Network Analysis:

The Hidden Structures behind the Webs We Weave

17-213 / 17-668

Social Capital 2: Benefits of Network Cohesion

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2-min Quiz, on Canvas

Bonding Social Capital

Social Capital in the Creation of Human Capital

Q: What is “human capital”?

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→ Economic value that inheres in the skills and experience

→ Example measure: years of education

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Q: What is social capital?

Social Capital in the Creation of Human Capital

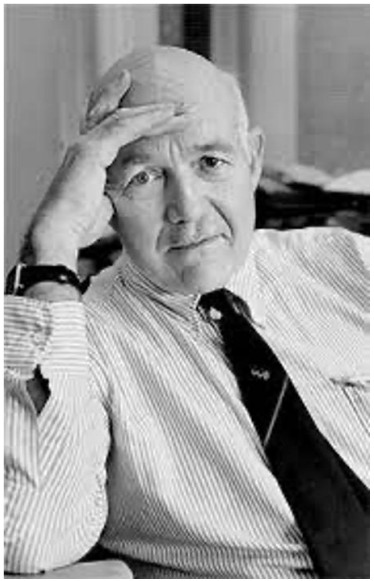
Q: What is “human capital”?
→ Economic value that inheres in the skills and experience
→ Example measure: years of education

Q: What is social capital?
→ Economic value that inheres in social relationships
→ Example: bridging social capital, arbitrage, brokerage, structural holes, etc.

So far, we considered economic value that is derived from the **absence of relationships**

Social Capital in the Creation of Human Capital

Now, let's consider the social capital that comes from the **presence of relationships**



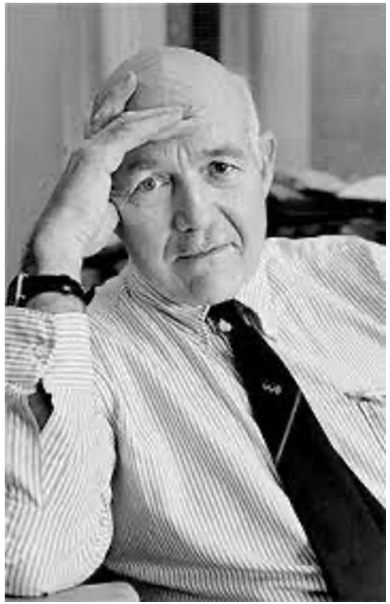
James Coleman

Mathematical sociologist

Social theorist:

- Reconciling social structure and individual rationality
- Proposed the "boat model" of social change

Explaining Social Action



What makes people act the way they do socially?

Agency: Individuals behave rationally to maximize their gains

- Economics, rational choice theory, game theory

Structure: Individuals are enabled and constrained by the social structures in which they are embedded

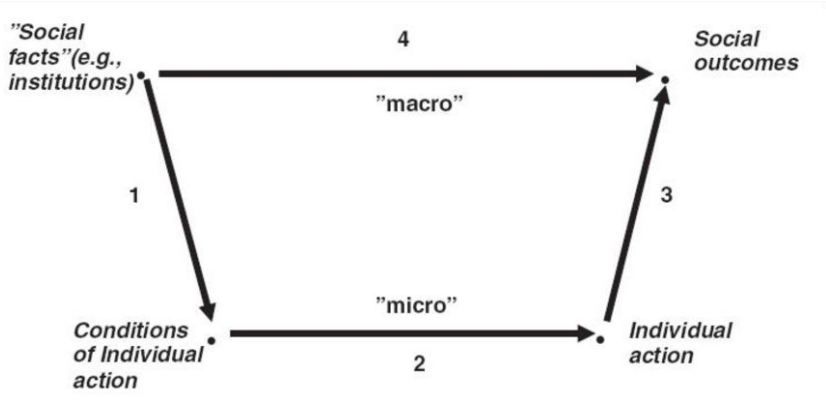
- Sociology, normative action, structuralism

Coleman's question:
How can we combine individual agency and rationality with the social contextual contingencies that enable and constrain social actors?

Coleman's Boat Model

Given social structural opportunities and constraints, individuals calculate utility of choosing one action over another

Collective outcomes emerge from individuals' rational choices
These collective outcomes shape social structure



Coleman's idea of Social Capital

Coleman does not give a clear definition

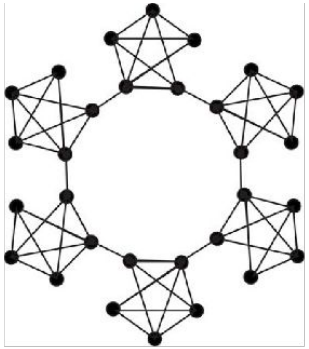
- A concept defined by its function
- Inheres in the structure of relations between (dyadic) actors and among (group of) actors.
- Social capital can be a variety of different entities that have some aspect of social structure and facilitate certain actions within that structure.

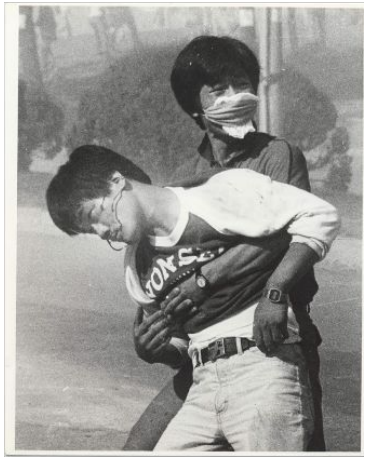
Example forms of social capital

Example 1: **Obligations and expectations**

- Jewish diamond merchants
- Dense network ties ensure trust
- Multiplexity enables exchange of diverse obligations (financial vs. social support)
- Reduces transaction cost (doing business without formal contracts, lawyers, etc.)

Example forms of social capital





Example 2: **Social similarity** (homophily)

- Radical student organization (South Korea)
- “Study groups” form micro protest units
- Same hometown, high school, university
- High stakes, life vs. death
- High levels of trust required

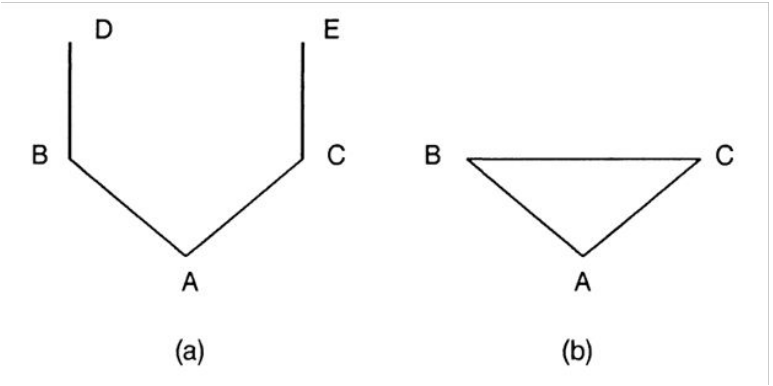
Example forms of social capital

Example 3: **Social norms**

- Israeli parents benefit from the social norm that strangers look after kids
- Less direct supervision required
- It takes a village to raise a child

General trust underlies the effects of social norms in the creation of social capital

Open vs. Closed Networks



Open network benefits A (left)
Closed network constrains A (right)

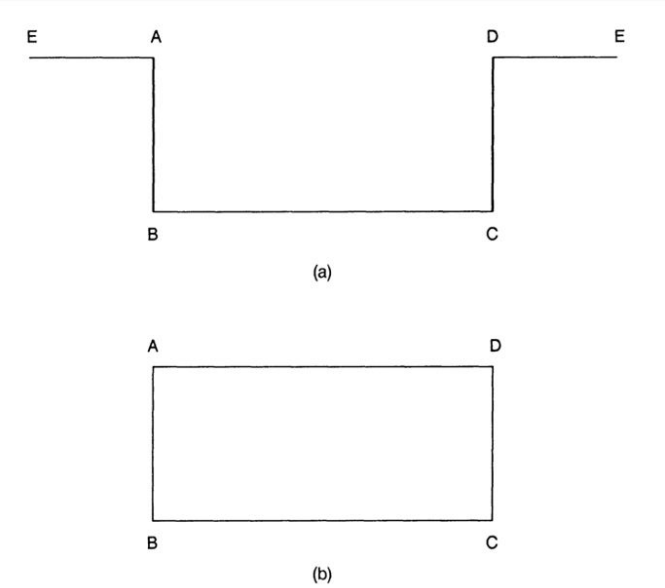
Open network can isolate A (left)
Closed network can offer support to A (right)

Norms can be enabling for some but constraining for others

Some social structures facilitate particular forms of social capital (e.g., open networks offer vision advantage)

Collective sanctions are ineffective in open structures

Open vs. Closed Networks

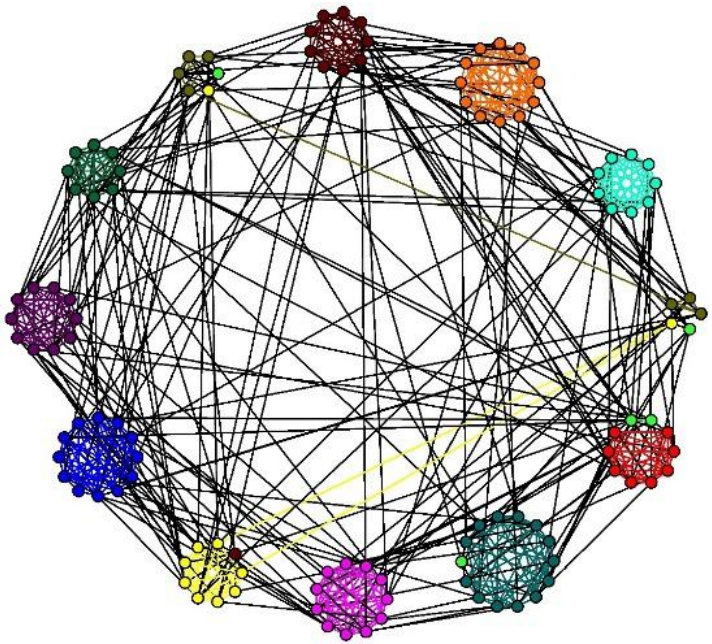


B, C are high school friends
A, D are parents

Q: What might be the benefits for A and D in the open network structure (top) and the closed network structure (bottom)?

Q: What might be the benefits for B and C in the top and the bottom network structures?

Growth in networks and social capital



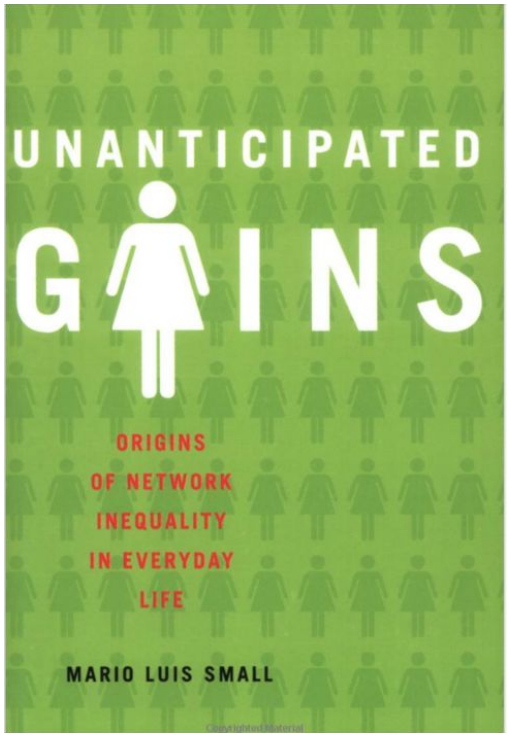
Small groups to larger groups to societies

Network density decreases, so closure becomes exponentially difficult to maintain.

Q: Then, how is social order possible?

- What inventions replace the function of closed network structures in large social entities?

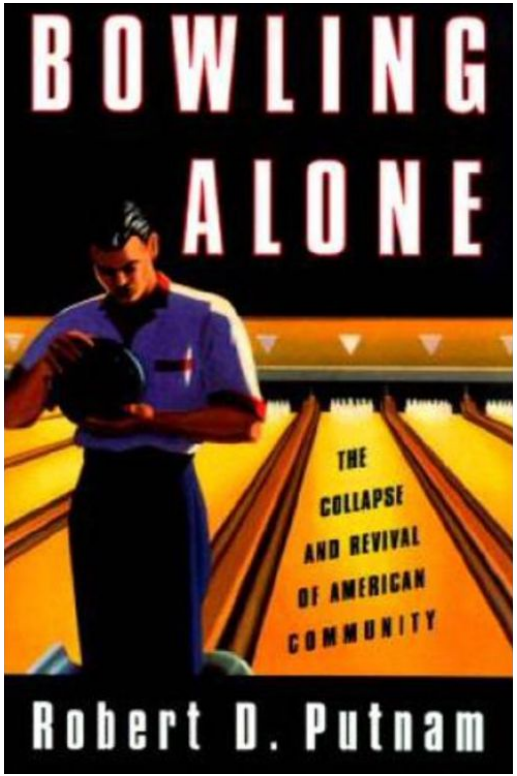
Creation of Social Capital through Relational Spillovers



Multiplex relations create spillovers in social capital

- Resources in one relationship can be appropriated for use in other relationships
- Organizations shape the context of interaction (e.g., friendly vs. competitive)
- Hence, how much people gain from their connections depends on institutional conditions
- Example: Child care center policies correlated to the size of friendship network of mothers
- The social support that mothers gained

Creation of Social Capital through Relational Spillovers



Decline of social capital in the U.S.?

Communal activity and civic engagement declined over the decades

People bowl alone, sign fewer petitions, join fewer organizations

Grassroots organizations (institutions) on the decline

Tragedy of the Commons

Natural resources are **public goods**

- Fisheries, grassland
- **Rivalry**: Does your consumption diminish what I can consume?
- **Excludability**: Is it possible to exclude others from consumption?

Natural resources are rival and non-excludable

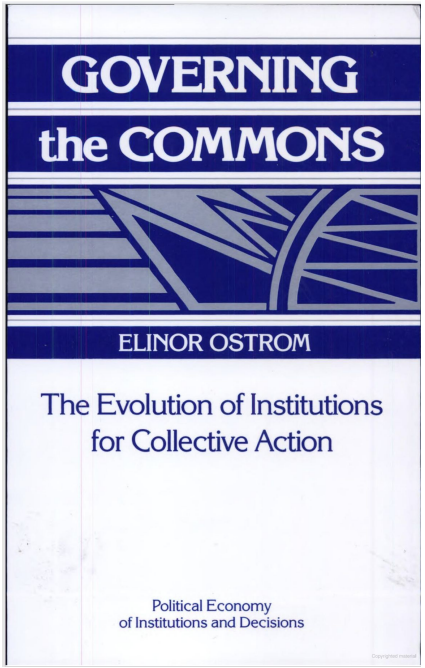
Tragedy of the Commons

Consumption of Public goods: A prisoner's dilemma

Consumption of public goods that are rival and non-excludable creates a prisoner's dilemma

- Consumption does not entail cost to the individual → over consumption
- This leads to depletion, making everyone worse off
- Hence, the tragedy

Governing the Commons: Solving the Collective Action Problem



Elinor Ostrom studied small-scale communities to understand how they solve this dilemma

Common characteristics of successful communities

1. Commons need to have **clearly defined boundaries**

2. **Rules should be proposed and decided on by local people** and have a deep rootedness in local ecological needs

3. **Participatory decision-making** is crucial

4. Commons need to be **monitored**

Governing the Commons with Bonding Social Capital

In network measurement, bonding social capital is conceptually related to **network density** (triangles) and **structural cohesion**

Highly dense networks have clear boundaries, facilitate trust, and make monitoring and sanctioning of violators easy

Others have proposed structural cohesion as another conception of bonding social capital

Connectivity of the network as social capital

A cohesive network:

- Is robust to removal of ties

  → component size does not change significantly

- Is effective in transmitting information while minimizing attrition, distortion of information from node A to node B

  → multiple paths through which information can flow, such that attrition in one path does not affect transmission

  “A group is structurally cohesive to the extent that multiple independent relational paths among all pairs of members hold it together.”

Connectivity of the network as social capital

k-Components

- Maximally connected component where every node is connected to every other node through k or more paths
- A set of nodes that breaks into subcomponents with the removal of at least k nodes

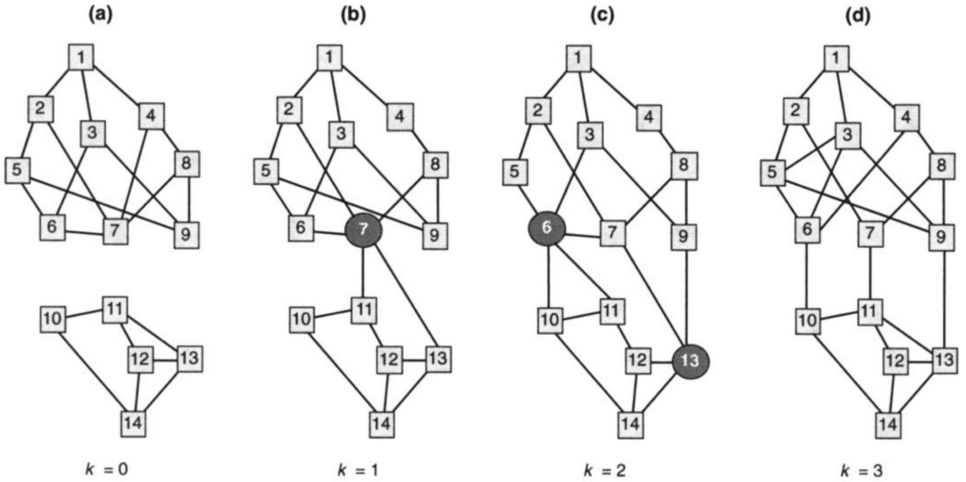


Figure 1. Examples of Connectivity Levels

Connectivity of the network as social capital

k+1-Components are nested in k-components

Example: bicomponent is a subset of nodes in a component

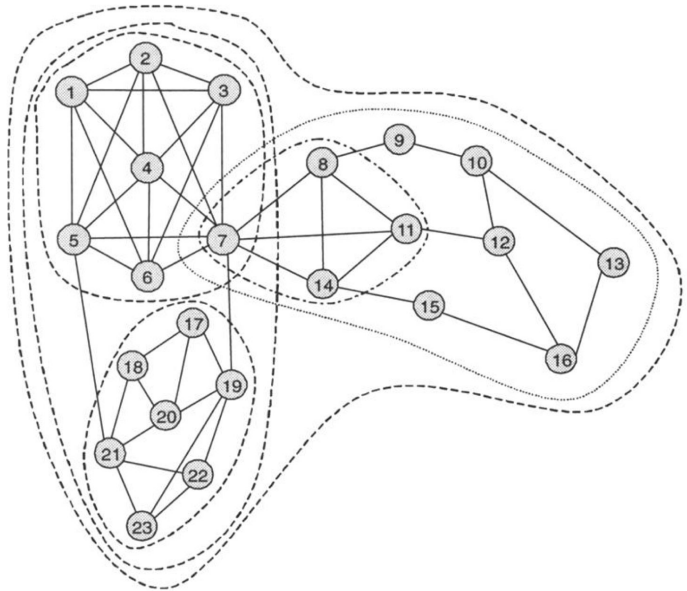


Figure 2. Nested Connectivity Sets

Connectivity of the network as social capital

If the size of the k+1 component sharply diminishes relative to the k-component, this indicates low structural cohesion at the level of k

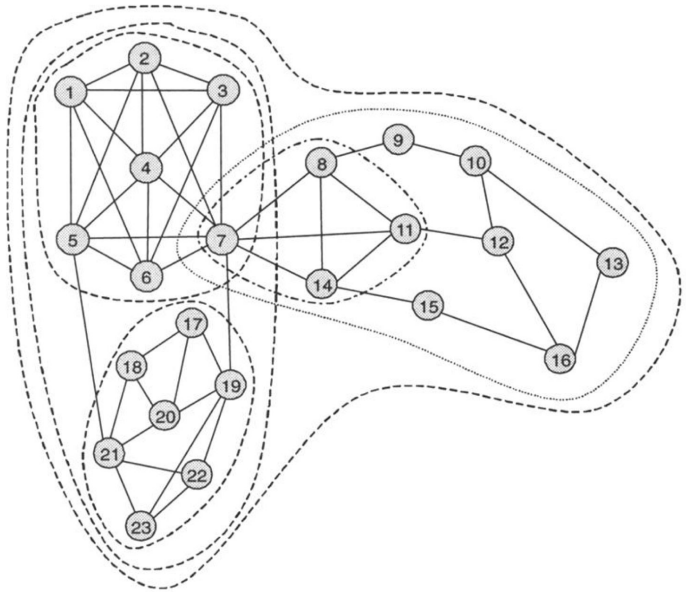


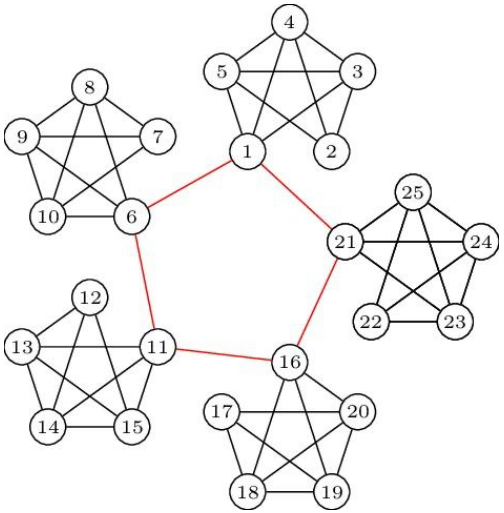
Figure 2. Nested Connectivity Sets

Example: Coauthorship network in sociology

Sociology is an extremely diffuse discipline

Some speculated that the structure of sociology consists of isolated components: Subfields do not talk to each other much

→ Sociology is a connected caveman graph



Example: Coauthorship network in sociology

Sociology is neither scale-free nor caveman-like

Structural cohesion characterizes coauthorship network

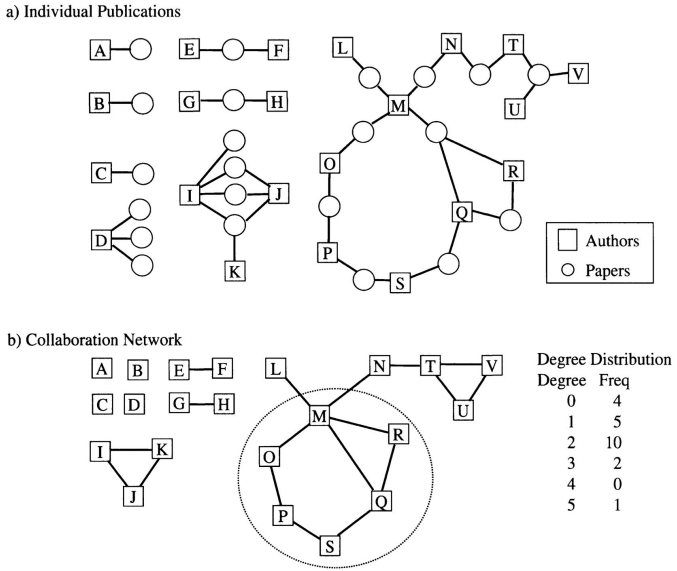
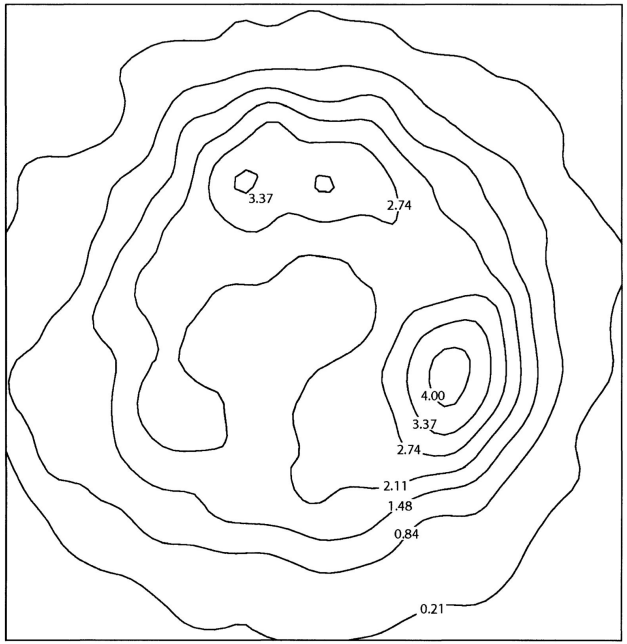
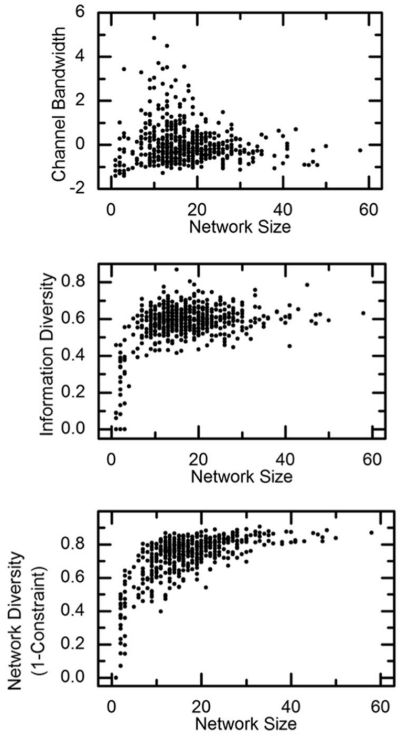


Figure 2. Constructing Collaboration Networks



Revisiting the Diversity Bandwidth Tradeoff

Bonding and Bridging Social Capital



Aral and van Alstyne 2011

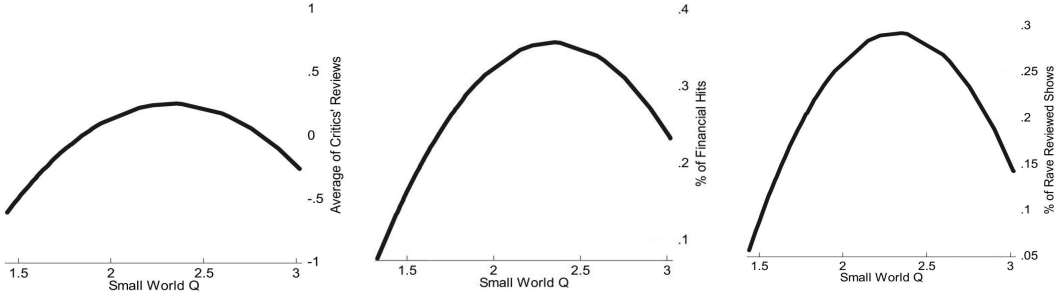
Bonding → bandwidth, strong ties, density, structural cohesion, social support

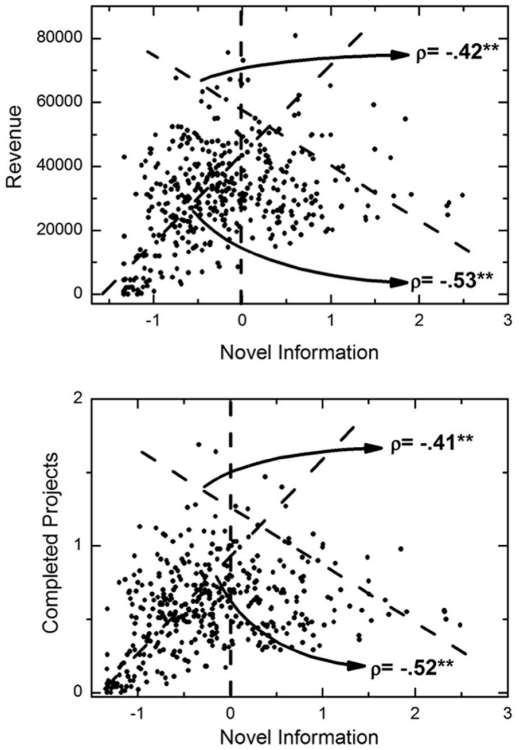
Bridging → diversity, weak ties, bridging ties, information advantage

These two types are complementary

Imbalance is usually suboptimal

Finding the Optimal Balance





Broadway musical study

Low small-world Q: Low clustering, high diversity

High small-world Q: High clustering, low network diversity

Aral and van Alstyne 2011

Summary

Bonding social capital inheres in the community

Alternative conceptions of bonding social capital → Structural cohesion (k-components)