

Employing the Social Network Paradigm in Teaching about Sustainability.

D.B. Tindall

Department of Sociology, University of British Columbia

Introduction

- I teach and have taught courses dealing with various aspects of sustainability – primarily from a sociological perspective.
- I also teach courses periodically on social network analysis.
- And I sometime combine these two perspectives, and discuss the application of social network analysis to sustainability.

Introduction

- In this presentation I will introduce some concepts from the social network literature, some applications to sustainability issues, and some reflections on my teaching where I have tried to link these two things.
- Suggestions and questions would be appreciated.

Not (mostly) about social media (e.g. Facebook.)

- In this talk I am mostly talking about “traditional” face to face social network relationships – not social media.
- Social media is just one form of communication in social networks, and from a scholarly perspective the two should not be seen as synonymous.

The Network Paradigm



Conceptual Overview

“Social network analysis” refers to three different interrelated things:

- 1) a paradigm for viewing the world with some accompanying theories (e.g. structural holes),
- 2) a set of substantive empirical research problems (e.g. social capital), and
- 3) a set of research methods for studying the above (the name generator question).

Conceptual Overview

- Social network analysis is the study of social structure and its effects. It conceives of social structure as a social network, that is a set of actors (nodes) and a set of relationships connecting pairs of these actors.
- The actors can be groups, organizations or even nation-states as well as persons, and the relationships are flows of resources that reflect relations of control, dependence, and cooperation.

Conceptual Overview

- A core concern of social network analysis is to understand how social structures facilitate and constrain opportunities, behaviours, and cognitions.
- Network analysts investigate patterns of relationships that connect members of social systems, and how these patterns channel resources to specific locations in social structures.

Conceptual Overview

- Their basic premise is that knowledge about the structure of social relationships enriches explanations based only on knowledge about the attributes of actors.
- Network analysts investigate patterns of relationships that connect members of social systems, and how these patterns channel resources to specific locations in social structures.

Collecting Social Network Data

Collecting Social Network Data

- In some of my classes I talk about the various ways in which social network data can be collected, including issues relating to research design and sampling.

**Types of dyadic phenomena commonly studied.
(Borrowed from Borgatti et al. 2013. Table 3.3)**

Category	Varieties and examples
Co-occurrences.	<ul style="list-style-type: none"> • Co-membership in groups. • Co-participation in events. • Physical distances • Similarities in attributes (e.g., political views).
Social Relations	<ul style="list-style-type: none"> • Kinship relations • Affective relations (e.g., dislikes) • Perceptual relations (e.g., knows)
Interactions	<ul style="list-style-type: none"> • Transactions (e.g., ‘sells to’) • Activities (e.g. ‘sleeps with’)
Flows	<ul style="list-style-type: none"> • Ideas and information • Goods • Infections

Some Survey Techniques for Social Network Data Collection

- Name Rosters (sociometric items).
- Name Generators.
- Name Interpreter items.
- Collecting Data on Vulnerable Populations.
- Single Item Summary measures.
- The Position Generator.
- The Resource Generator.

Collecting Social Network Data for Environmental Research.

Collecting Social Network Data for Environmental Research.

- In my teaching I have shown students various types of instruments for collecting social network data. Some of these have come from my own research, and some from others.
- Most are instruments that were designed in the context of environmental/sustainability research.

Collecting Social Network Data for Environmental Research.

- Students and I discuss the advantages and disadvantages of different techniques, and the types of social network measures that can be developed from them.

ENVIRONMENTALIST NETWORK

1. I'm interested in the ties between people involved in one way or another in forestry and/or the wilderness preservation movement in B.C. For each person listed on the left side of the page, please check the applicable columns on the right.

From
Tindall's
Environmental
Movement
Research.

NAMES	I've never heard of this person	I've heard of this person but have had no contact with him/her.	I've talked to this person at least once.	I talk to this person at least a few times a year, but less than once a month	I talk to this person at least once a month (or more often)	I've worked with this person	This person is a close friend	I like this person	I dislike this person
Vicky Husband									
Sharon Chow									
Rosemary Fox									
Tom Loring									
Warrick Whitehead									
Dave White									
Duncan Stewart									
Peter McAllister									
Deitrich Luth									
Elizabeth May									
Sydney Haskell									
Saul Arbess									
Jim Gillespie									
Colin Esbenesen									
Mike Teachman									
Jess Jessen									

27%

Section 4 - Continued. How frequently [do you] does your organization communicate with each of the following organizations or individuals?

The column choices are as follows:

1. **Never.** (You may either click on 'Never' or leave the row blank.)
2. **Occasionally** (A few times a year.)
3. **Regularly** (More than a few times a year, but less than once a month.)
4. **Often** (Once a month or more often.)

4.05 NGOs:

	1. Never	2. Occasionally (A few times a year)	3. Regularly (More than a few times a year)	4. Often (Monthly or more often)
CARE (Cooperative for Assistance and Relief Everywhere)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Climate Action Network Canada	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Climate Reality Canada	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
David Suzuki Foundation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ecojustice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Energy Probe	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Environmental Defence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	1. Never	2. Occasionally (A few times a year)	3. Regularly (More than a few times a year)	4. Often (Monthly or more often)
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Administrator Toolbar This survey is invite only, respondents will require a valid invite code to view this survey.

	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1. Influential in domestic climate change politics	2. Gives expert scientific info	3. Influences my org's policy positions	4. Collaborate with regularly
Stephen Harper	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kathryn Harrison	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Thomas Homer-Dixon	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Matt Horne	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Will Horter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mike Hudema	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mark Jaccard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Peter Kent	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Naomi Klein	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Andrew Leach	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Marc Lee	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ezra Levant	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Preston Manning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ian Mauro	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Elizabeth May	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	1. Influential in domestic climate change politics	2. Gives expert scientific info	3. Influences my org's policy positions	4. Collaborate with regularly

17. About how many people from the WCWC do you know? (For example, count all the people whom you know that you could hold a casual conversation with.)

Please specify approximate number of WCWC members you know. _____

Of these people, how many are:

Close friends? _____ How many of these are women? _____

Acquaintances? _____ How many of these are women? _____

Coworkers? _____ How many of these are women? _____

Family members who live in your household? _____ How many of these are women? _____

Other relatives? _____ How many of these are women? _____

Other? _____ (please specify type of relationship below.) How many of these are women? _____

Item from
the Forest
Values
Study.

TYPE OF OCCUPATION OR ORGANIZATION	TYPE OF RELATIONSHIP			
	ACQUAINTANCE	CLOSE FRIEND	RELATIVE	MYSELF
Do you know anyone in the following areas? Would you classify yourself in the following areas.				
B.C. Ministry of Forests Manager or Employee				
Private Sector Forestry Consultant				
Forestry Sector manager or worker involved in Harvesting (e.g. logger)				
Saw Mill Manager or Worker				
Pulp Mill or Fine Paper Mill Manager or Worker				
Managers or Workers involved in Value Added/Remanufacturing Wood Products (e.g., building wood furniture)				
Reforestation/Silviculture Manager or Worker				
Non-Traditional Forestry (e.g., Horse Loggers) Manager or Worker				
Manager or employee of a Federal Park/ Manager or employee of Parks Canada (Dept. Of Canadian Heritage)				
Manager or employee of a Local Park				
B.C. Ministry of Environment Manager or Employee				
Scientist specializing in plants and trees				
Scientists specializing in animals (e.g., wildlife)				
Scientist specializing in water or soil				
Scientist specializing in ecology				
Member of a Mountain Climbing Club				
Member of an Outdoor Recreation Organization				
Member of a Hunting Organization				
Member of an Angling Organization				
Member of a Birding or Naturalist Organization				
Member of a Local Hiking Group				
Tourism Worker				
Recreation Operator				
Guide (Tourism/Recreation)				
Outfitter (Tourism/Recreation)				
Union Representative (Forest Industry Sector)				
Union Member (Forest Sector)				
Trapper				
Rancher				

Supplementary Table 2 (Continued): Position Generator Questionnaire Item

QUESTION 45 CONTINUED

Item from
the WPM
Study

TYPE OF JOB	TYPE OF RELATIONSHIP			
	ACQUAINTANCE	CLOSE FRIEND	RELATIVE	SCWC MEMBER
Do you know anyone in the following types of work?				
bus drivers ...				
gardeners/landscapers				
auto mechanics				
plumbers ...				
waiter/waitress				
police officers ...				
loggers ...				
mill workers ...				
retail sales clerks ...				
ministers, priests, or rabbis ...				
economists/financial specialists ...				
computer/electronics technicians ...				
biologists ...				
pharmacists ...				
chemists ...				
social researchers ...				
professional painters or sculptors (artists) ...				
architects ...				
social workers ...				
nurses ...				
physiotherapists ...				
fishermen/fisherwomen ...				
municipal politicians ...				
provincial politicians...				
federal politicians ...				
university or college students ...				
high school students ...				

Archival Methods

- An “unobtrusive method of data collection”.
- Padgett’s study of families in renaissance Florence (e.g. studying real archives).
- Analyzing e-mails, tweets, and Facebook interactions.
- Analyzing other types of documents – such as media accounts.

Ethnographic Methods

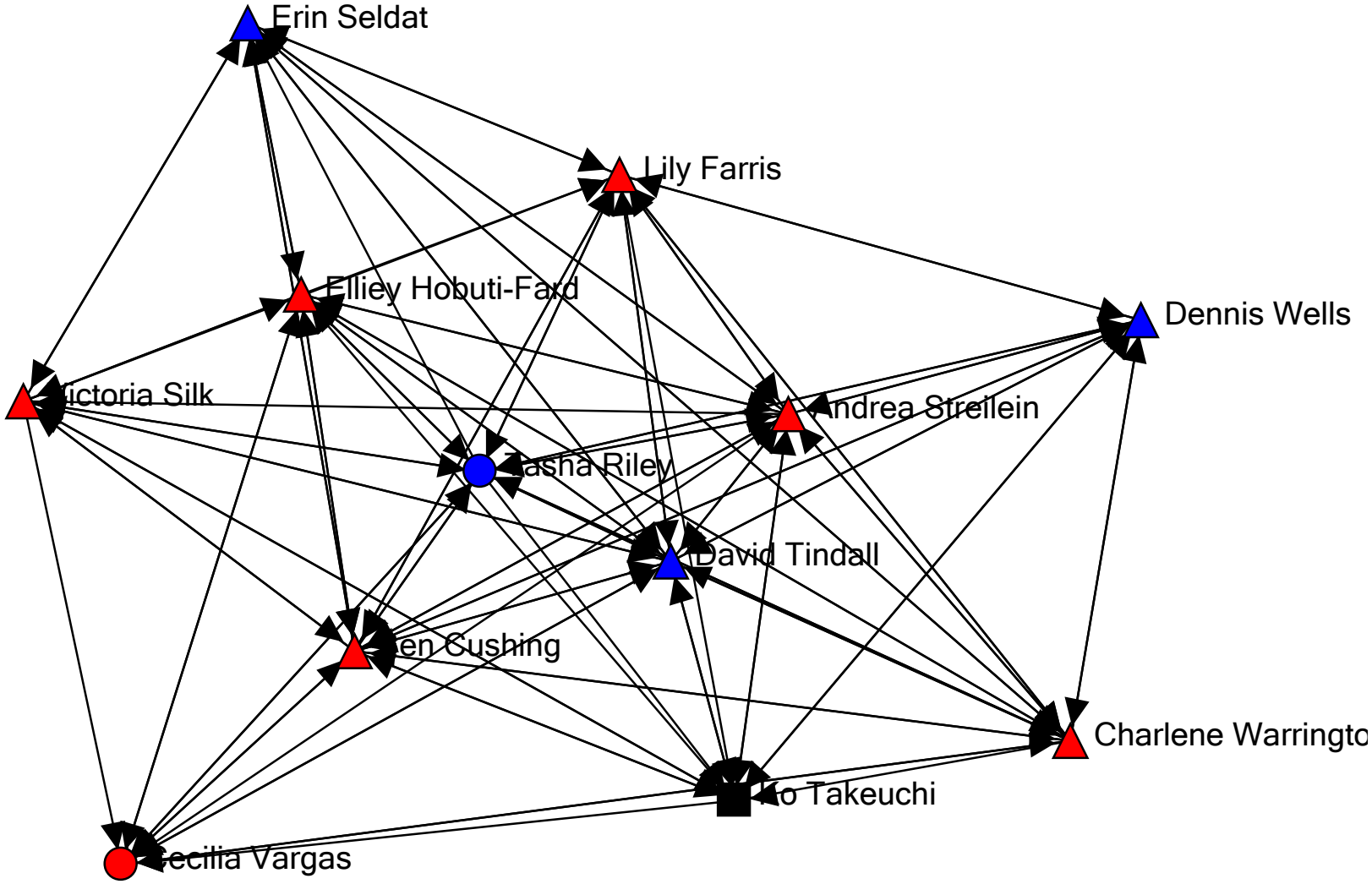
Visualizations

Introduction to Some Social Network Concepts

points/nodes (vertices)

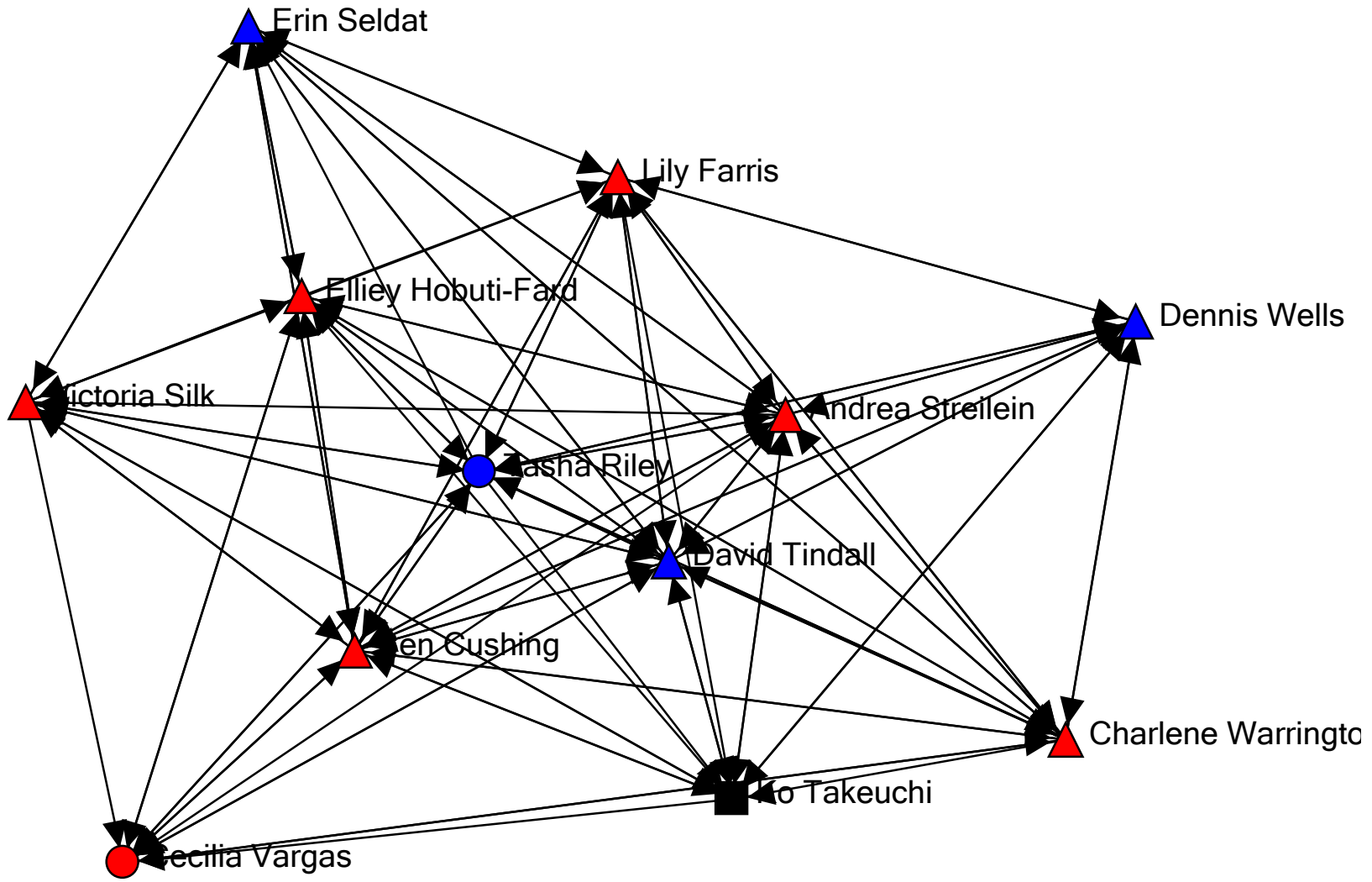
- Points or nodes (also referred to as vertices) are social units in a social network graph.

Members of a Graduate Course In Sociological Methods.

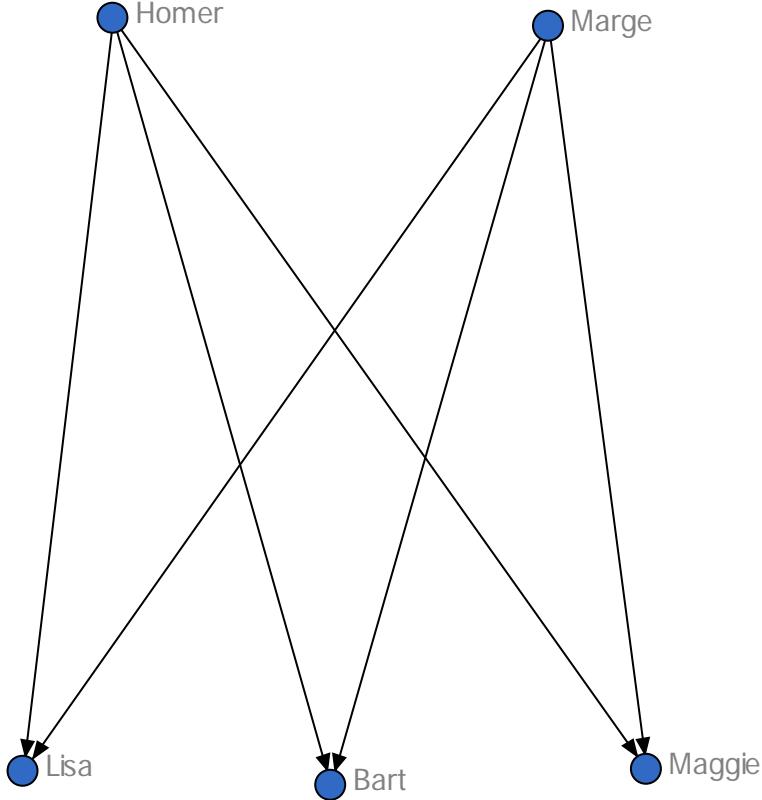


lines/ties

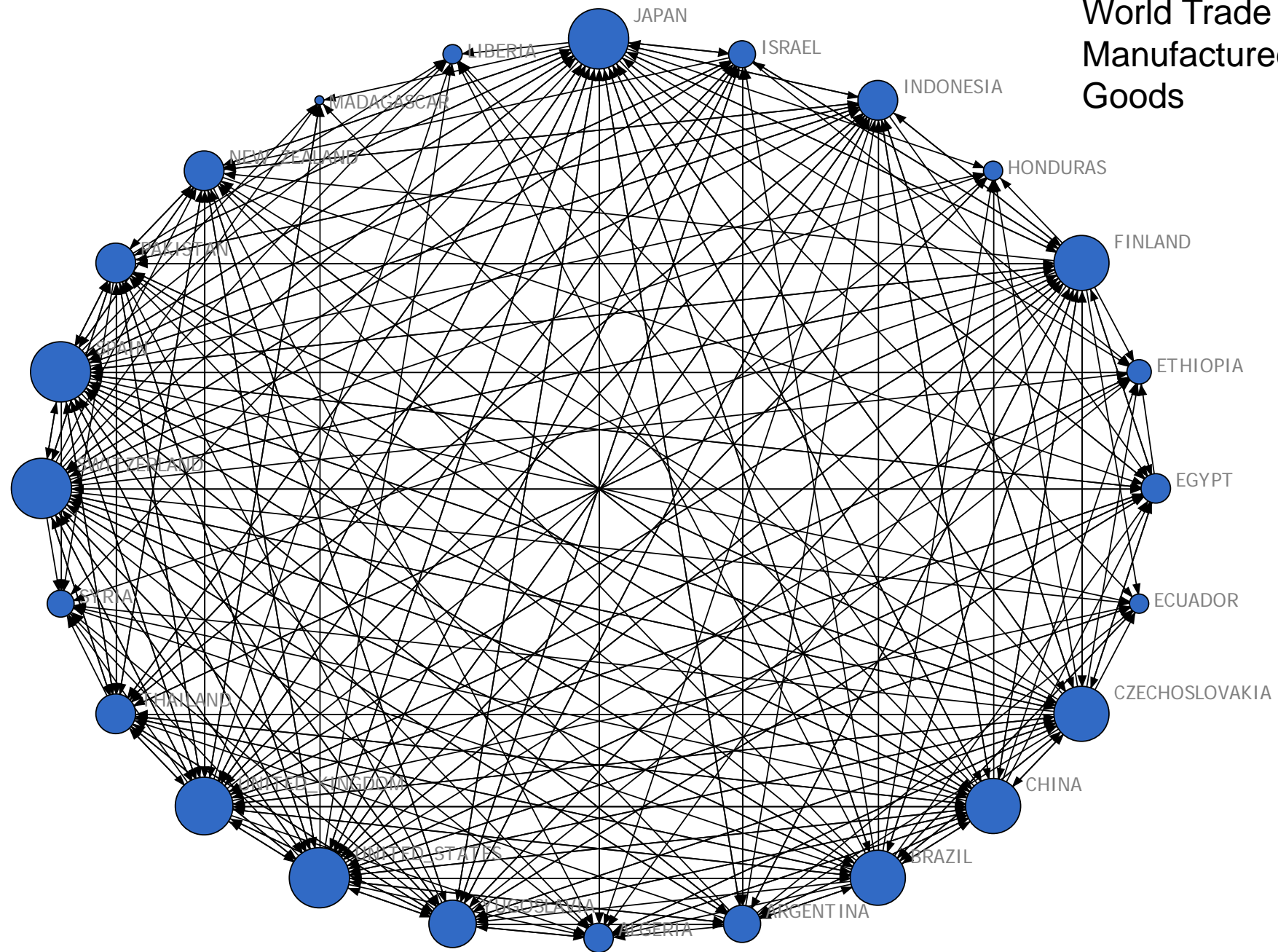
- Lines or ties in a graph represent relationships between the nodes (social units) in the graph.



The Simpsons: Parent-Child Relations.



World Trade in Manufactured Goods



directed/non-directed ties (arcs/edges)

- The relationships in a social network graph can be directed (meaning they have a “sender” and “receiver”) or they can be non-directed (meaning there is no distinction between the “sender” and “receiver”).

directed ties

- Directed ties are sometimes called “arcs”. One example of a directed tie might be gift giving. E.g., Gary gave a present to Mary.

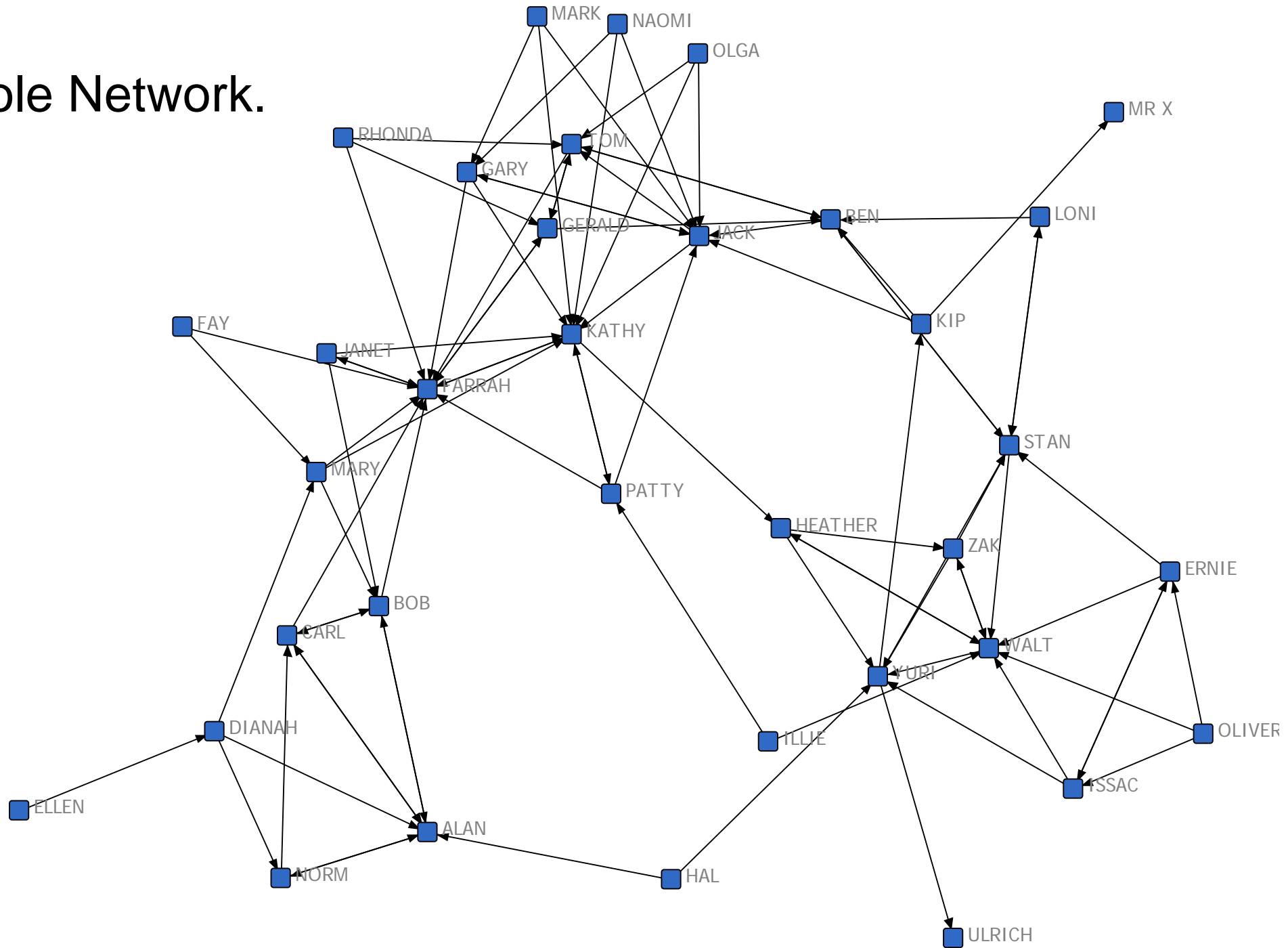
Non-directed ties

- Non-directed ties are sometimes called edges. One example might be communication. E.g., Susan talked with Joan.

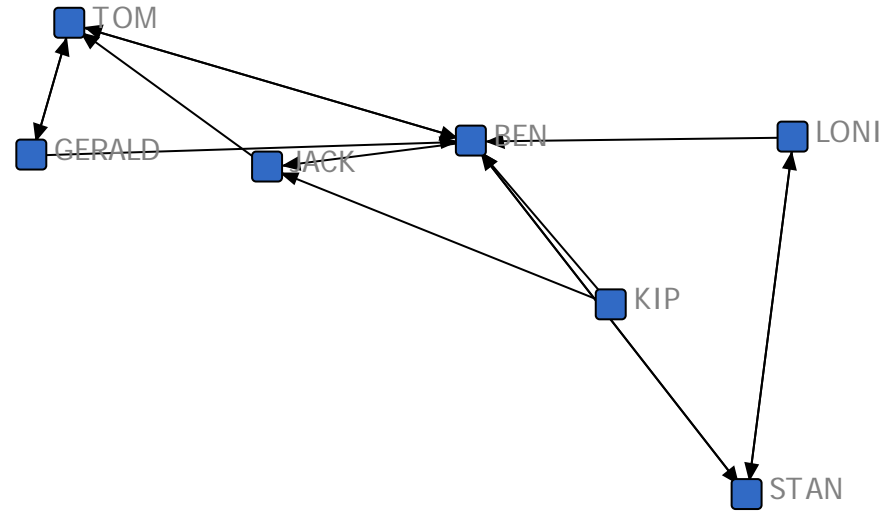
ego nets versus whole nets:

- Whole networks refer to the pattern of ties amongst all of the nodes (or actors) within a bounded social network.
- Ego networks refer to the pattern of ties radiating out from particular individual to a set of alters, and (sometimes) the relationships amongst the alters.

A Whole Network.



Ben's Egocentric Network.



Teaching Experiences

Interest in participating in class network questionnaire, and analyzing data.

Interest in participating in class network questionnaire, and analyzing data.

- In some classes I ask students to fill in a social network questionnaire based on their pattern of relations with other students in the class.

Example Student Social Network Questionnaire.¹

FRST 470 NETWORK QUESTIONNAIRE

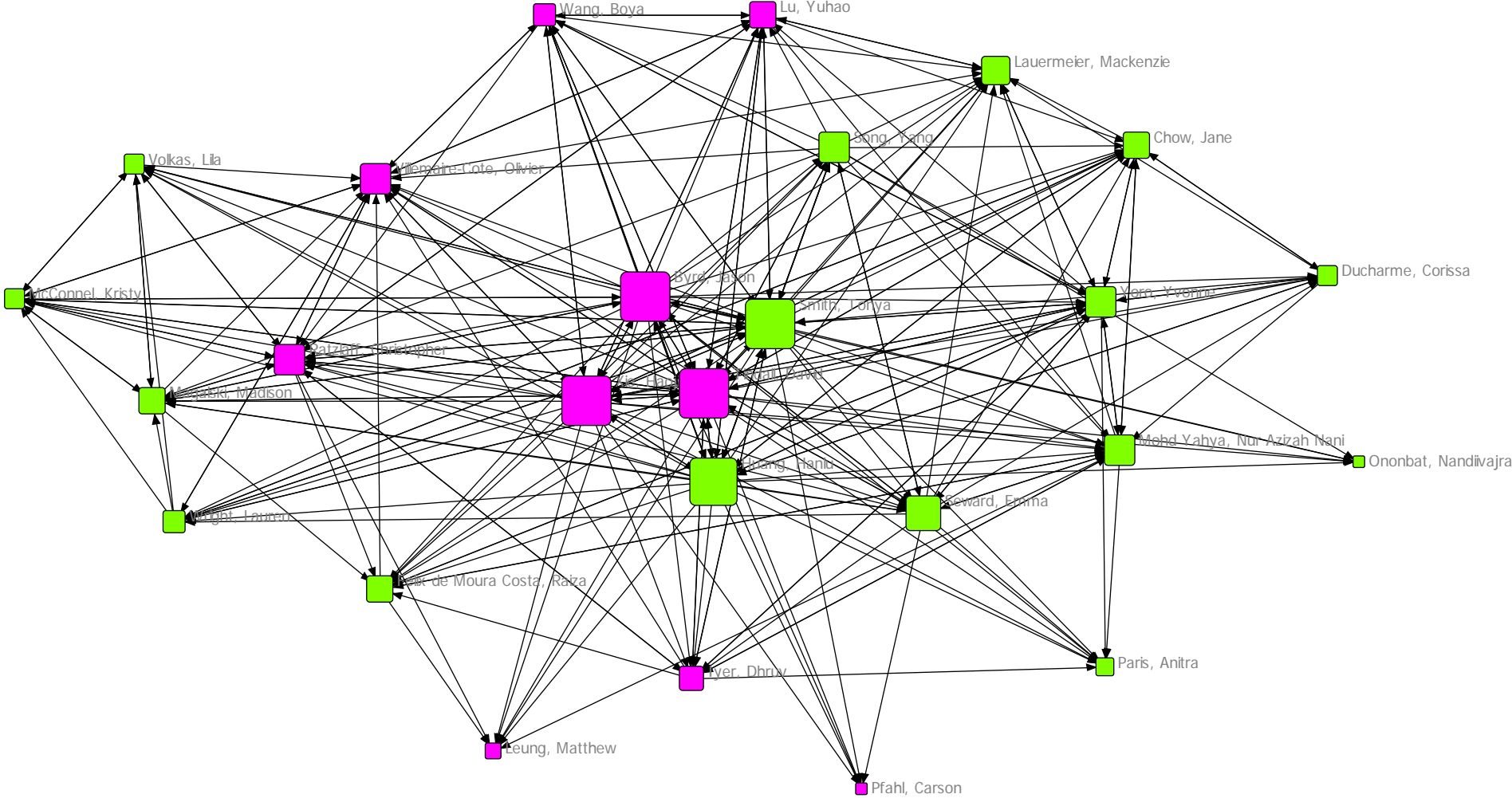
NAME: _____

DATE: _____

Please read each of the statements on the left. For each statement please place a **check mark (✓)** under the name of the person at the top of the column (where **“yes”** is the appropriate response) or leave **blank** (where **“no”** is the appropriate response). (The data obtained from this questionnaire will be utilized later in the course). Please leave the cells corresponding to your own name blank.

	Jane Chow	Corissa Ducharme	Raiza Félix de Moura Costa	Hannah Huang	Dhruv Iyer	Mckenzie Lauermeier	Matthew Leung
1. I have talked to this person during this course:							
2. I am in the same FRST 470 lab groups as this person:							
3. I have previously been in the same class with this person:							
4. I am from the same home town as this person:							
5. I am in the same program as this person:							
6. I have exchanged (notes, advice, information) with this person:							
7. I have talked to this person in social settings off campus:							

AN INTRODUCTION TO SOCIAL NETWORK ANALYSIS



Interest in participating in class network questionnaire, and analyzing data.

- Students generally find this exercise interesting. (Based on observation.)

Interest in examining visualizations.

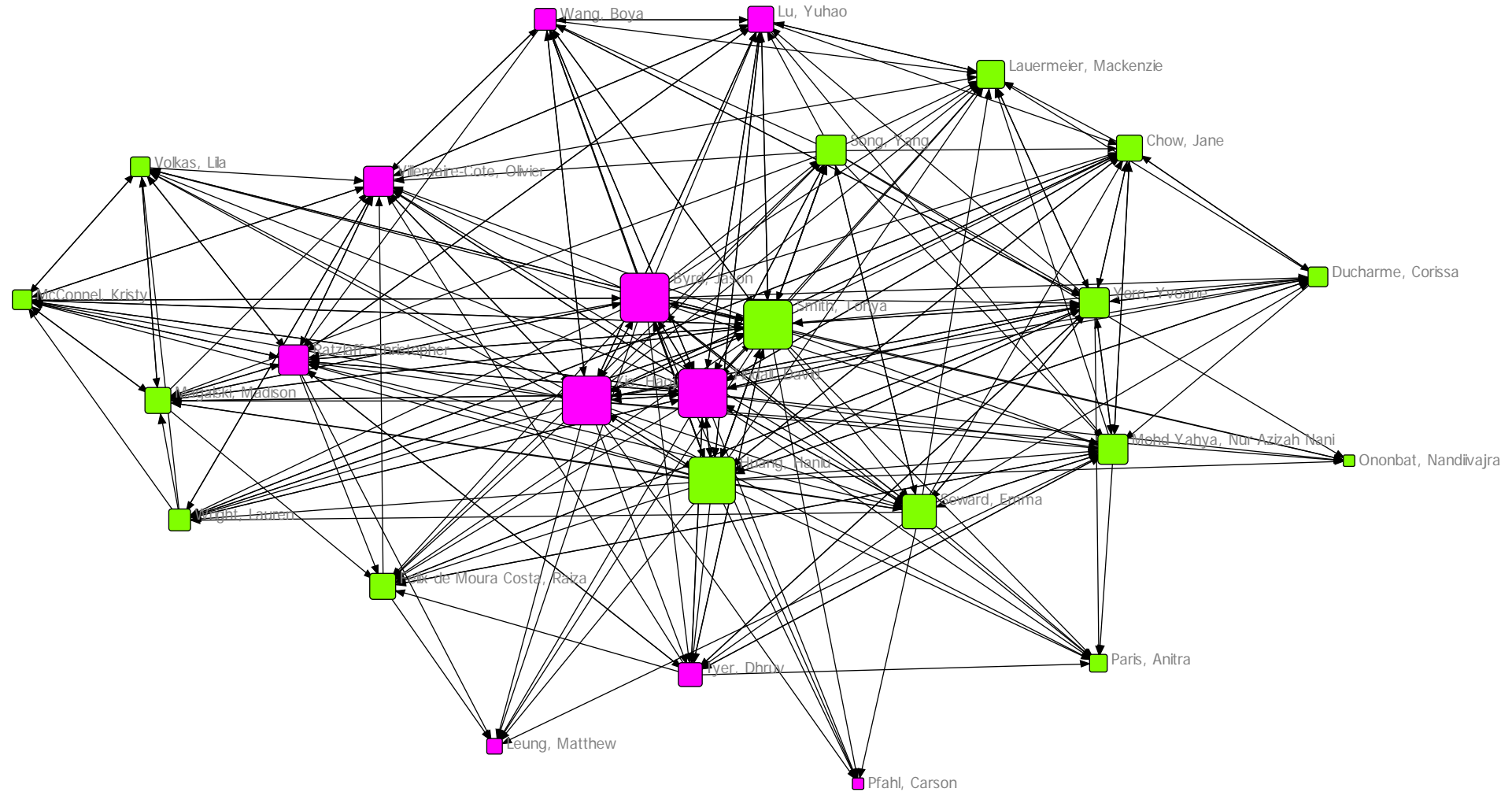
Interest in examining visualizations.

- Students also find developing a network graph from the student network questionnaire data quite interesting.
- It is more meaningful than just analyzing data that they do not have knowledge about.

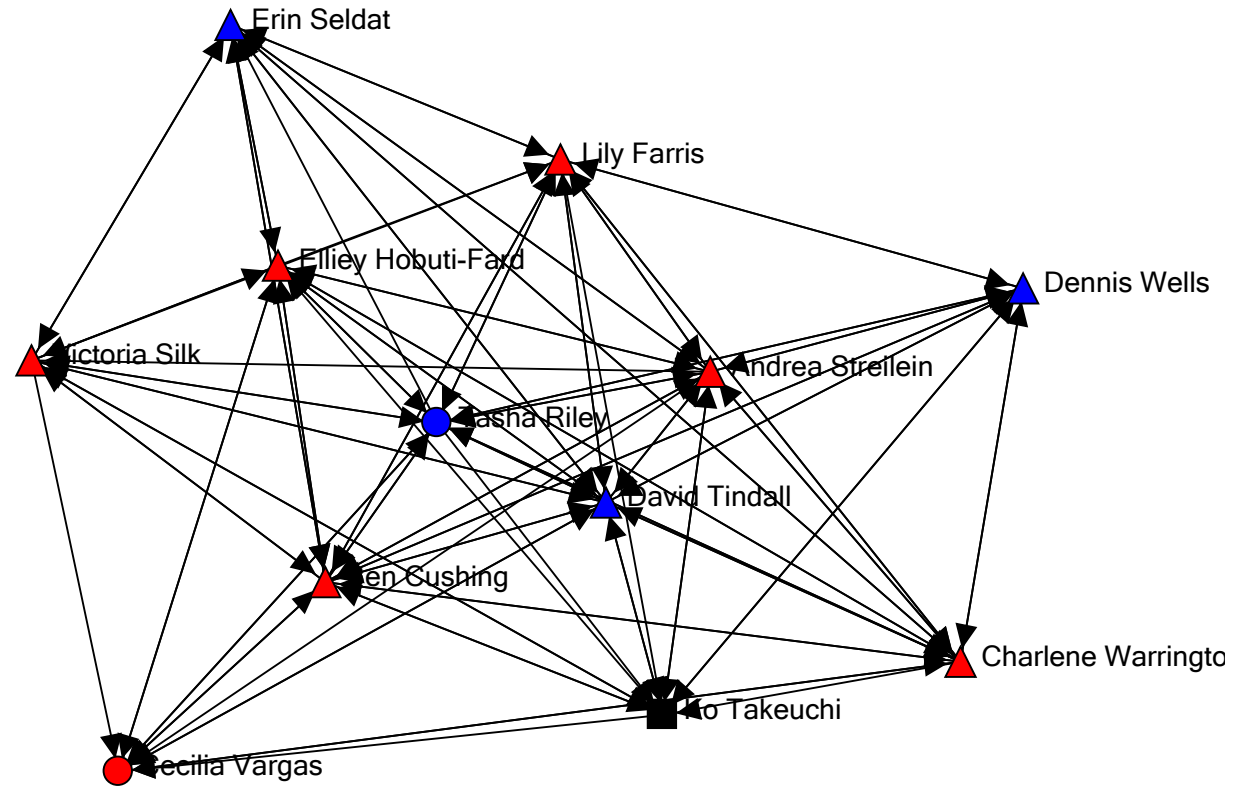
Interest in examining visualizations.

- Once the basic graph is drawn, we can then utilize features of the graphing program to highlight certain features of the graph such as node centrality, attributes of nodes, and tie strength.

AN INTRODUCTION TO SOCIAL NETWORK ANALYSIS



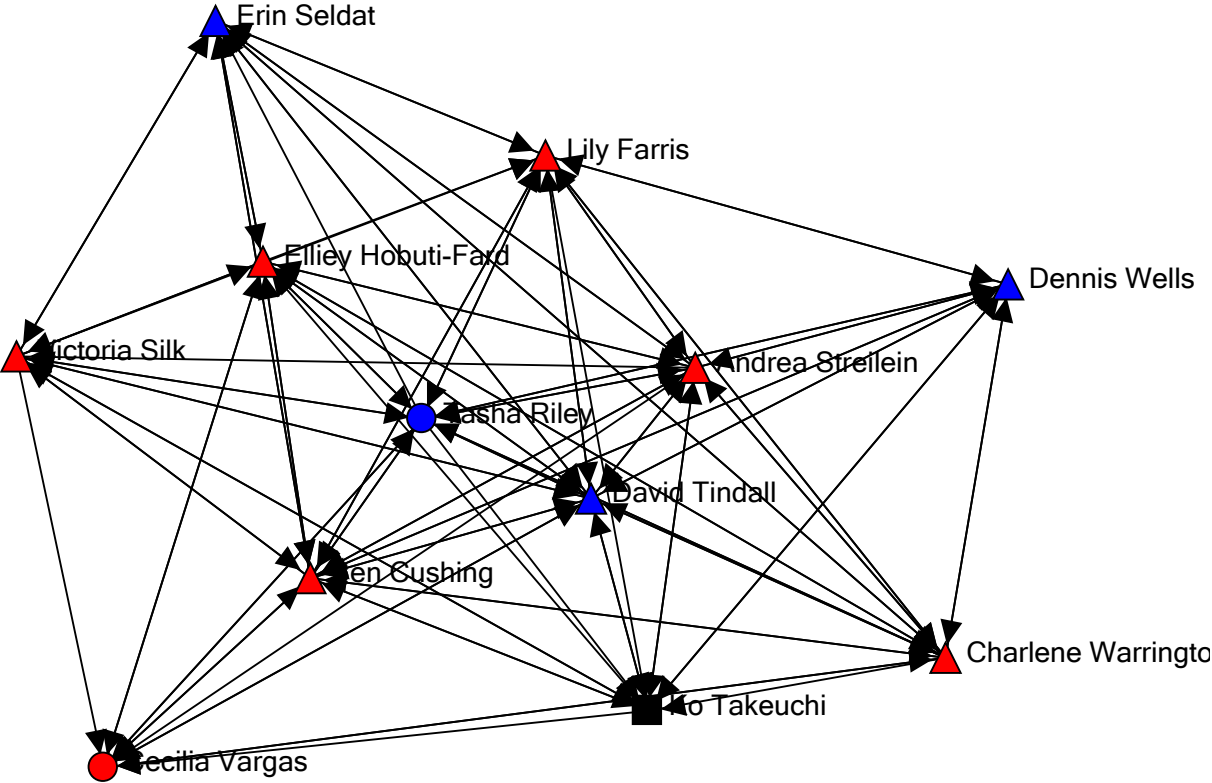
Members of a Graduate Sociology Course.



Visualizations raise questions about measurement and methods.

- Participating in the exercise often leads them to consider issues like “measurement” and network concepts such as “reciprocity”.
- Graphs are also useful for illustrating the idea of linkages to nodes at a distances such as “friends of friends”.

Members of a Graduate Course
In Sociological Methods.



Applications and substantive problems:

The Tragedy of the Commons.

SOCIAL OR COLLECTIVE DILEMMAS

- Commons dilemmas occur when an individual is forced to choose between self-interest and societal interest with regard to the usage of a shared limited resource (e.g., water, air, trees, space, fish, the pool of "financial resources" in collective bargaining for wages, etc.).

- The logic of the dilemma dictates that self-interest is rational for the individual, but if pursued by all societal members, will eventually lead to lower payoffs for all, and threaten resource disaster.
- The dynamics of the dilemma would seem equally applicable to competing groups within a society as to individuals.

- In social science perspectives, the Prisoner's Dilemma Framework is often given for explaining the logic of the dilemma.

Payoff Matrix for the Prisoners' Dilemma Based on Years in Prison.

**Second
Prisoner**

**First
Prisoner**

	Confess	Not Confess	
Confess	a -8 / -8	b -10 / 0	Confess
Not Confess	c -10 / 0	d -2 / -2	Not Confess

Social Networks and the Prisoner's Dilemma.

- In my classes, I note that social networks process are one way in which the payoff structure of the Prisoner's Dilemma can be altered.

The Prisoner's Dilemma

-- A Variation Incorporating Collective Norms.

Payoff Matrix for the Prisoners' Dilemma Based on Norms and Potential Sanctions.

**Second
Prisoner**

**First
Prisoner**

	Confess	Not Confess	
Confess	a -8 / -8	b -10 / -10	Confess
Not Confess	c -10 / -10	d -2 / -2	Not Confess

Social Networks and the Tragedy of the Commons

- Bodin and his colleagues have made similar arguments with regard to the role that social networks play in ecological governance of common property resources.

Social Networks and Commons Problems.

- “... research has shown that there is a set of specific criteria (or design principles) that characterize long-term success in such locally based approaches of common-pool resources governance (Ostrom, 1990). These principles (e.g. a bounded set of actors, ability for actors to self-organize, actors’ commitment in following the commonly devised rules, and their mutual trust in the commitment of others to also comply, etc.) are inherently embedded in social processes and affected by factors such as trust for their long-term operation and effectiveness (e.g. Acheson, 1981; Fenny et al., 1990; Dyer and McGoodwin, 1994; McCay and Jentoft, 1998). In other words, the social arena from where they organize and operate is largely defined by their patterns of social relations.

Örjan Bodin et al. p. 13 in Bodin and Prell (Editors) 2011. *Social Networks and Natural Resource Management*. Cambridge University Press.

Collective action.

- Collective action refers to a collection of individuals and groups working together, usually outside of formal institutions, to achieve a common goal.
- Collective action is one solution to certain types of environmental problems.
- When the goals of collective action involves social change, we refer to it as a social movement.

Social Networks and Collective Action

- In several of my classes I talk about the role that social networks play in collective action – especially in regard to environmental issues.

What do ties do in social networks?

In recent years social movement scholars have given considerable attention to social networks in social movements.

Four types of network processes have been explored, though these are not entirely separate phenomena.

The Four Basic Types Are:

- 1) personal networks that are implicated in the initial recruitment and ongoing mobilization of social movement members;
- 2) interorganizational networks that link members of distinct social movement groups;
- 3) network structures that help transmit ideas and other aspects of culture;
- 4) networks that produce social capital for group members.

Networks and Collective Action

- Network Explanations Versus Other Types of Explanations
- Social networks versus social media.

Networks and Collective Action

Network Mechanisms:

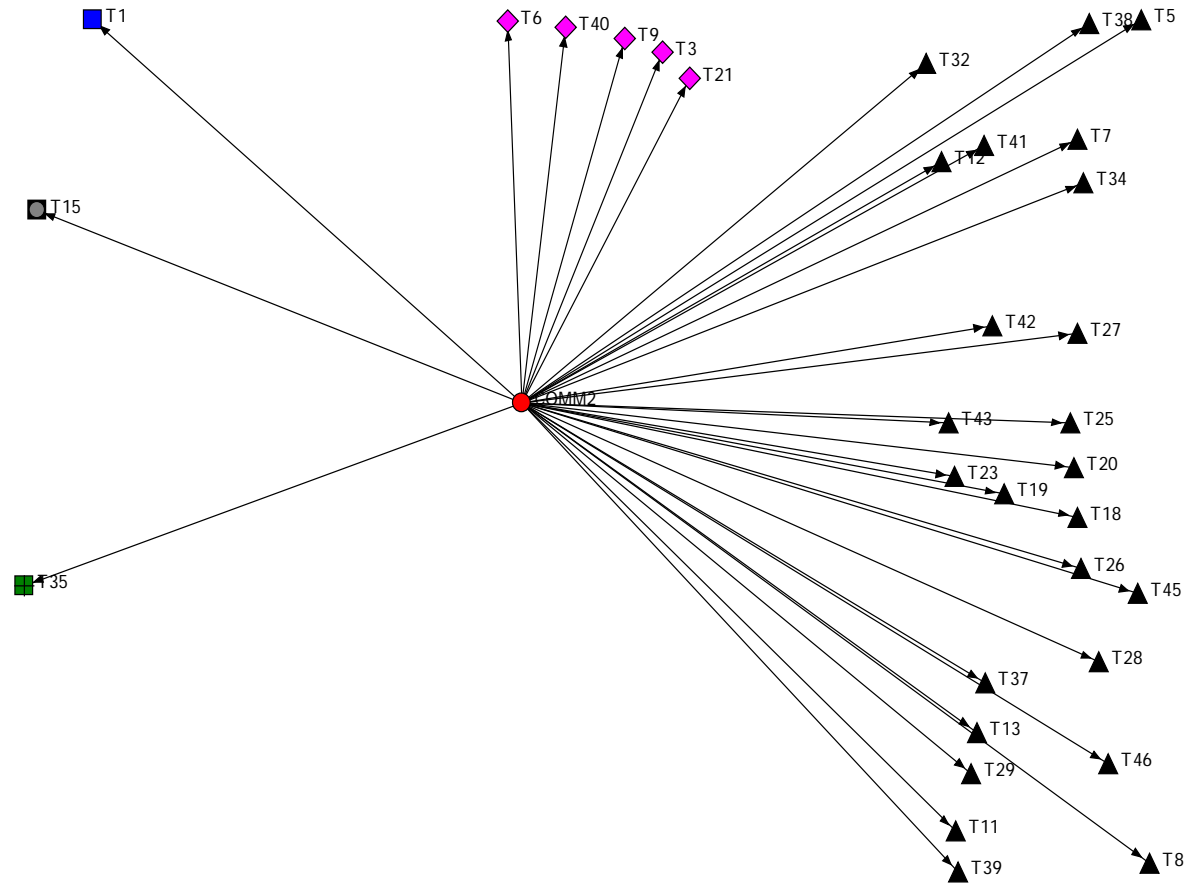
- Communication
 - Information
 - Social Influence
 - Identity Formation

Networks and Collective Action

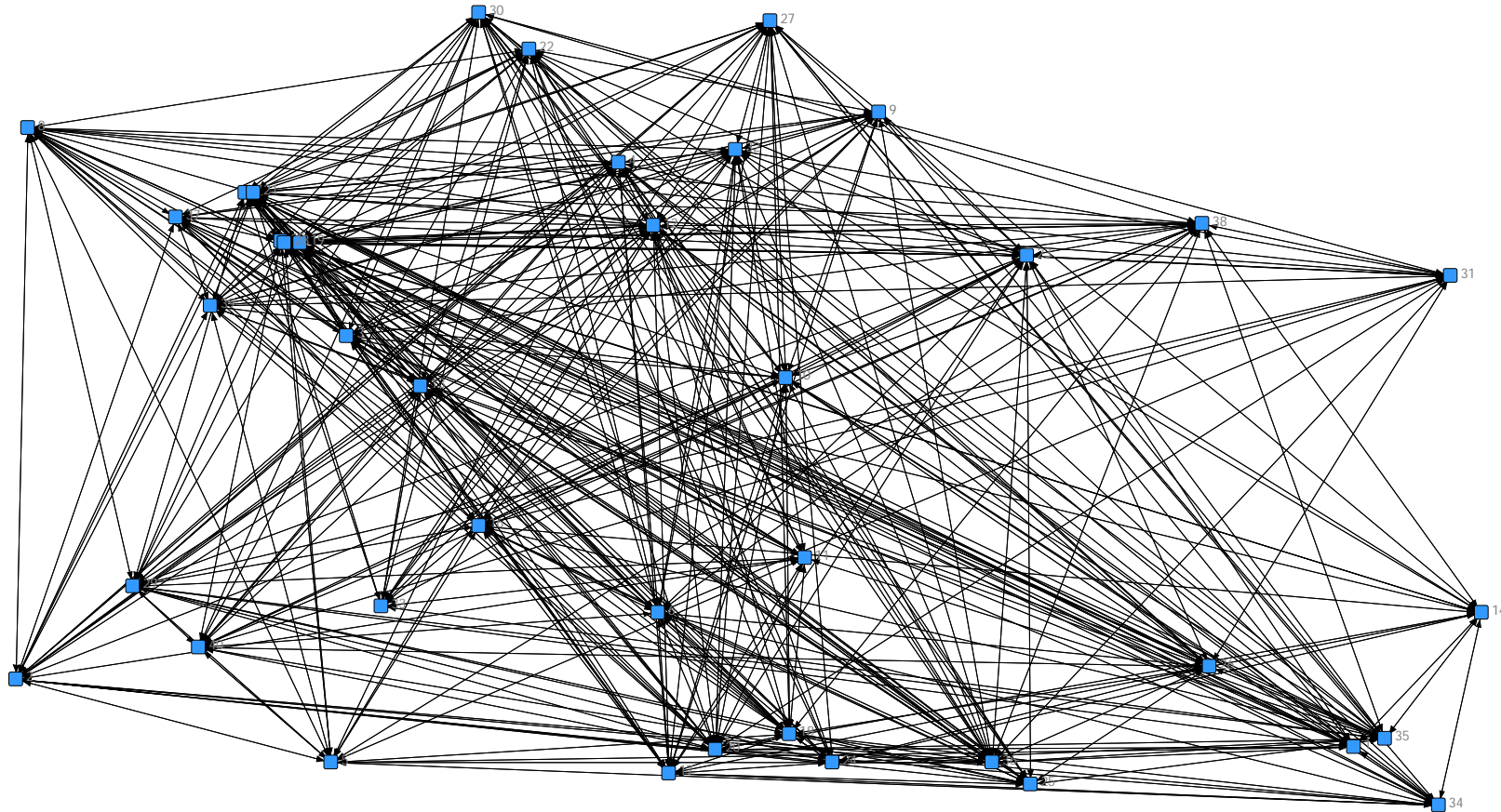
Some methodological issues:

- Whole Network Versus Ego-Network Data.
- Challenge of Obtaining Whole Network Data.

An Ego Network.



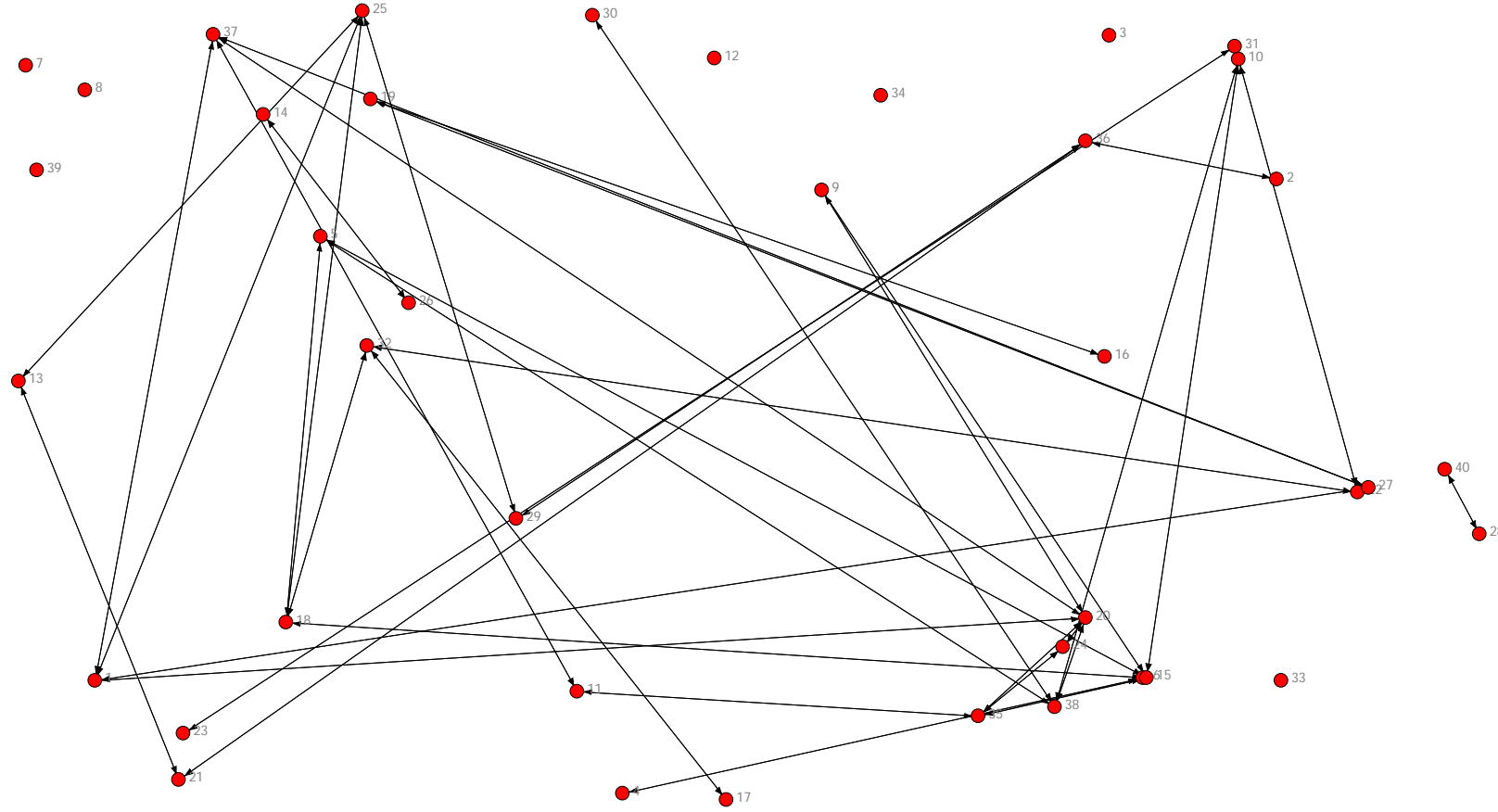
A Whole Network with Relatively High Density (50%).



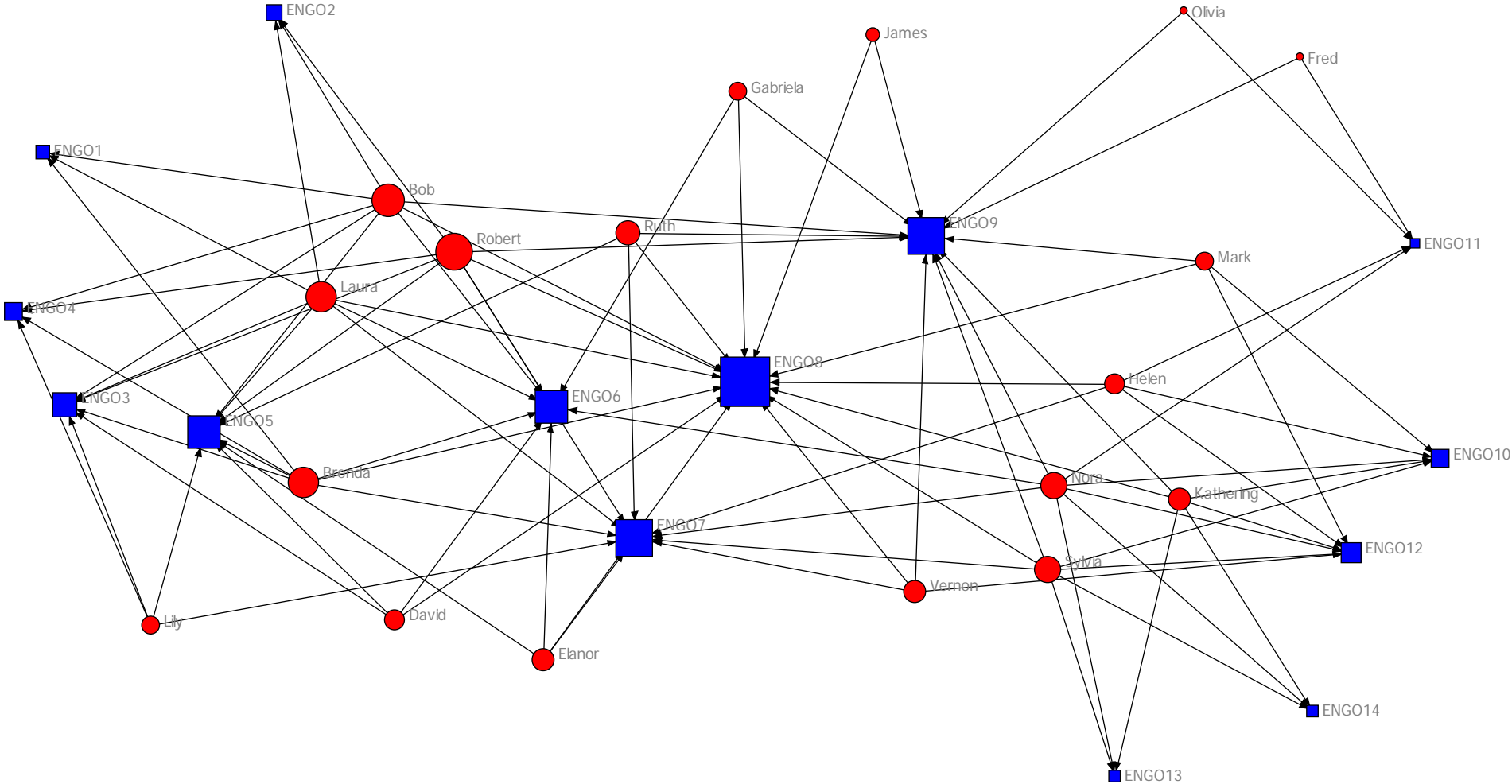
Networks and Collective Action

- One-Mode Versus Two-Mode Data.

A Whole Network (one mode data) with Relatively Low Density (5%).



Example of Two-Mode Network Degree Centrality.



The Relationship Between the Network Centrality of Environmentalists, and the Frequency of Media Citations.

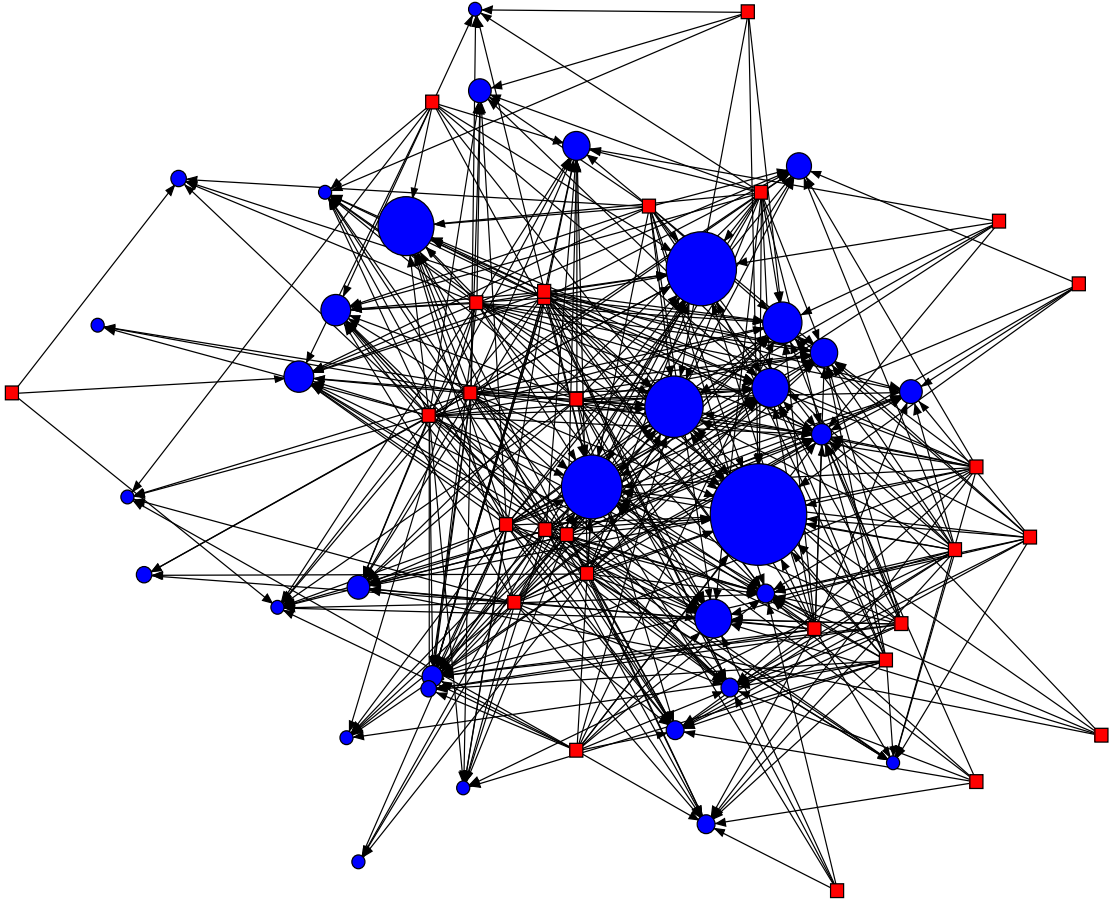
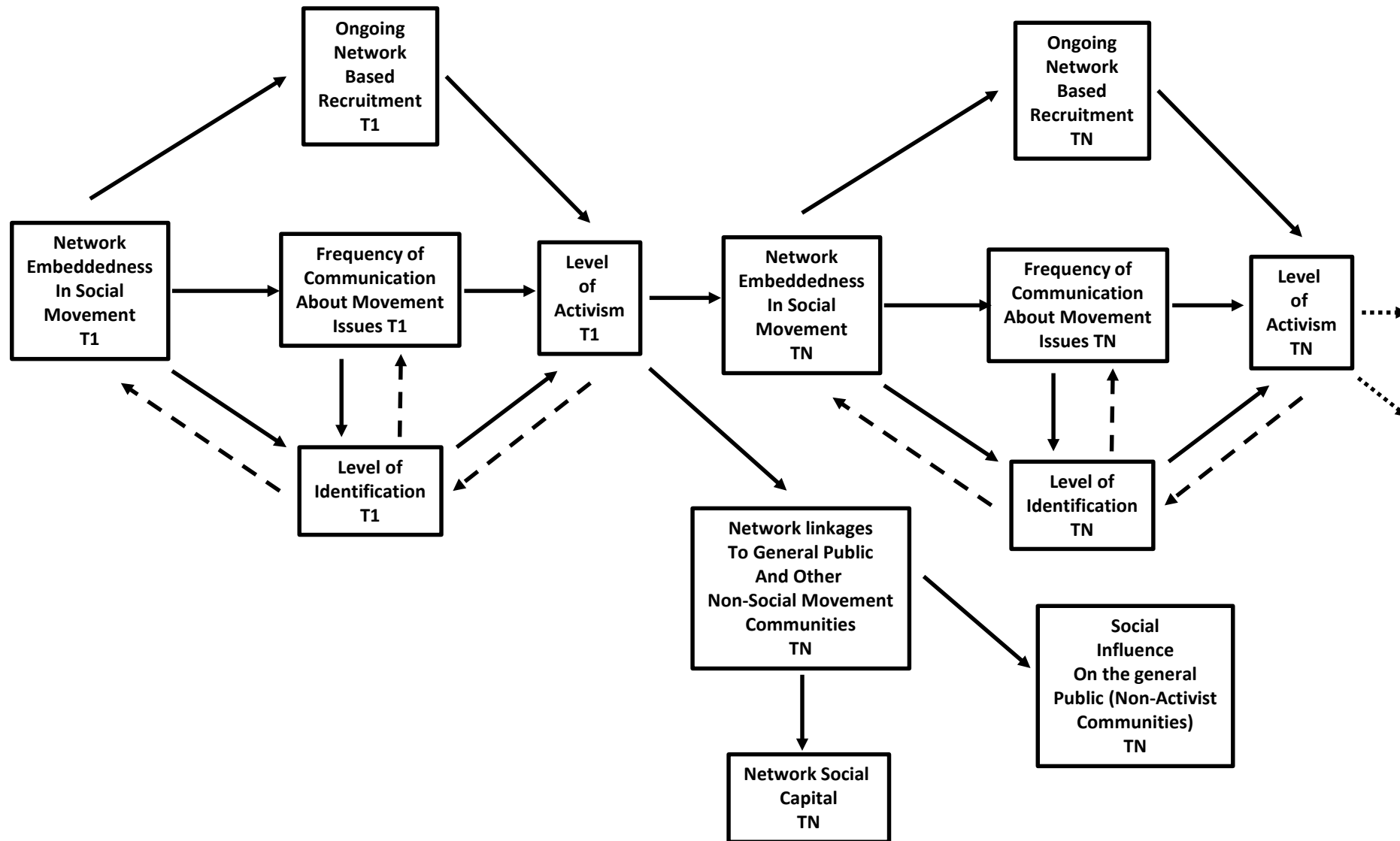


Figure 2. A Network-Social Psychological Model of the Participation of Individuals in Low Cost/Risk Social Movement Activism.*



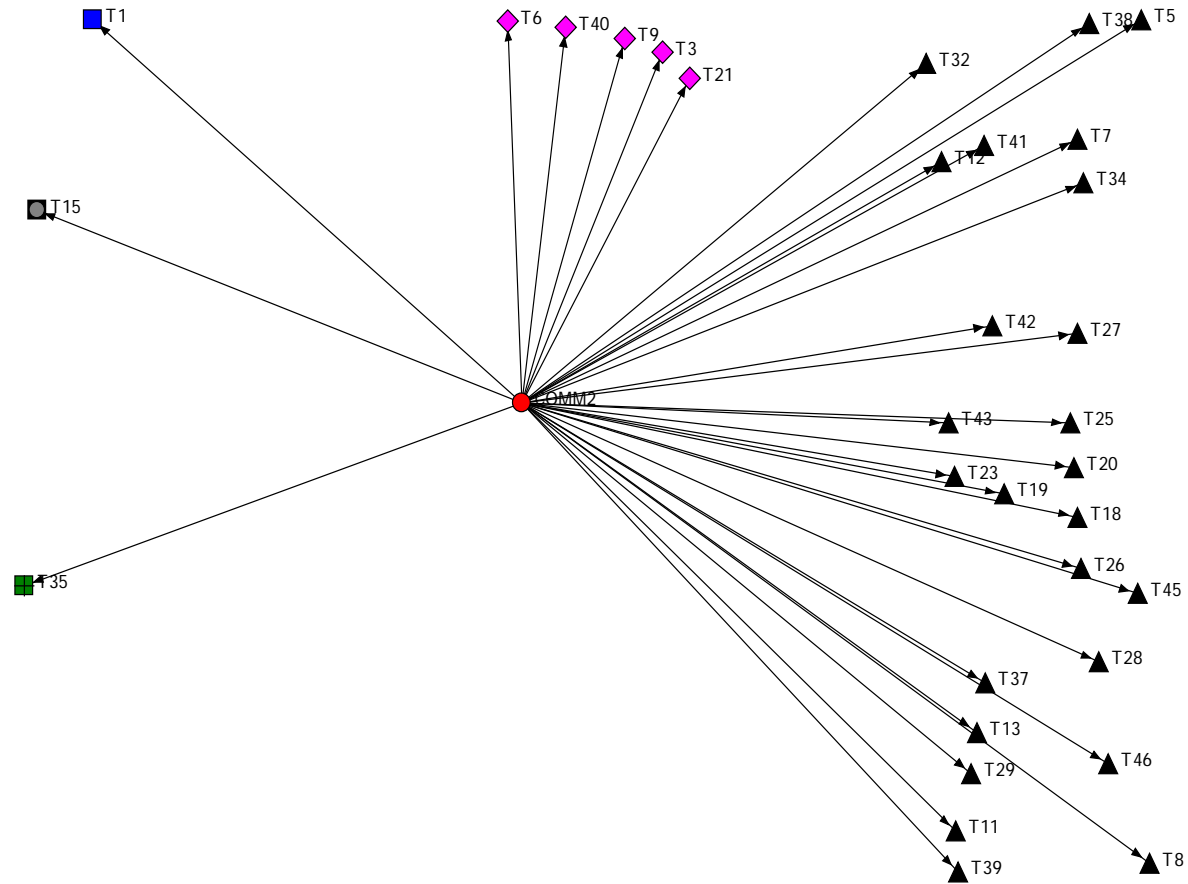
* Dashed lines indicate paths of potential reciprocal influence. Dotted lines indicate processes continue over time.

Social Capital.

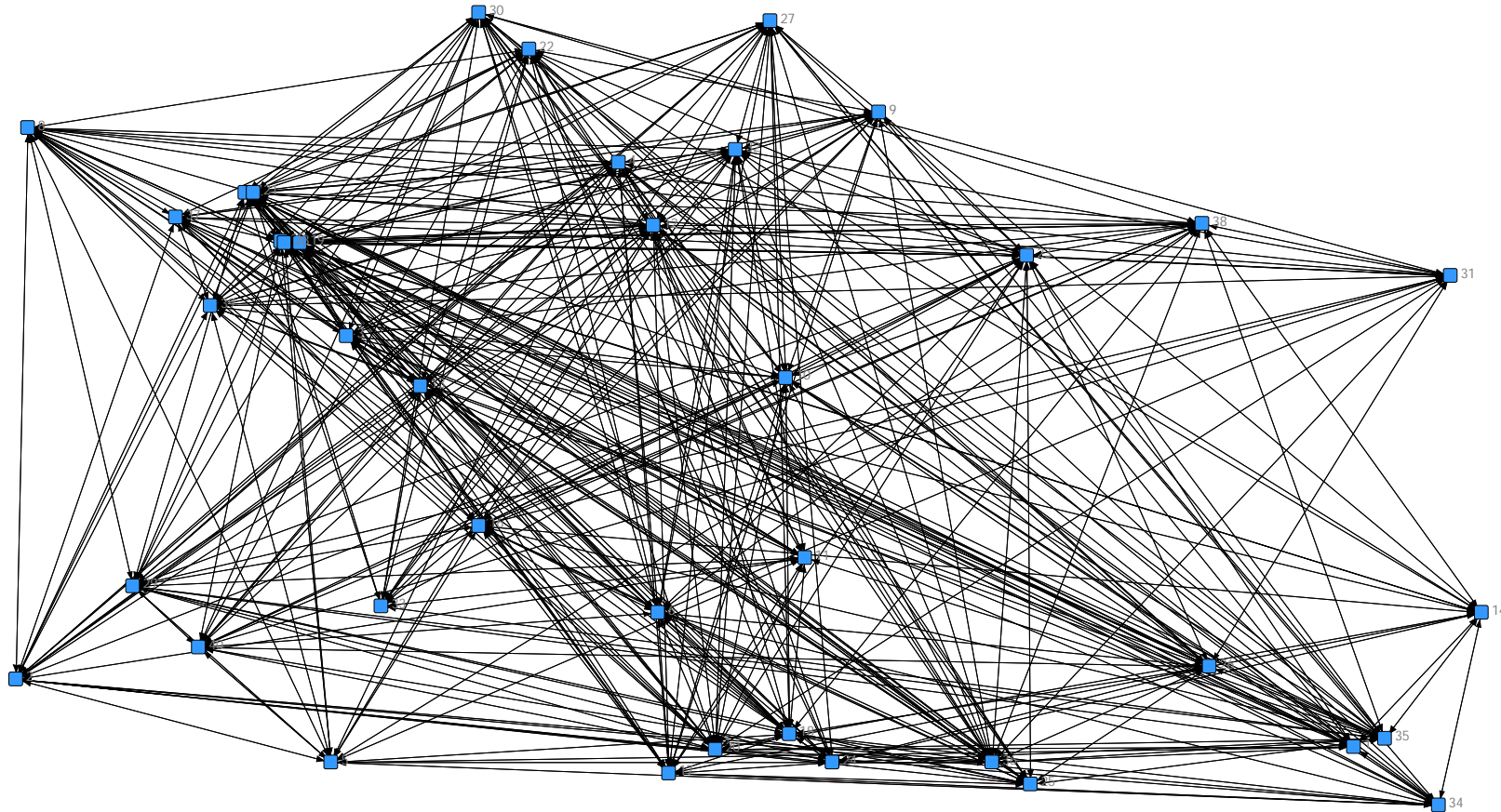
Social Capital.

- Social capital refers to social goods or resources, associated with social structure, that is available to individuals and communities.
- This concept is often employed in the context of social sustainability, and is sometimes examined to assess the extent to which communities are likely to be resilient in the face of significant stressors such as hurricanes or other natural disasters.

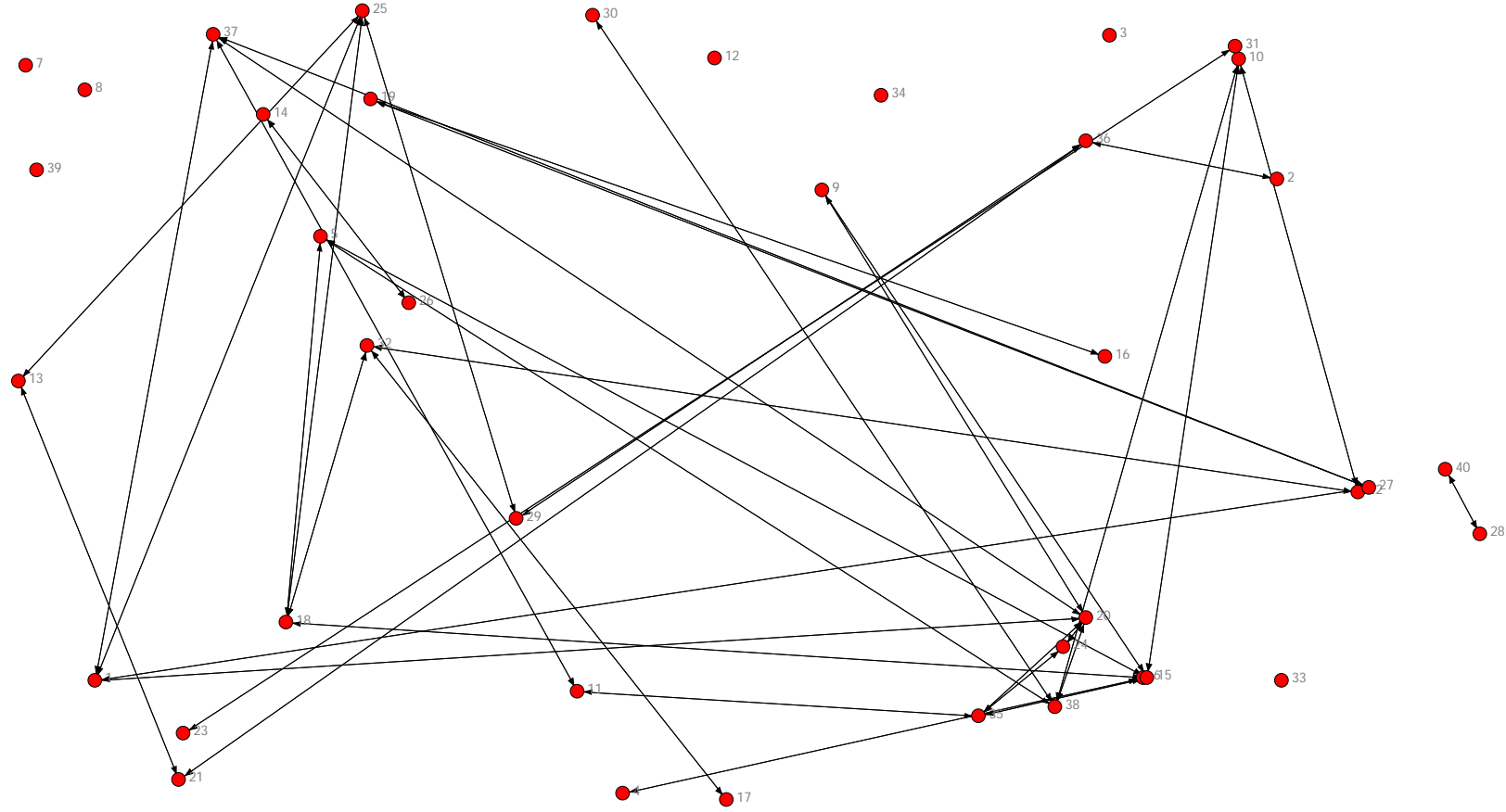
An Ego Network.



A Whole Network with Relatively High Density (50%).



A Whole Network (one mode data) with Relatively Low Density (5%).



Introduction to Social Capital

- Putnam defines social capital as “features of social organization such as networks, norms, and trust that facilitate coordination and cooperation for mutual benefit.” (1993:36)

- A useful distinction is made in the social capital literature between:
- “bonding social capital” which refers to linkages which are mainly or exclusively among members of the same group, and
- “bridging social capital” in which linkages exist amongst members of different groups.

Social capital “is defined by its function.

- It is not a single entity, but a variety of entities having two characteristics in common: They all consist of some aspect of social structure, and they facilitate certain actions of individuals who are within the structure” (Coleman 1990, p. 302).

- Despite these differences, there is general agreement about the important contribution that social networks make to the creation and transfer of social capital.

Nan Lin: Social Capital as An Individual, Instrumental Good.

- Network extensity provides greater access to resources that may benefit individuals.

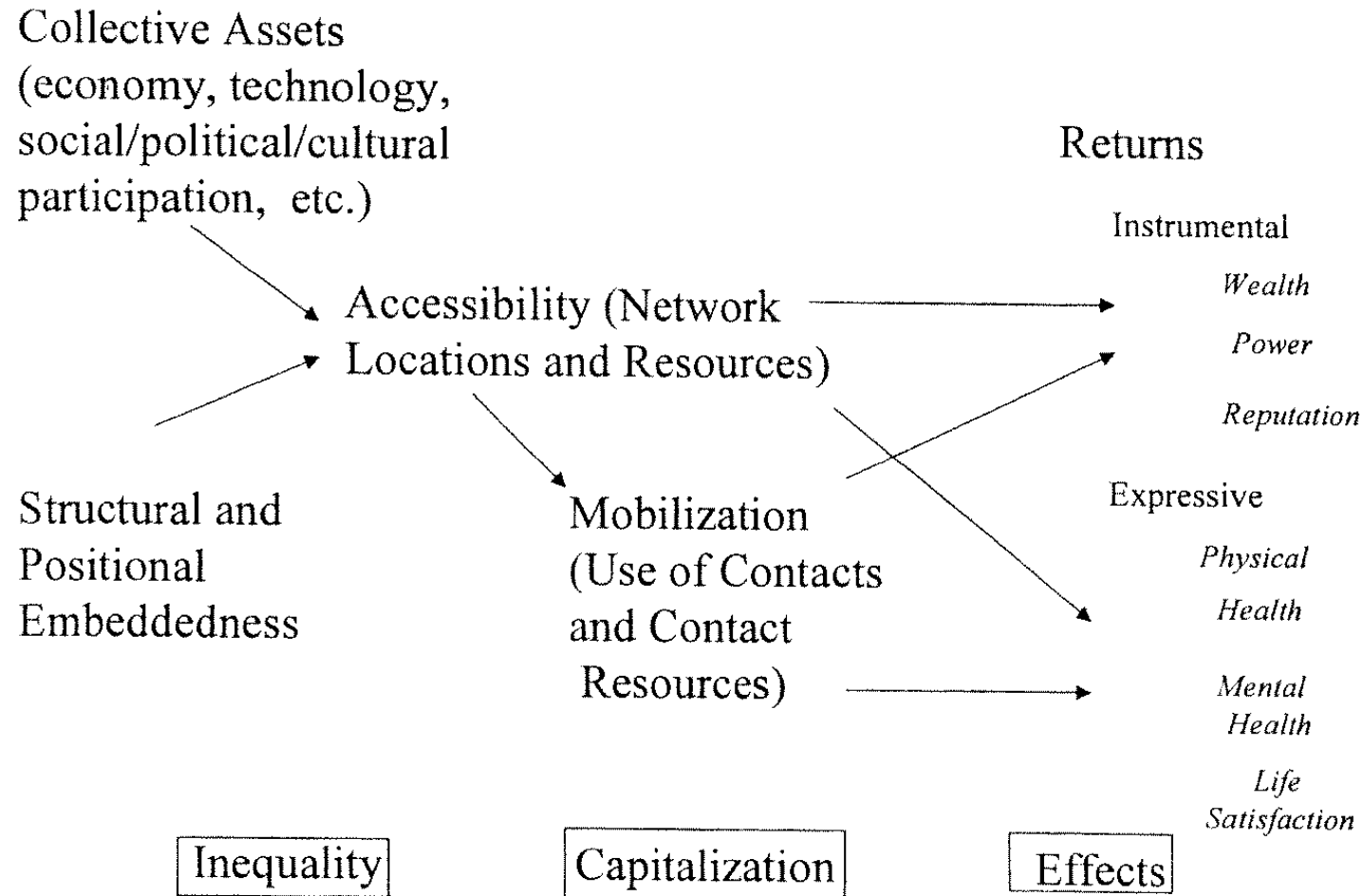


Figure 1. Modeling a theory of social capital (adapted from Figure 13.1, Lin 2000).

Diffusion and attitude formation.

- A number of studies have examined how information (including information about sustainability) is diffused through social networks.
- Some studies have found that attitudes, and opinions on environmental issue are associated with the location of actors in social networks.

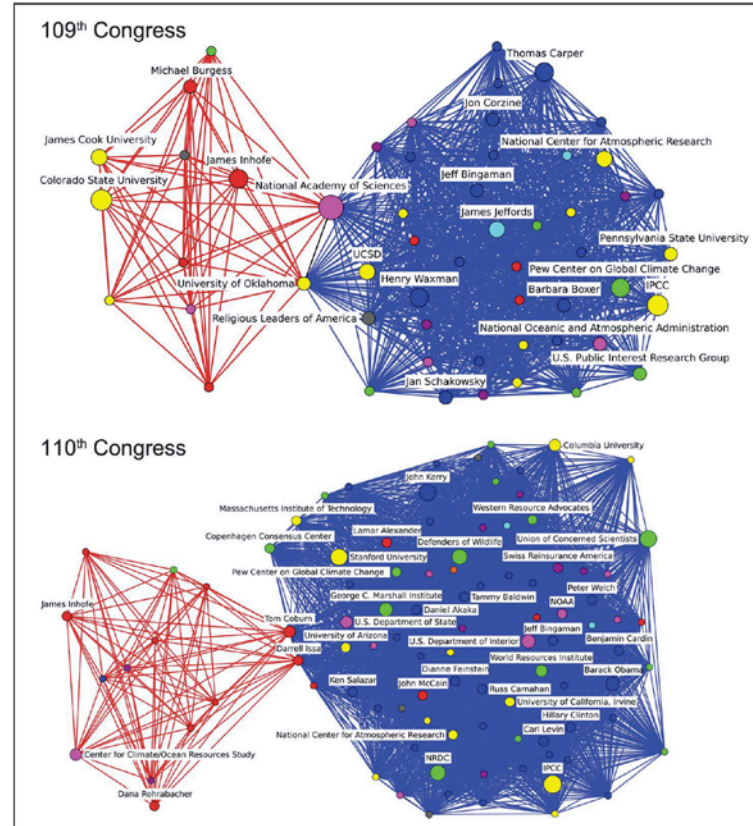


Figure 2. Network diagrams for the statement “climate change is real and anthropogenic” Blue indicates Democrats in Congress, red indicates Republicans in Congress, aqua indicates Independents in Congress, pink indicates representatives from the executive branch of the government, green indicates environmental groups, purple indicates businesses, orange indicates business and trade organizations, yellow indicates scientists, and gray indicates policy actors who fall into the “other” category. Node size is dependent on the number of times the actors talked about the same category. Red lines indicate opposition to the statement. Blue lines indicate agreement.

By the 110th Congress, the number of times this issue came up increased to 97. Of those statements, about 11% were in disagreement with this issue. Those who disagreed include congressional Republicans, a House Democrat, businesses, and representatives from two environmental groups known to promote climate skepticism.

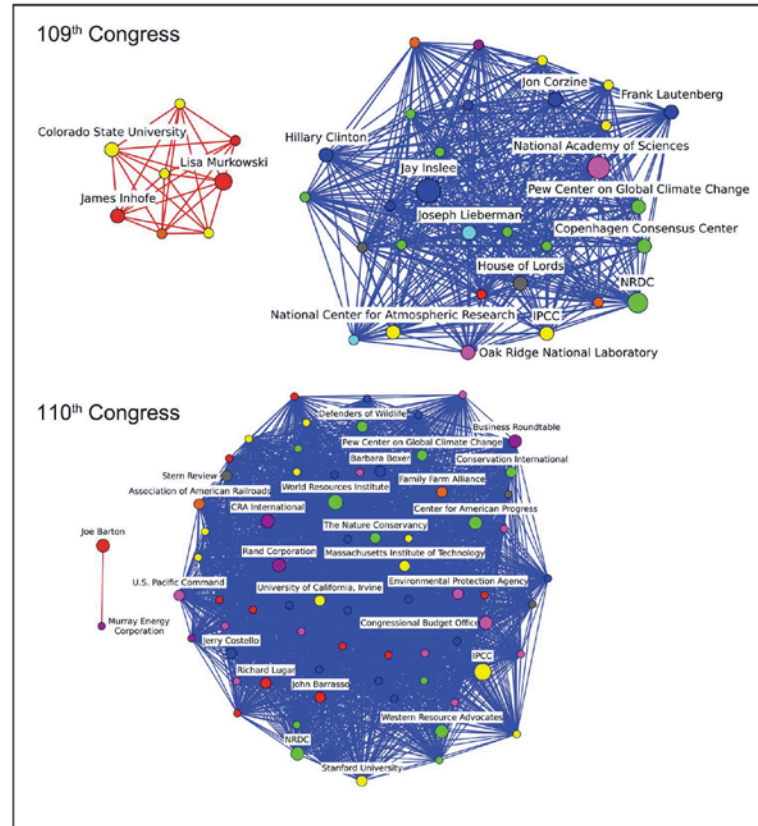


Figure 3. Network diagrams for the statement "climate change is caused by greenhouse gases (GHGs)"
See note to Figure 2.

Legislation should regulate CO₂ emissions. In contrast to the consensus we see regarding the science of climate change, we turn now to issues related to what policy instrument is appropriate for regulating carbon dioxide, and what consequences could be expected from these instruments (see Figure 4). First, we consider the question of whether legislation should regulate carbon dioxide emissions. In the 109th Congress, there were 37 actors who spoke about carbon dioxide regulation. Of all the statements made on the issue, about 41% were against regulation. Those who opposed included

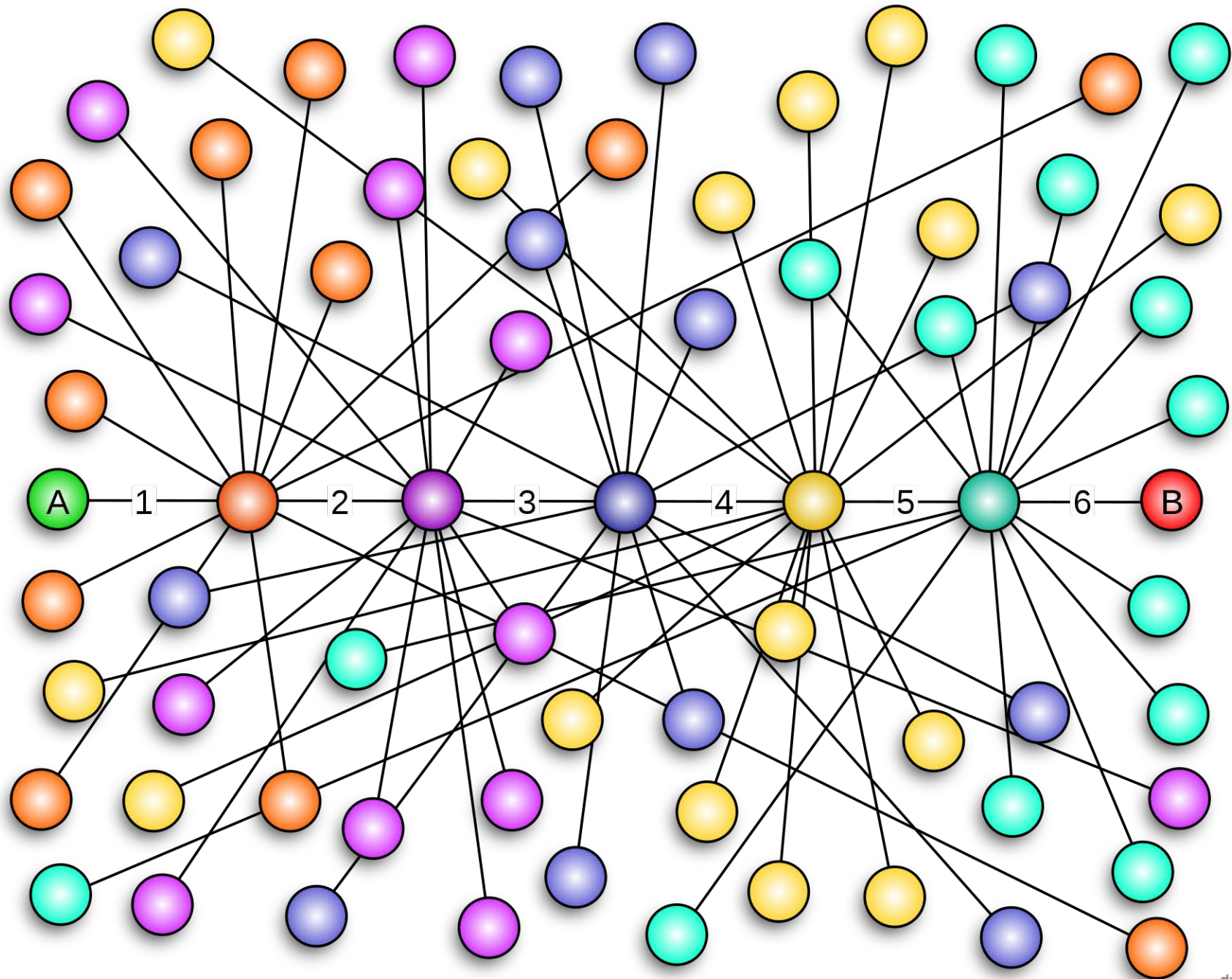


Table 4. Logistic Regression Model Explaining Having a Plan to Deal with Climate Change.

	2: Having a plan to deal with climate change
Concern about climate change	0.963*** (7.10)
Network ties to ENGOS	0.353*** (3.81)
New Ecological Paradigm scores	0.375 (1.92)
Education	0.067 (1.32)
Income	-0.000 (-0.66)
Gender (Female = 1)	-0.158 (-0.61)
Age	-0.027** (-2.66)
Youth (Under 30 = 1)	-0.083 (-0.17)

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Ecological governance.

- Bodin et al. note that social network analysis is important for understanding ecological governance.
- SNA can help us to understand the role of informal structure in ecological governance, and sometimes these informal structures fit better with ecological systems than do formal structure.

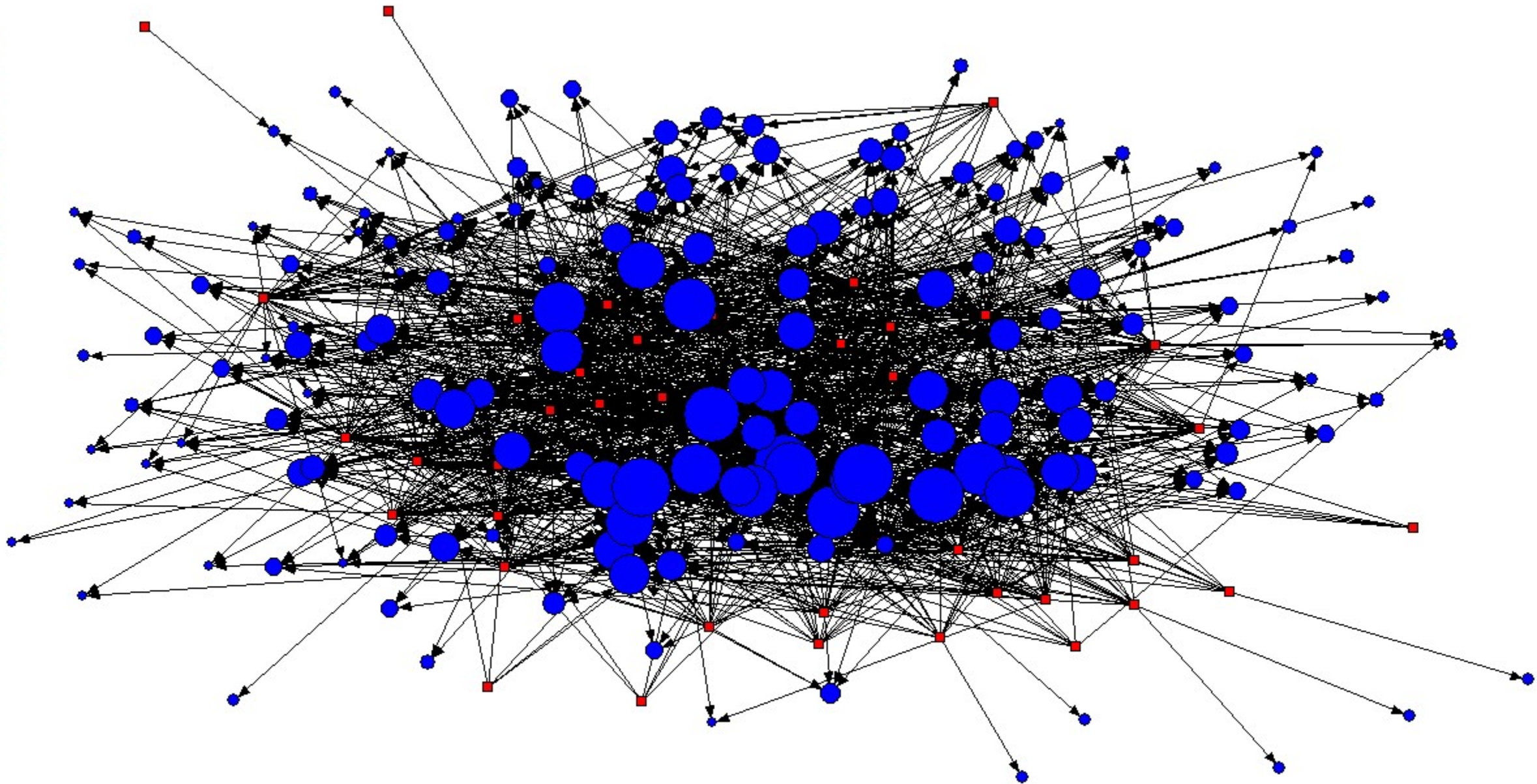
- Informal networks of resource users and beneficiaries, actor groups, leaders, agencies, knowledge carriers, and institutional entrepreneurs, seem instrumental in trust building and conflict resolution, in mobilizing key resources, in navigating social-ecological transitions when responding to crises, and in transforming unsustainable governance regimes towards adaptive and multi-level stewardship of whole landscapes and seascapes. Social networks are often the glue that ties together the individual with the organizational and the institutional and with key actors operating in networks that span multiple scales and governance levels.
- Bodin et al. Social Networks and Natural Resource Management . Cambridge University Press.

Environmental Policy Networks.

- A variety of scholars have utilized social network analysis to examine the role of social networks in policy making and environmental politics.
- Again, the tools of social network analysis can be powerful both analytically, as teaching tool for helping students to understand political processes related to sustainability.

Environmental Policy Networks.

- A core idea here is that the location of an actor in a social network affects their position on policy issues, and their relative influence in a policy network.
- From a wider lens, many policy processes can be seen as network processes where networks of actors engage in policy discourse, and try to influence formal government policy construction.



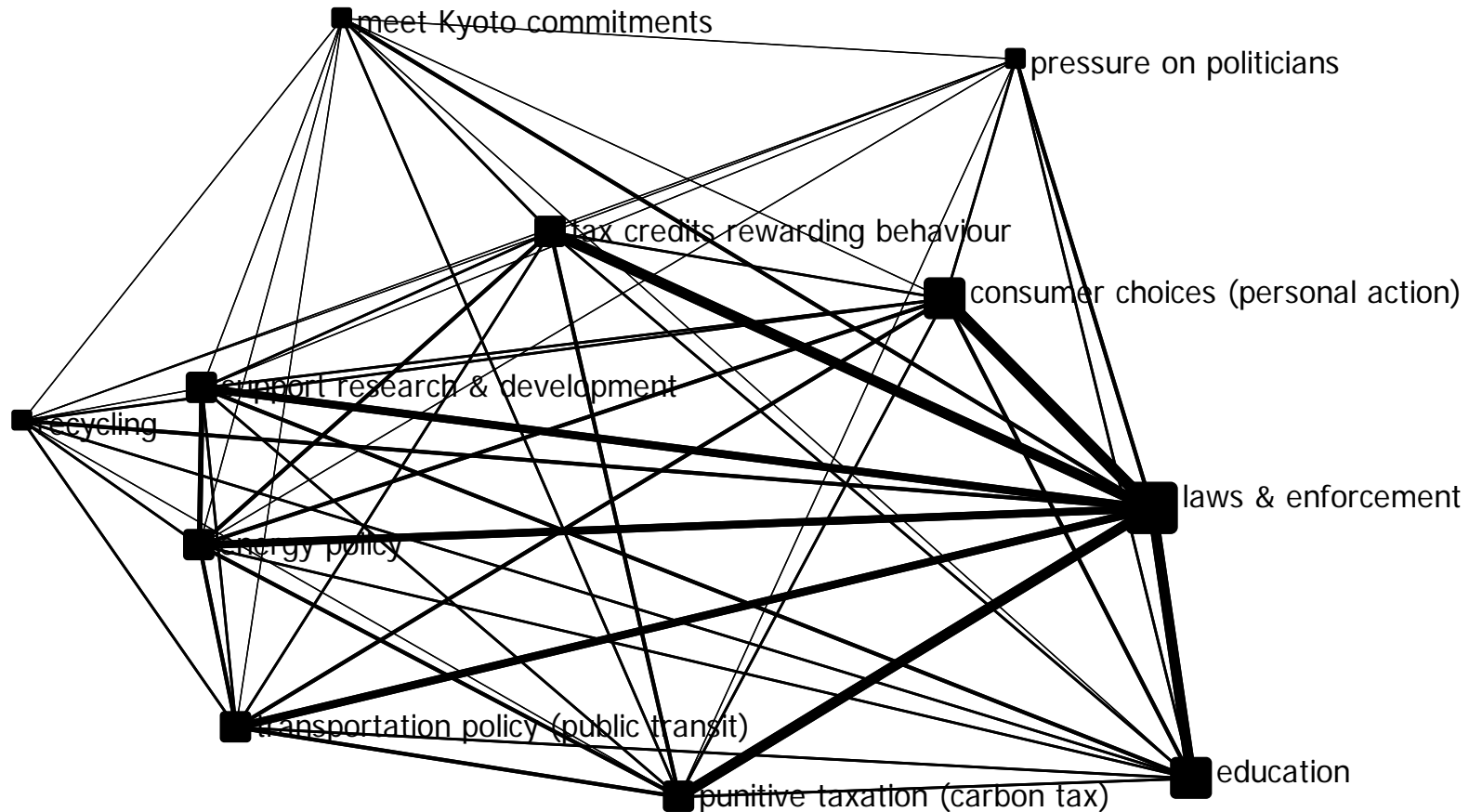
Thinking relationally beyond
individuals and groups.

- There is a tendency to think about social networks as involving ties amongst individuals. However, the nodes in social networks can be larger social units such as organizations, countries, and so on.
- Further we could either broaden the notion of “social”, or drop it all together, and think about links amongst various types of nodes that might be relevant for thinking about sustainability issues.

- For example, some folks have looked at elements of discourse as nodes, and have examined the relations amongst them.
- Others have employed two mode analyses amongst social units and non social units (such as discourse, or ecosystem elements).

Discourse network analysis.

A Discourse Network of Proposed Solutions for Dealing with Climate Change.



Mixing discourse and social network analysis.

A Discourse Network Analysis Describing the Conflict over Jumbo Pass.

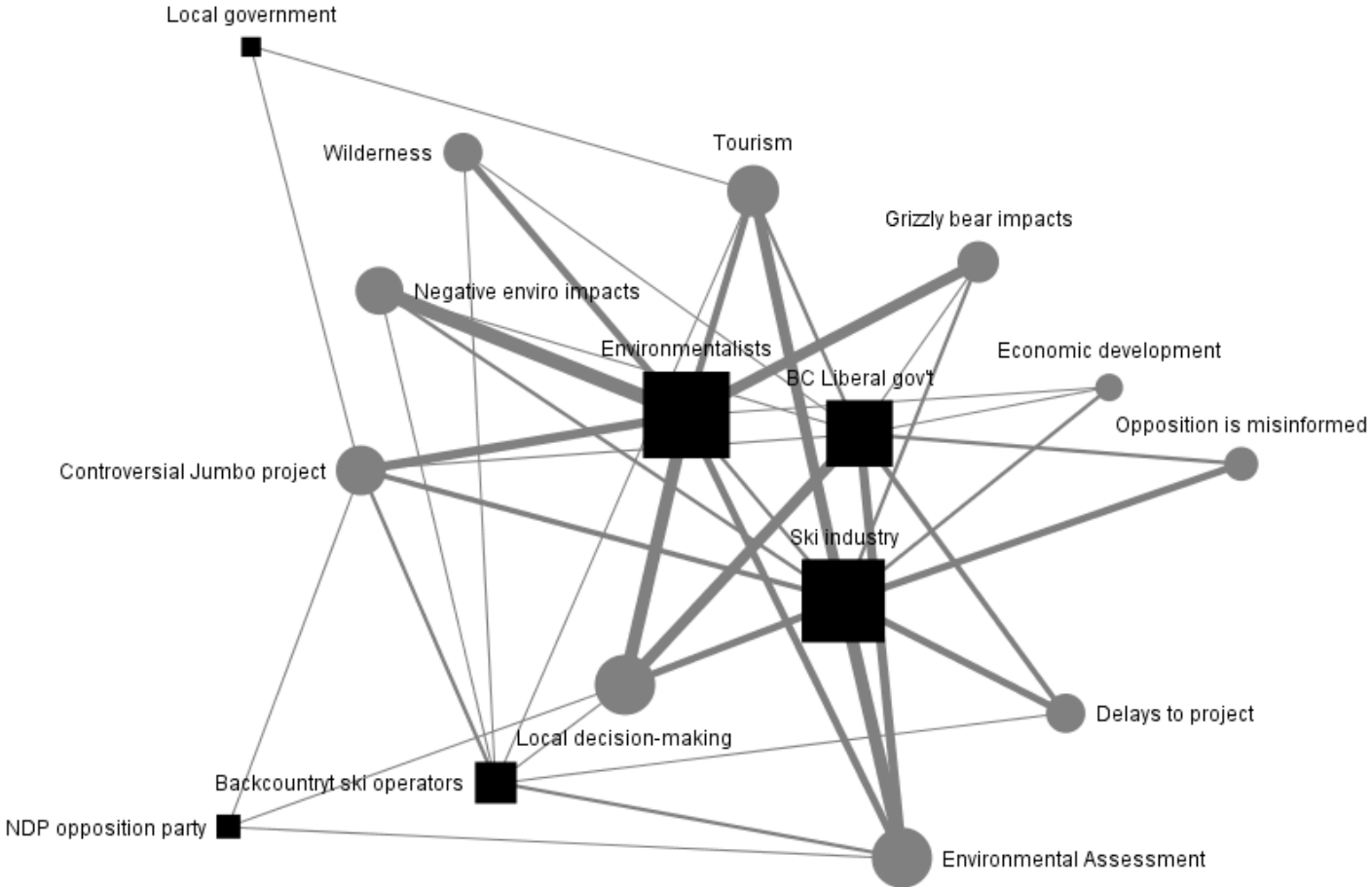
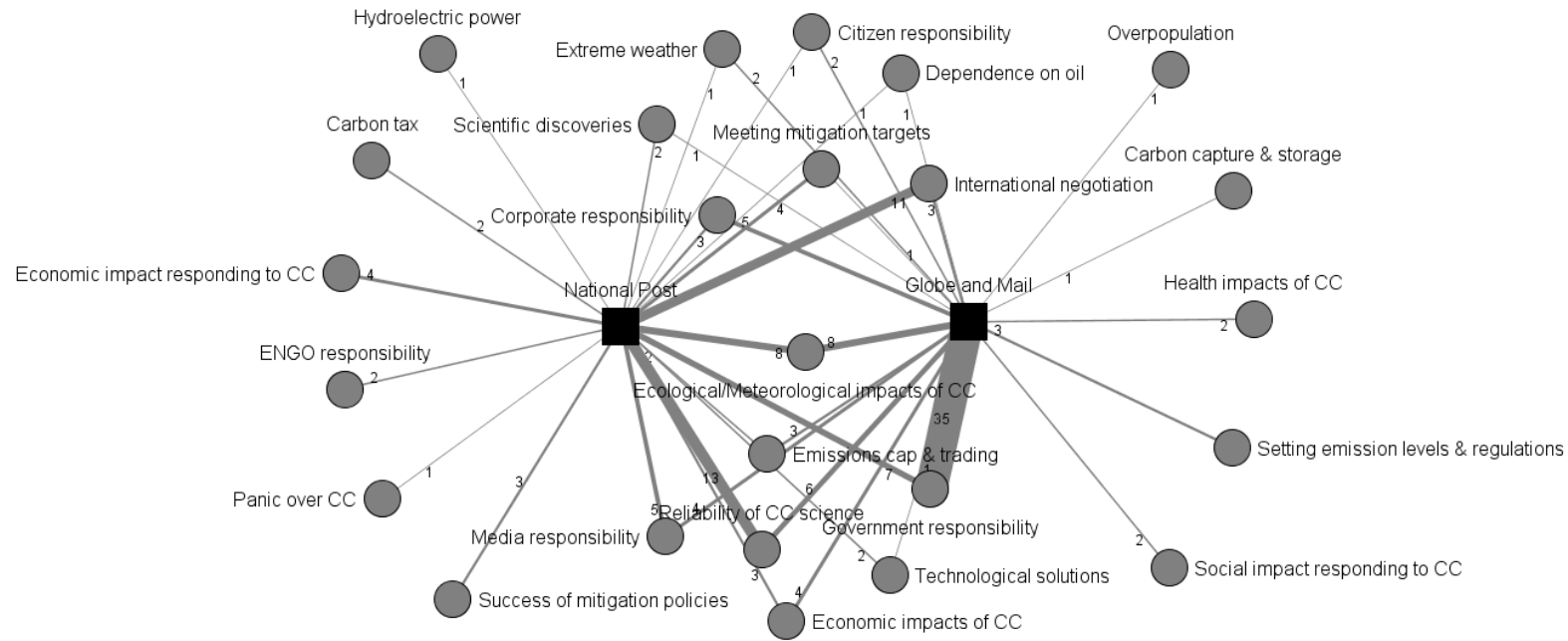


Figure 3. Discourse network linking primary issue categories to news outlet, 2006 (links showing frequency of articles with theme).



Mixing social actors and ecosystem elements.

- It is possible to have two mode, or multimode. In these networks some elements are social, and others are a different type of entity.
- In one set of examples, Orjan Bodin and his colleagues have examined the fit between social elements and ecosystem elements by employing social network analysis.

Linkages Amongst Social Units, and Eco-System Units.

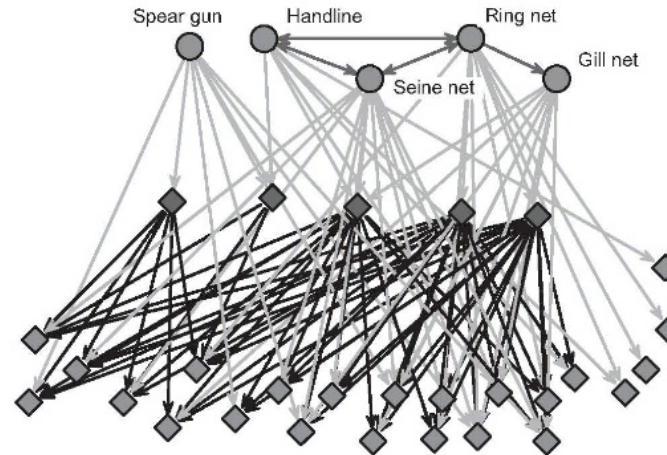
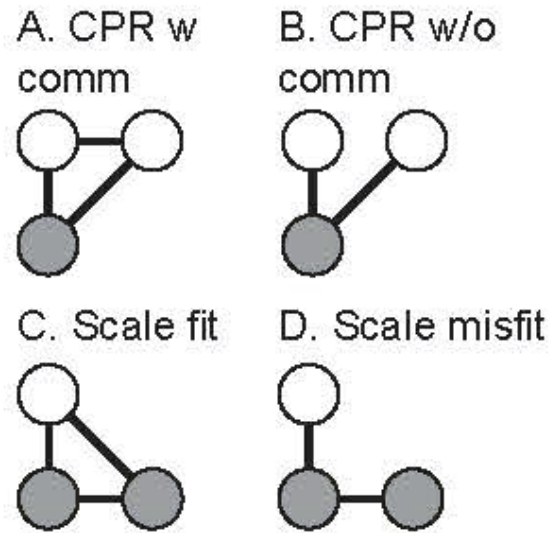


Figure 2. Estimated social-ecological network of the African small-scale fishery. Circular nodes at the top are gear-defined groups of fishers (Crona & Bodin 2006), dark grey diamonds in the middle are targeted species of predator fish, and light grey diamonds at the bottom are targeted species of prey fish. Dark grey lines with double-headed arrows are links that represent an exchange of ecological knowledge and information (i.e., communication) among groups of fishers, light grey arrows are extraction of particular fish species by certain groups of fishers, and black arrows are trophic interactions.

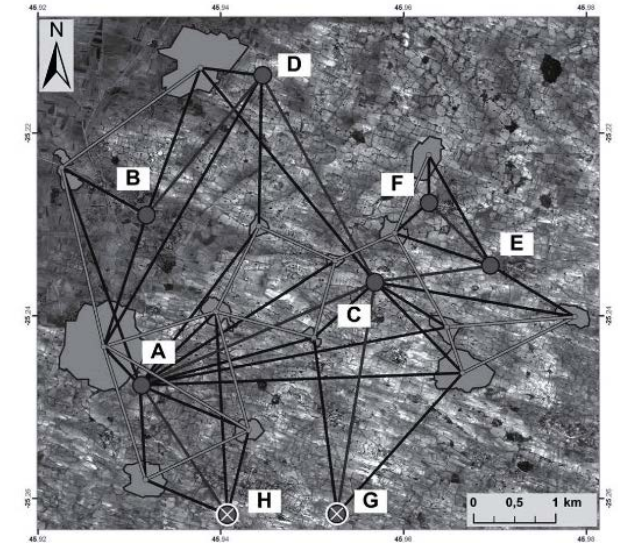


Figure 3. Estimated social-ecological network of the Madagascar agricultural landscape (adapted from Bodin and Tengö [2012]). Grey circles are nodes representing different clans residing in the landscape, polygons are nodes representing forest patches, black lines show which clans are benefiting from ecosystem services stemming from which forest patches, light grey lines show patch interconnectivity through seed dispersal, and dark grey lines are social ties between clans. The clans with a white cross reside outside the area shown.

Some Concluding Points

- Network/Structural analysis can be a novel paradigm for some audiences.
- Graphs and other techniques can be used to illustrate relations and processes that might not be otherwise obvious.
- As in other realms, interactive activities for students enrich learning.

Some Concluding Points

- It is “natural” to think about individuals as nodes, but various types of units can serve as nodes, including non-social units.
- Multi-mode networks can be constructed, and this can be particularly useful for analyzing illustrating linkages between social and ecosystems.