its **who** you know.

■ Cognitive Social Networks:

◆ Its not who you know, its **who they think** you know.

■ Knowledge Networks:

◆ Its not who you know, its **what they think** you know.



Cognitive Knowledge Networks

It's not
who you know.

It's what
who you know
knows.

There's research. And then there's research written by the world's top analysts and strategists. The leading industry authorities on everything from E2B and healthcare to investing in the Pacific Rim. Bottom line? The only people who should be guiding your investment decisions are the people who are truly "in the know." Who measure success one investor at a time. Move your money. Get well connected.

Well Connected | MORGAN STANLEY
DEAN WITTER

msd.com

*Source: msd.com/news, December 1999

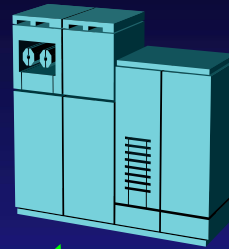
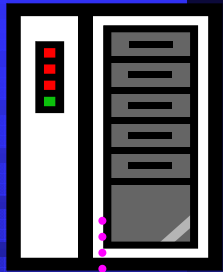
Morgan Stanley Dean Witter and Well Connected are service marks of Morgan Stanley Dean Witter & Co. Services are offered through Dean Witter Reynolds Inc., Morgan Stanley & Co. Incorporated and Morgan Stanley Dean Witter DBA Inc., members SIPC. © 2000 Dean Witter Reynolds Inc.

Source: Newsweek,
December 2000



INTERACTION NETWORKS

Non Human Agent to
Non Human Agent
Communication



Non Human Agent
(webbots, avatars, databases,
“push” technologies)
To Human Agent



Publishing to
knowledge repository



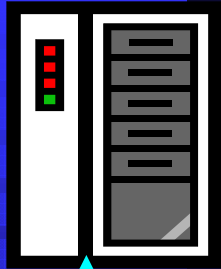
Retrieving from
knowledge repository



Human Agent to Human Agent
Communication



COGNITIVE KNOWLEDGE NETWORKS



Non Human Agent's
Perception of Resources
in a Non Human Agent



Human Agent's Perception of
Provision of Resources in a
Non Human Agent

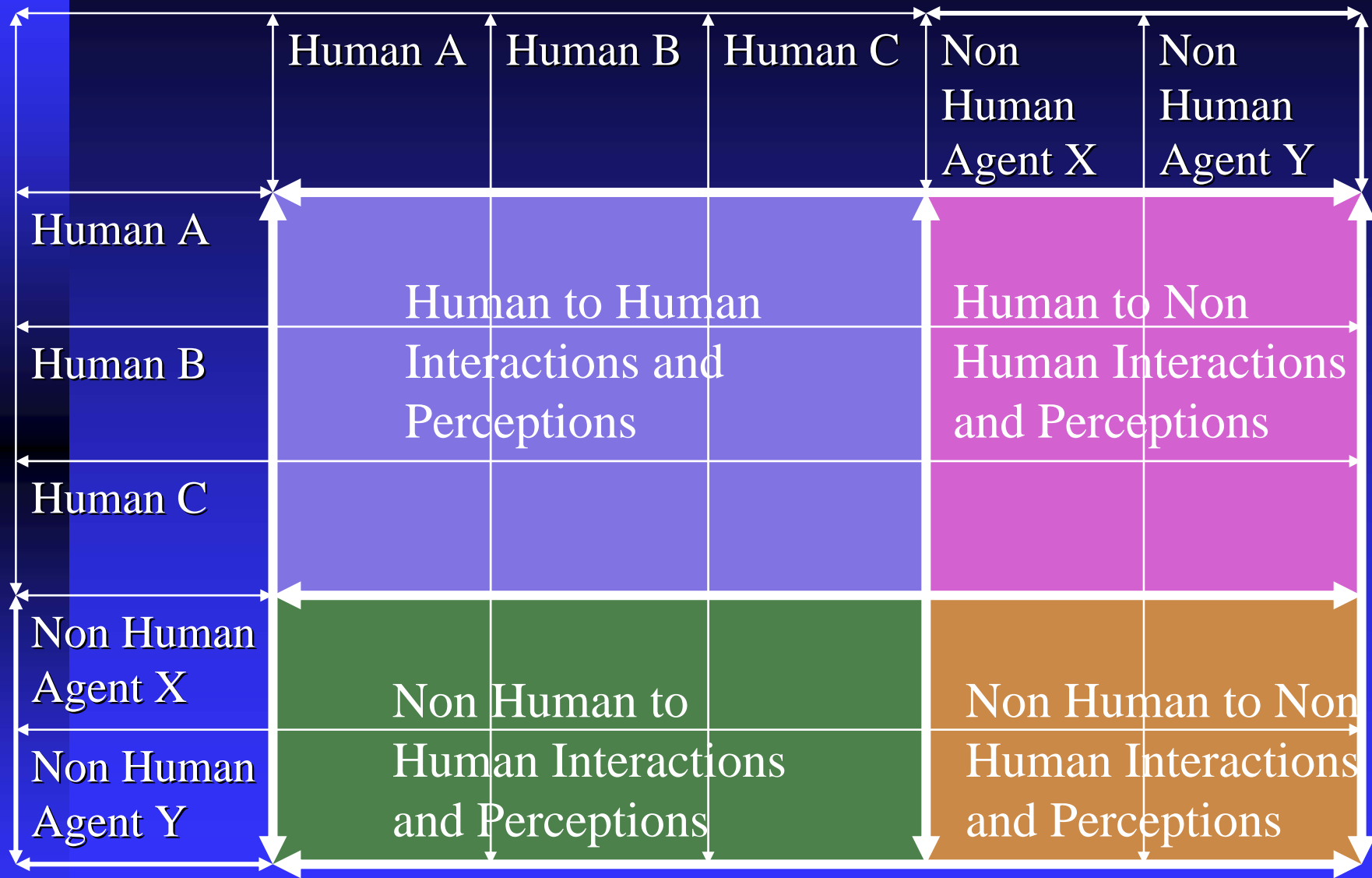
Non Human Agent's
Perception of what a Human
Agent knows *



Human Agent's Perception of
What Another Human Agent
Knows



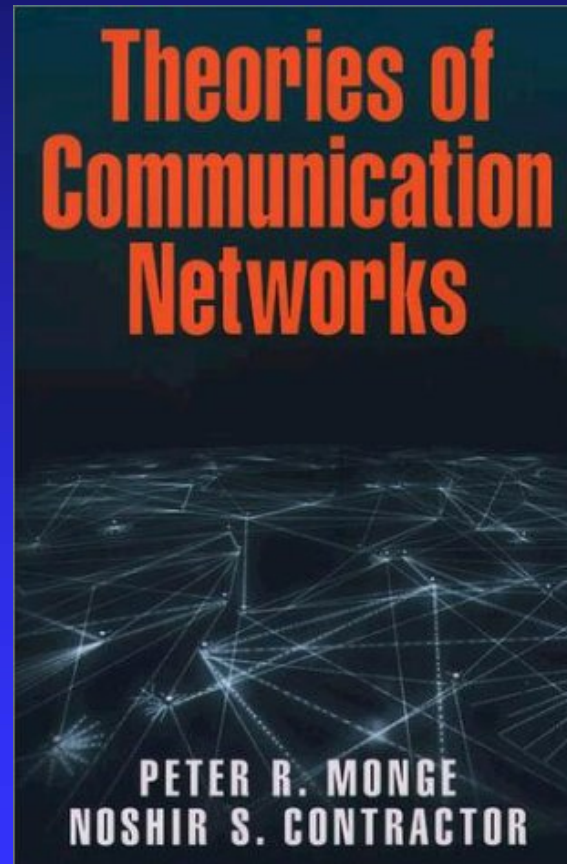
* ... Why Amazon thinks I am gay and Tivo thinks I am pregnant ...



WHY DO WE
CREATE,
MAINTAIN,
DISSOLVE, AND
RECONSTITUTE OUR
COMMUNICATION AND
KNOWLEDGE NETWORKS?



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



Why do actors create, maintain, dissolve, and reconstitute network links?

- 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:

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

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



Differences in Networks: eGov and private sector

- Government can not pick its clients – individuals or firms
- Generally clients can not pick their government
- Differing definitions of productivity and accountability
 - ◆ Efficiency
 - ◆ Effectiveness
 - ◆ Inclusiveness, access, equity, archiving
 - ◆ Privacy, security, identity management
- Implementation governed by law legislated by elected officials
- Liability of oldness: Must evolve rather than benefit as a start-up
- Multi-level “front office”: individuals, firms, industry
- Multi-level “back office”: local, regional, national, EU governance
- Networks for dynamic vertical and horizontal alignment of entities

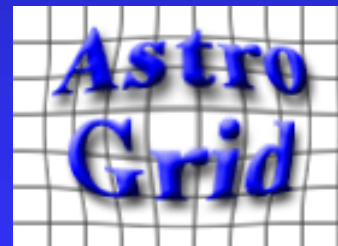
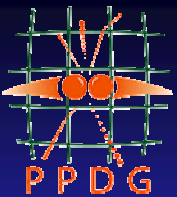
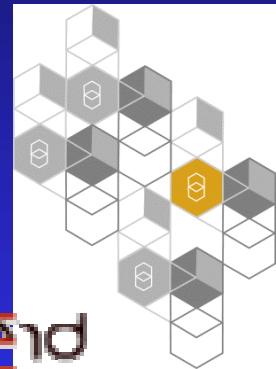
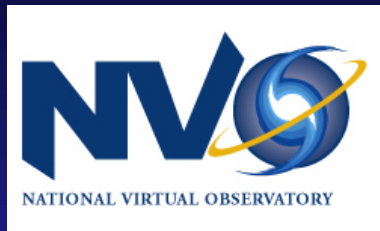




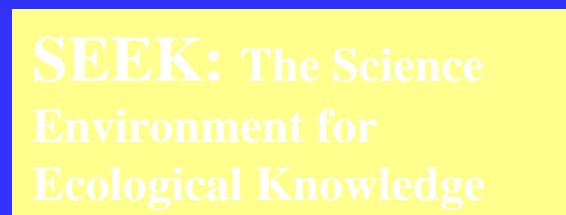
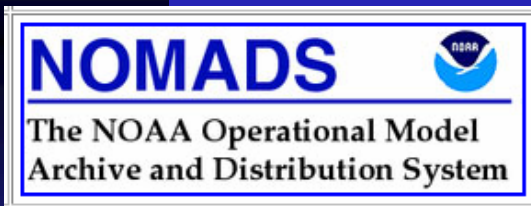
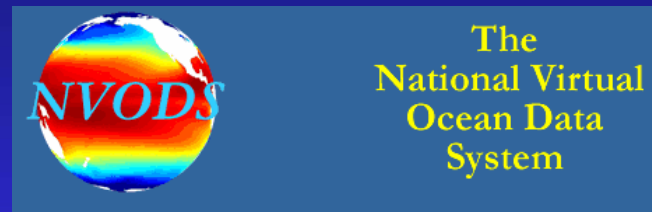
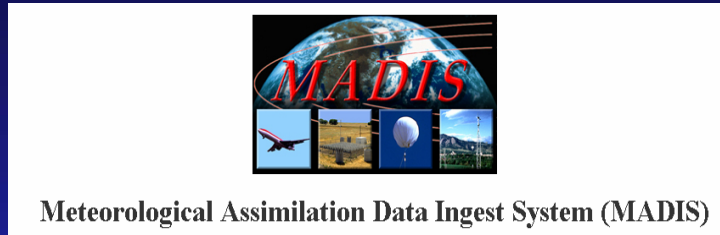
Projects on Enabling Networks

- Networks to enable eGov Cyberinfrastructures, NSF, NIH
 - ◆ Environment
 - ◆ Public Health
 - ◆ Emergency Response
- Transnational Immigrant Networks, *Rockefeller Foundation*
- Economic Justice Networks, *Rockefeller Foundation*
- Communities of Practice Networks, *Procter & Gamble*
- Food Safety Networks, UIUC Cross-Campus Initiative & *John Deere*
- Global Supply Chain Networks, *Vodafone*

Science and Engineering Cyberinfrastructures



Geosciences Cyberinfrastructures



Multidimensional Networks

Multiple Types of Nodes and Multiple Types of Relationships



Cyberinfrastructure for eGov Knowledge Networks

- *Environment: Collaborative for Large-scale Engineering Analysis Network for Environmental Research (CLEANER)*
- *Public Health: Tobacco Surveillance, Epidemiology, and Evaluation Network (TSEEN)*
- *Emergency Response: Collaboration for Preparedness, Response, & Recovery (CP2R)*

Announcements

[Social Network Analysis Tool](#) has been added to the CLEANER portal! (Jan,05,2006)

New Group Members

[Three \(3\) new members](#) join the CLEANER community since last time you logged in.

Recent Forum Activities

The following posts may be of interest to you:

[CLEANER Portal Design: posted by Liu](#)

Most read thread:

[CLEANER Management Plan](#)

Most recommended solution:

[CLEANER Future](#)

Most active member:

[Barbara Minsker](#)

Recent Documents

[CLEANER Video Conference.pdf](#)

[CLEANER Management Plan.doc](#)

Recent Data Activities

The following new data sets may be of interest to you:

[Real-time Hydrological Data Sets From Mississippi River](#)

Total data subscriptions available: 10

Total models in the community: 130

Sensor Status

Up: [150 sensors](#) have been up for 30 days.

Down: [3 sensors](#) are down for 2 hours.

Advanced Search

Areas

Select the area of the system you would like to search:

- My Space
- Collaboration
- Data
- Analysis
- Library

Referrals

Select the categories for which you would like to receive referrals:

- People
- Data
- Topics
- Documents
- Tools
- Projects

[Collaboration](#) >> [Search](#) >> [Advanced Search](#)

Advanced Search

Displaying Results 1 through 20 of approximately 286 [[Next 20 Results](#)][Draft Action Plan for Reducing Mitigating and Controlling Hypoxia in the Northern Gulf of ...](#)

HTML, Thursday September 04 2003 8:31 PM

[Notice of Availability and Request for Comment on Draft Plan of Action for Reducing Mitigating < ...](#)

HTML, Saturday October 14 2000 10:52 PM

[ens](#)

HTML, Monday September 29 2003 1:13 PM

[Chesapeake Research Consortium Publications](#)

HTML, Tuesday January 14 2003 6:28 PM

[Stormwater | Nutrient Trading](#)

HTML, Friday September 26 2003 10:22 PM

[Manage Tools](#)

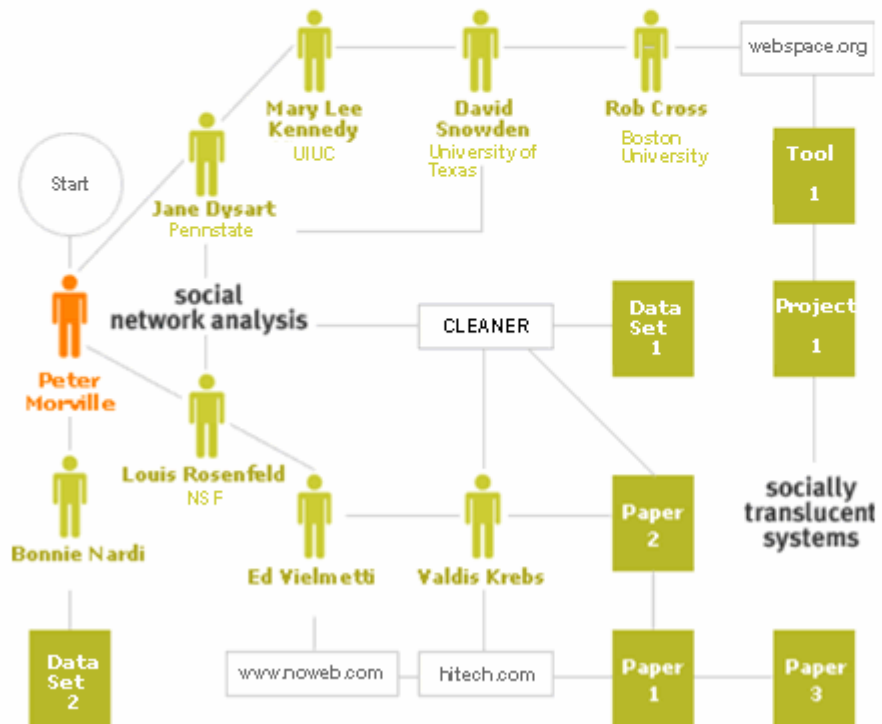
Relevant People

Based on your search, you might be interested in the following people:

[Scott Rayder](#)[Paul L. Kelly](#)[Robert Stickney](#)[Robert Twilley](#)[Social Network Map](#)

Search >> Advanced Search >> Social Network Analysis

Social Network Map



Cyberinfrastructure for eGov Knowledge Networks

- Environment: Collaborative for Large-scale Engineering Analysis Network for Environmental Research (CLEANER)
- Public Health: Tobacco Surveillance, Epidemiology, and Evaluation Network (TSEEN)
- Emergency Response: Collaboration for Preparedness, Response, & Recovery (CP2R)



Tobacco Surveillance, Epidemiology, and Evaluation Network (TSEEN)

- National Cancer Institute
- Center for Disease Control's National Center for Health Statistics (NCHS),
- Center for Disease Control's Office of Smoking and Health (OSHO),
- Agency for Healthcare Research and Quality (AHRQ),
- National Library of Medicine (NLM) and
- Non-government agencies such as the American Legacy Foundation.

TSEEN Network Referral System

- Low-tar cigarettes cause more cancer than regular cigarettes ...
- A pressing need for systems that will help the TSEEN members effectively connect with other individuals, data sets, analytic tools, instruments, sensors, documents, related to key concepts and issues

Cyberinfrastructure for eGov Knowledge Networks

- Environment: Collaborative for Large-scale Engineering Analysis Network for Environmental Research (CLEANER)
- Public Health: Tobacco Systems Integration Grid (Tobacco SIG)
- Emergency Response: Collaboration for Preparedness, Response, & Recovery (CP2R)

CP2R: ICT Support in Emergency Management Networks

Drawing Analogies
from Natural
Systems



Natural System: Honey Bees

ENTOMOLOGY: Learning from natural robust societies.

Successful systems (evolution time)

Ant - based models have successfully been applied to solve optimization [Dorigo, 1996; Botee, 1999] and networking [Bonabeau, 2000] problems, among others.



Bees' setting and objectives in foraging [Seeley, et al. 1991] resembles disaster relief response scenario (**collective decision-making**).



Problem: Information Overload

- Hundreds or Thousands of first responders operate sharing couple of voice channels (radio, cell-phones)

[Domel, 2001]



<http://www.hollandsentinel.com/images/031503/Borculofire4.jpg>

- If technology provides a mean to enhance delivery and media of information, we envision this problem would increase

Information Overload: Ants

Analogy (Ants' alarm propagation)

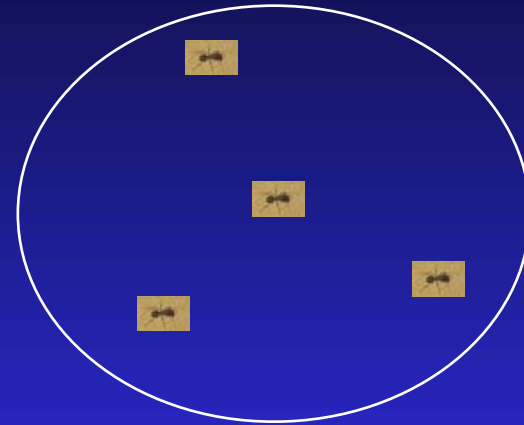
Division of Labor; each ant "has" a threshold for each stimulus (pheromone).

When stimulus is greater than threshold the ant will be on "alarm" mode.

Centels ants detects a hazard and release "alarm" pheromone (volatile).

Each pheromone release will last for a limited time; seconds or minutes.

The heterogeneous response to alarm pheromone avoids all ants react immediately (good or bad?).



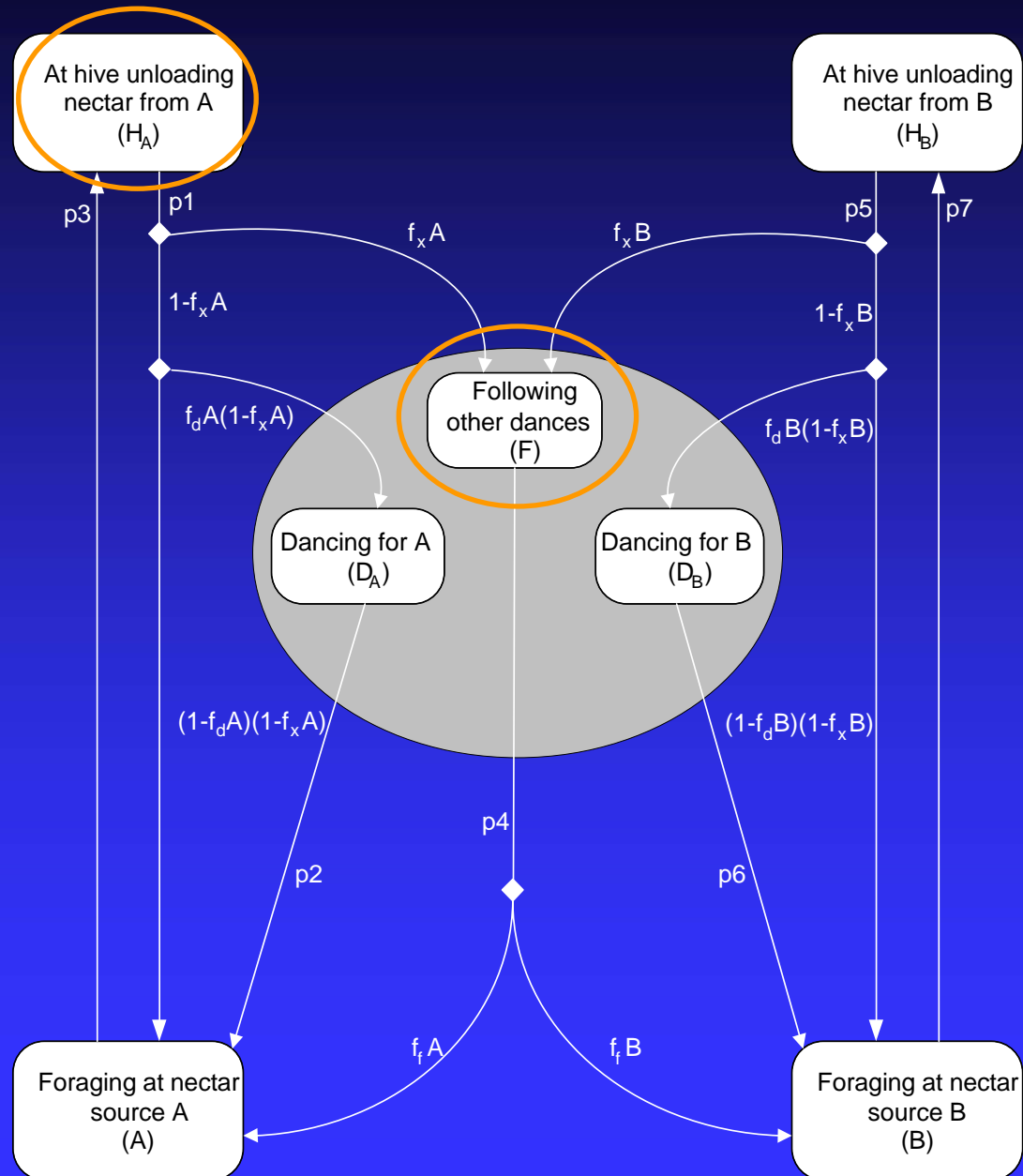
Idea:

Actors will propagate information received only if the stimulus, i.e., "quality of information", is greater than his/her threshold for that type of information.

Avoiding cascading effect; controlling information overload.

Natural System: Honey Bees

Honey Bees (*Apis mellifera*)
Foraging Model [Seeley, 1991]



The system evaluates ALL the information, though individuals evaluate only partial information

3D Strategy for Enhancing eGov Networks

- **Discovery:** Effectively and efficiently foster network links from people to other people, knowledge, and artifacts (data sets/streams, analytic tools, visualization tools, documents, etc.). *“If only we knew what we knew.”*
- **Diagnosis:** Assess the “health” of eGov networks - in terms of scanning, absorptive capacity, diffusion, robustness, and vulnerability to external environment
- **Design or re-wire** eGov networks using social and organizational incentives (based on social network research) and network referral systems to enhance evolving and mature communities.



Summary

- The **Lovegety** underscore 21st century aspirations for more effective networking.
- Recent advances in **cyberinfrastructure development** provides the technological capability to more effectively leverage our networks.
- Recent advances in **communication networks research** provides important insights into the social and organizational motivations that explain how we leverage our networks.
- We are poised for the design, development, and deployment of large scale **socio-technical network referral systems** as part of the next generation eGovernance cyberinfrastructures.



Science of Networks in Communities

nosh@uiuc.edu

www.uiuc.edu/ph/www/nosh

