Distributed Knowledge

Transactive Memory Systems

Division of Labor based on specialization

- When working together, people readily create division of labor based on specialization
  - Automatic and unconscious, strongly evident in families, couples, close friends
  - Applies to knowledge as well as tasks
- Advantages are
  - Eased cognitive load due to division of labor – share burdens
  - Opportunity to build deep understanding – quality of knowledge
- Known as transactive memory
  - Wegner, Moreland, Hollingshead, Argote, etc.

Transactive Memory in Couples

- Partners develop ideas about each other's domains of expertise
- When exposed to information in the other person's area, they tend not to attend to it
  - Experiment: make each member of couple memorize list of items. Turns out they have harder time learning items that they know is in the partner's area.

TM: sample study

Transactive memory in close relationships.

Wegner DM, Erber R, Raymond P
Department of Psychology, University of Virginia, Charlottesville 22903-2477.
Journal of Personality and Social Psycholology, 1991 Dec;61(6):923-9

Results

- Memory performance of 118 individuals who had been in close dating relationships for at least 3 months was studied.
- For a memory task ostensibly to be performed by pairs, some Ss were paired with their partners and some were paired with an opposite-sex partner from another couple. For some pairs a memory structure was assigned (e.g., 1 partner should remember food items, another should remember history items, etc.), whereas for others no structure was mentioned. Pairs studied together without communication, and recall was tested in individuals.
- Memory performance of the natural pairs was better than that of impromptu pairs without assigned structure, whereas the performance of natural pairs was inferior to that of impromptu pairs when structure was assigned.

Transactive Memory Research

- Hollingshead (1998) variation
  - Let some pairs communicate as they learned
  - Strangers did better when they could communicate while learning than those who could not
    - Had an opportunity to learn each other's strengths and unconsciously divide up tasks
  - Dating couples did worse when they could communicate
- Liang, Moreland & Argote (1995) showed work groups performed better when their members were trained together than when trained individually
  - Due to shared knowledge of the skills of each member
- Moreland & Myaskovsky (2000) showed that written info about other's skills (in lieu of communication) improved performance of groups.

Transactive Knowledge Systems

- Knowledge distributed across organization
- What are the requirements of a distributed knowledge system?
  - In computer information systems you need
    - Possibly, a label for the information (what looking for?)
    - Address of the information (which computer)
    - Access to that address (permissions; ethernet connection)

Human transactional knowledge systems

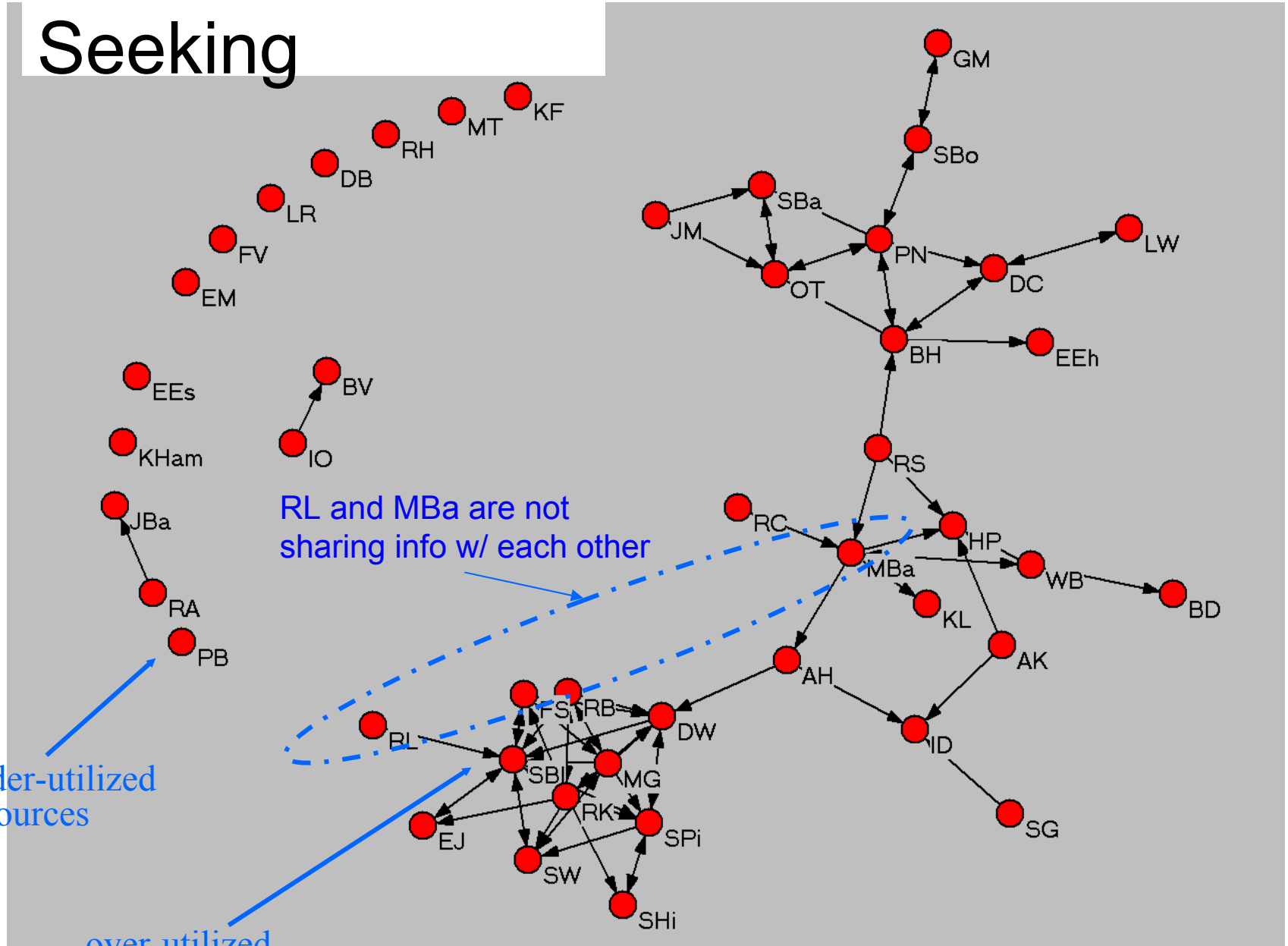
For this to work, seekers must …

- Know what they are looking for
  - Or get help reformulating the question
- Know who knows what (and how much)
  - Importance of interaction & reputation
  - Accuracy & consensus are both critical elements
- Have access to that person
  - Knowing the right way to approach them
  - Overcome physical barriers of time/space
  - Overcome org barriers (e.g., rank, unit)
  - Have something to trade with them
  - Quality of existing relationship
- Be able to communicate
  - Overcome cultural differences
  - Share sufficient background knowledge
- Have security
  - Able to admit ignorance without loss of reputation

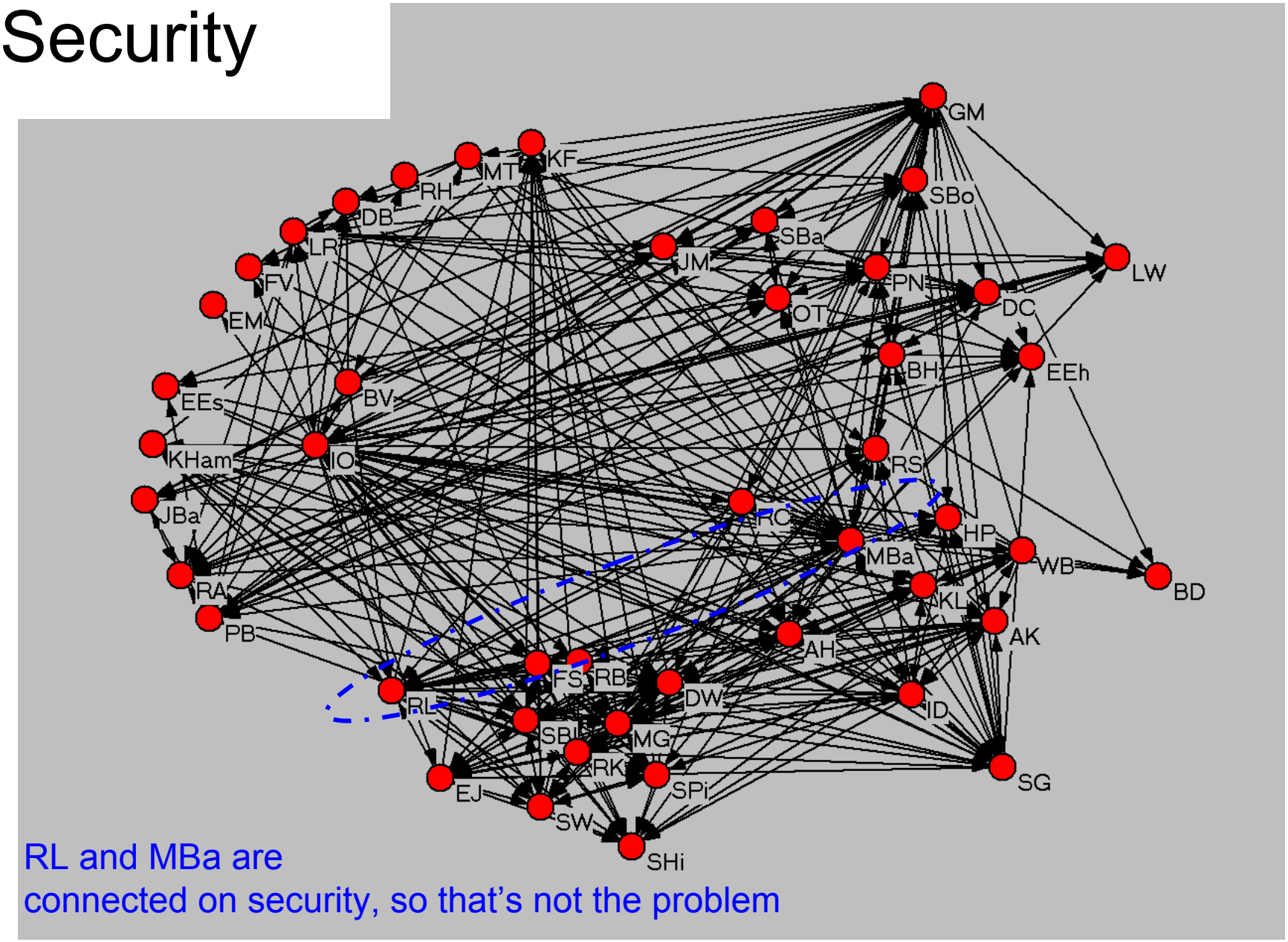
Implications for management

- Through network analysis, we can map who is seeking information from whom
- Easily discover over- and under-utilized resources
- Identify pairs of people who are not seeking information from each other (but should be)
- Then look at other social relations between them
  - Does A know what B's area of expertise is?
  - Does A have good impression of B's knowledge?
  - Does A have access to B?
  - Does A feel the costs of approaching B are too high?
- Depending on the answers, we can design specific interventions

Information Seeking

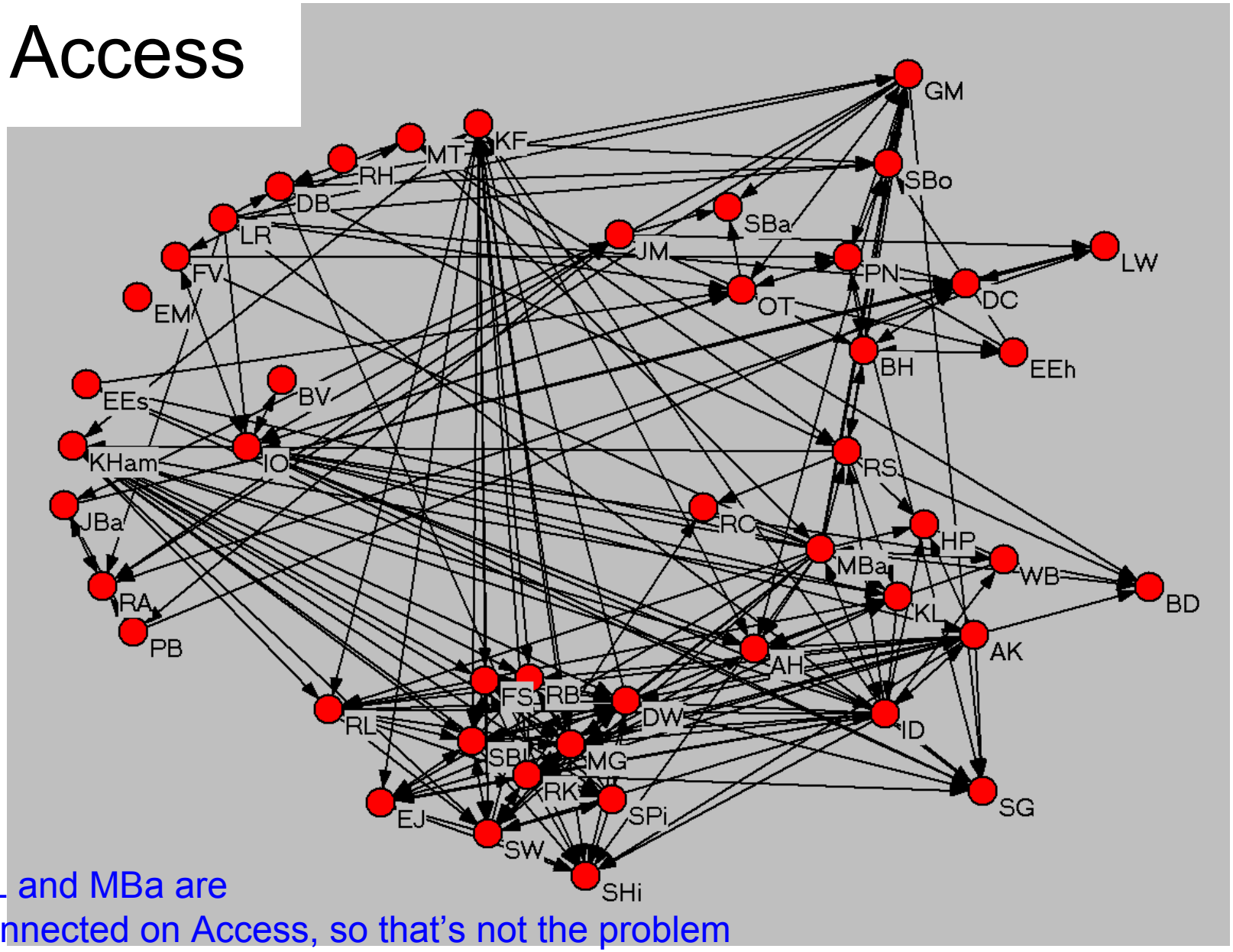


Security



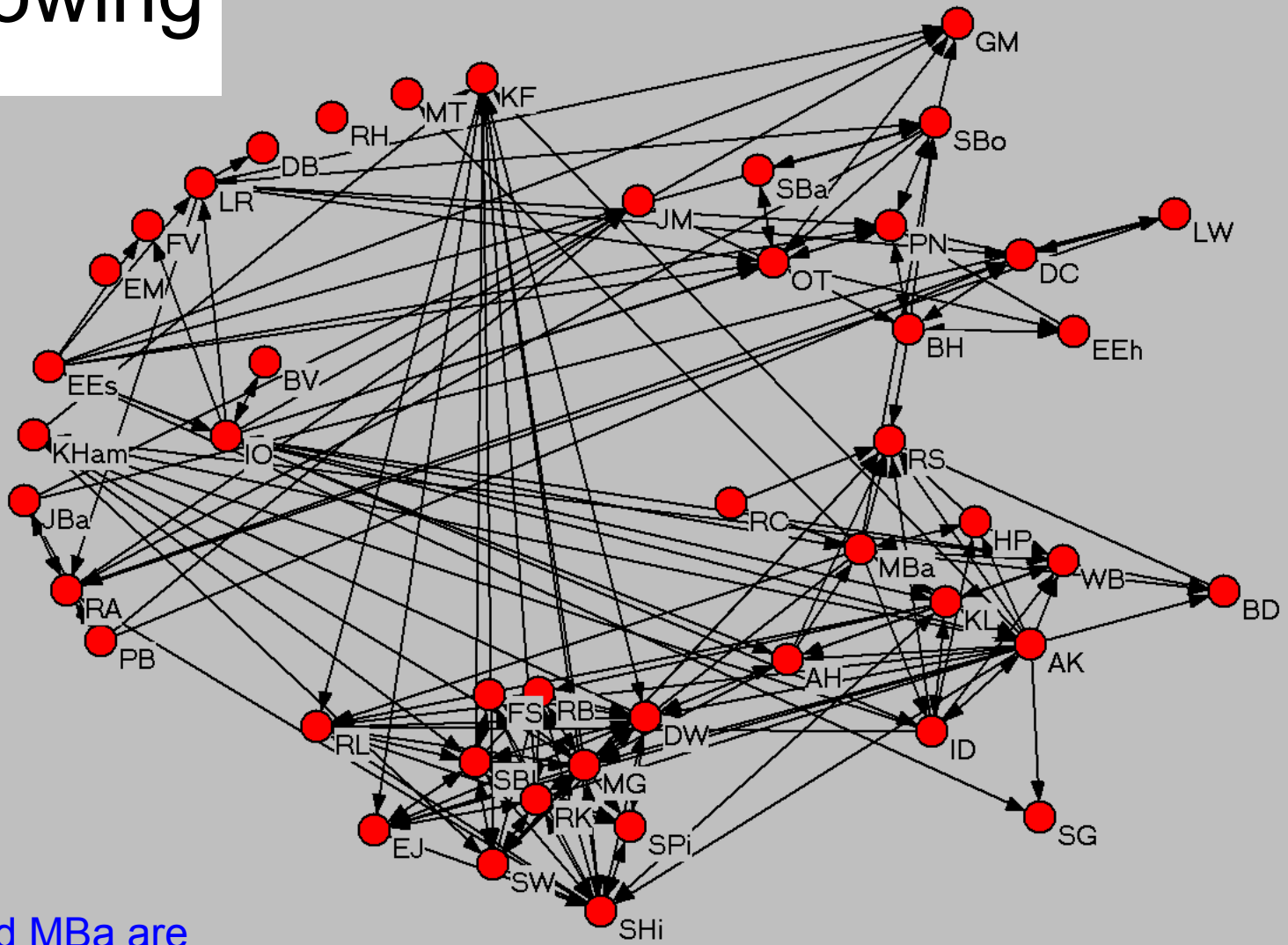
RL and MBa are
connected on security, so that's not the problem

Access



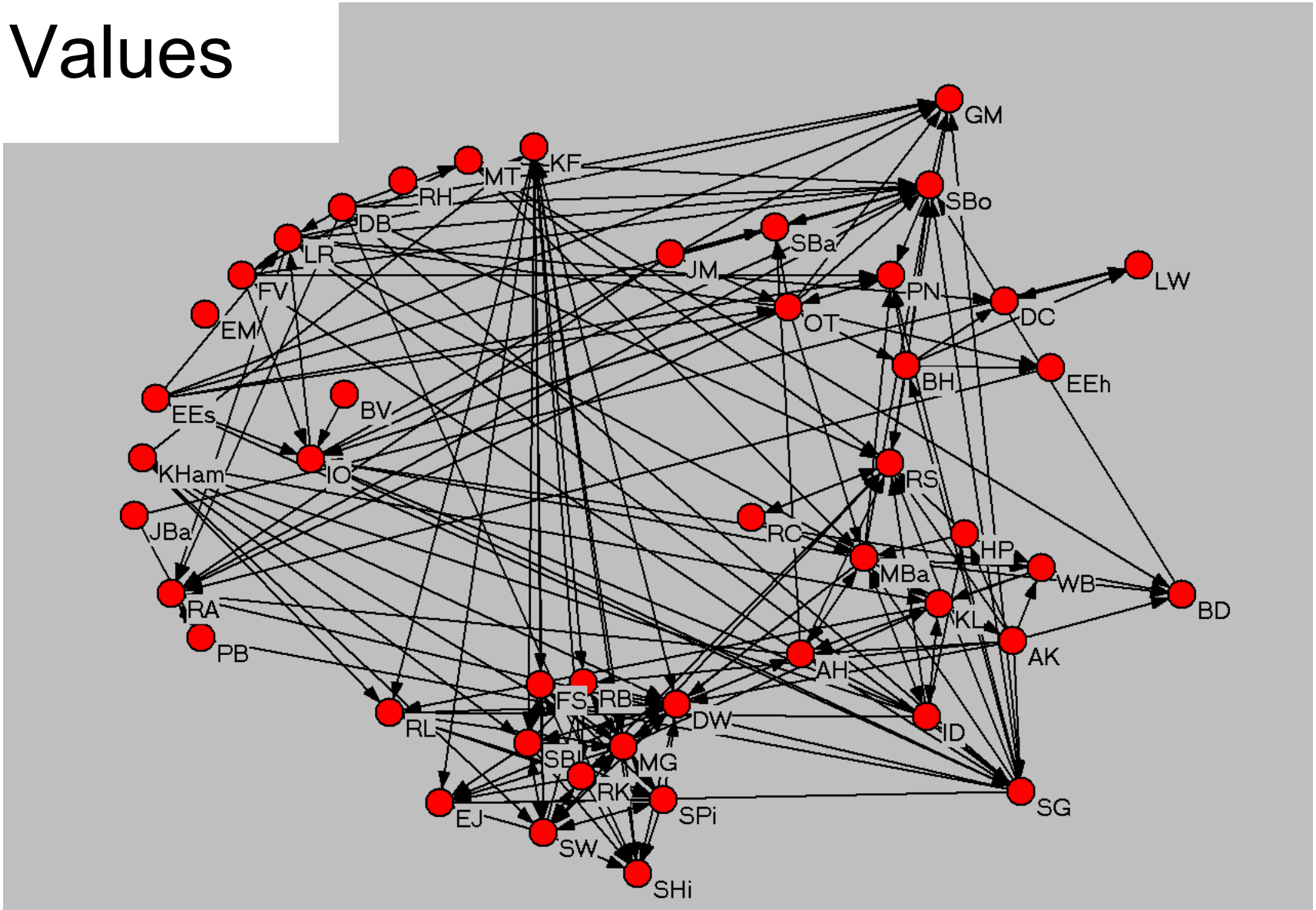
RL and MBa are
connected on Access, so that's not the problem

Knowing



RL and MBa are
connected on Knowing, so that's not the problem

Values



The problem: RL and MBa are NOT connected on Values relation (they don't have positive impression of each others' level of knowledge).

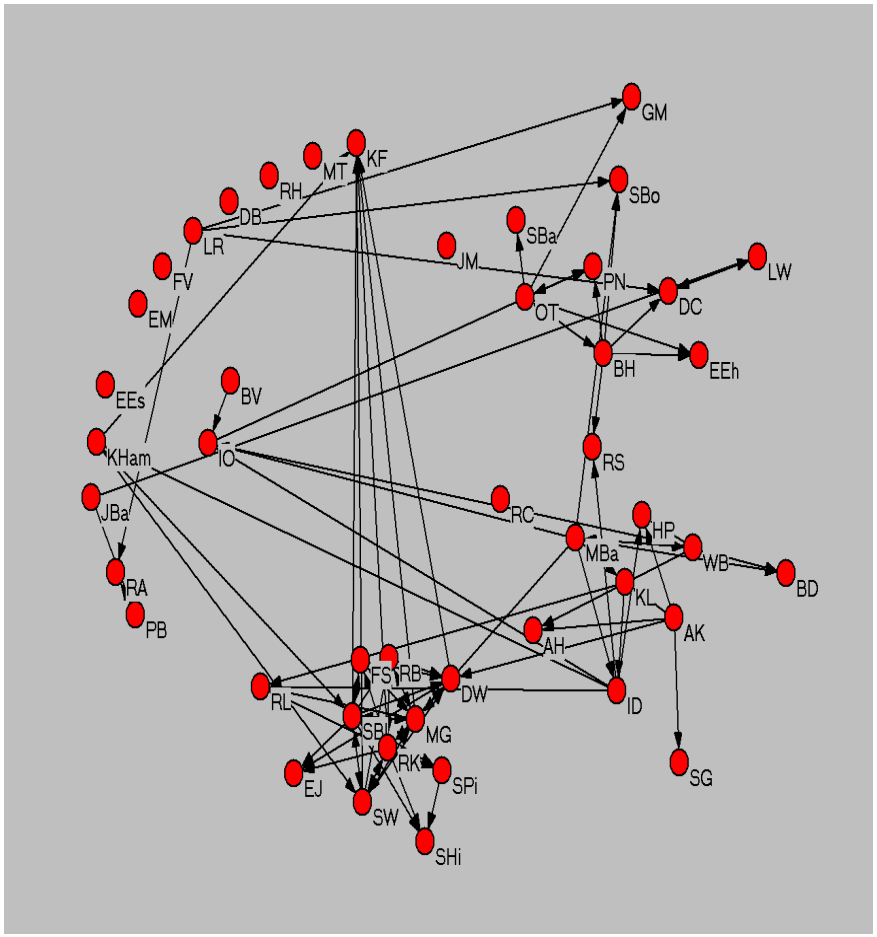
Tailored Interventions
when the problem is …

- Knowing (people don't know much about each other)
  - knowledge fairs, intermediation or skill profiling systems
- Valuing (people have poor reputations or low levels of knowledge)
  - skill training programs, job restructuring
- Access (people cannot easily interact)
  - co-location, peer feedback, recognition/bonuses or technologies.
- Security (not safe to admit ignorance)
  - peer feedback, face to face contact, cultural interventions.

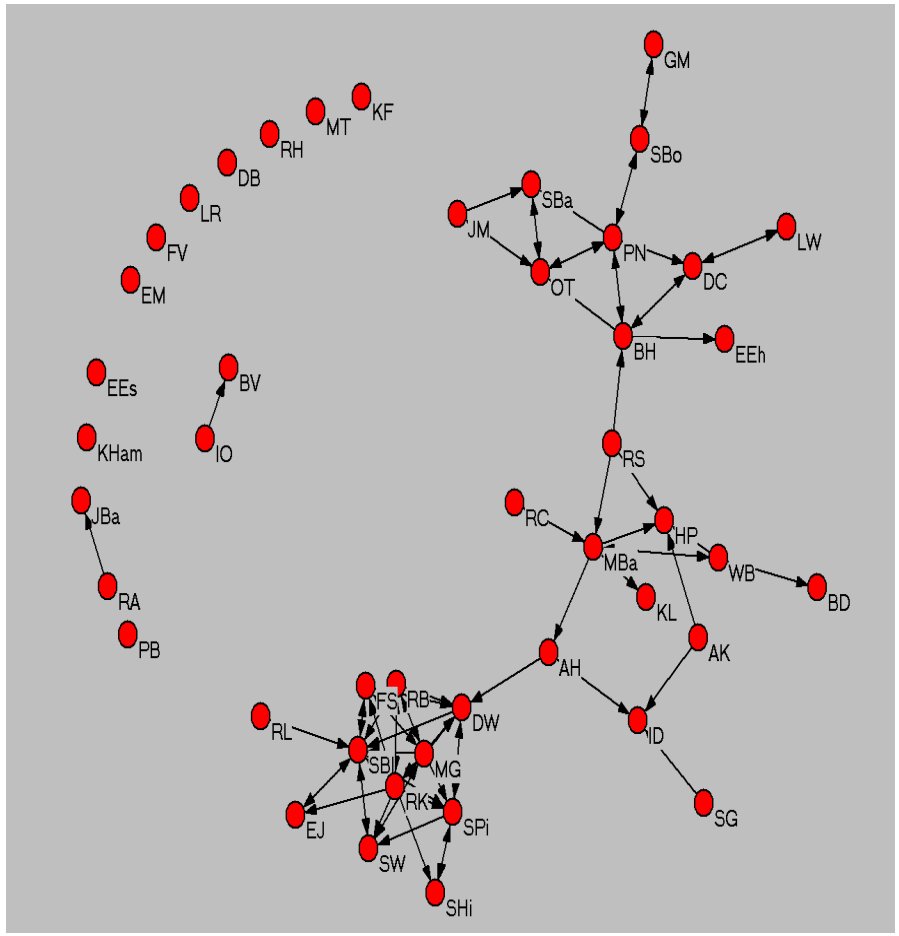
Predicting the future

- If we know what the factors are that need to be in place before A will seek advice from B (e.g., knowing what B's area is, having access, etc.), then
  - We can make a map that puts a line between any pair of persons who have all the right conditions for seeking advice from each other
    - In short, a map of potential advice seeking
  - In effect, predict the eventual pattern of information flow

Potential vs Actual information seeking



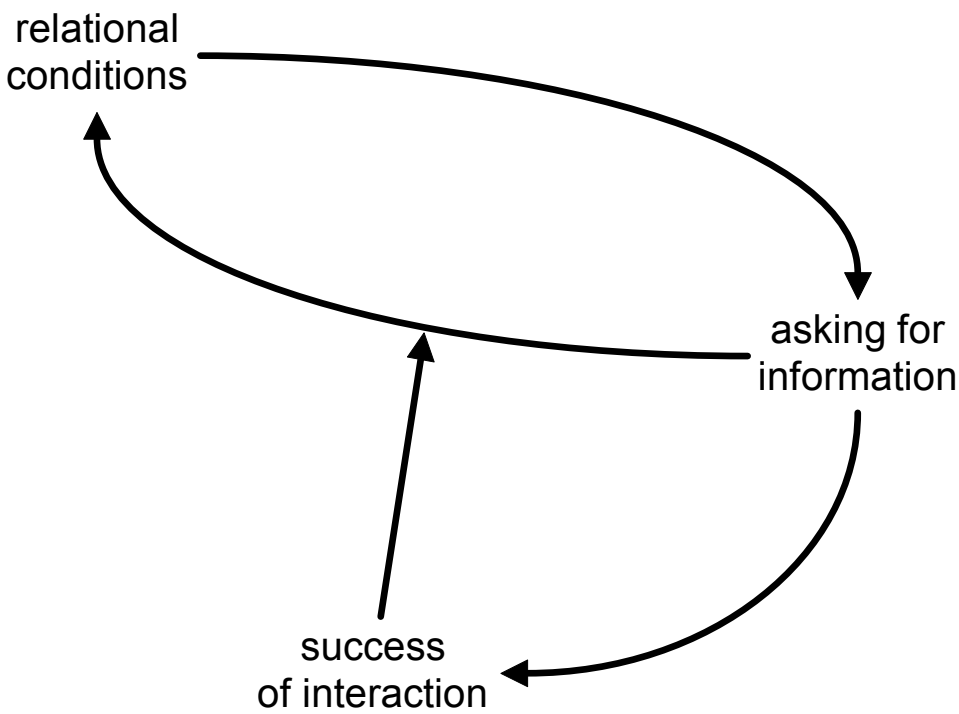
Potential information seeking



Present information seeking

Path Dependence

- Feedback cycle can lock people into seeking information from a small circle of others



The Information Market

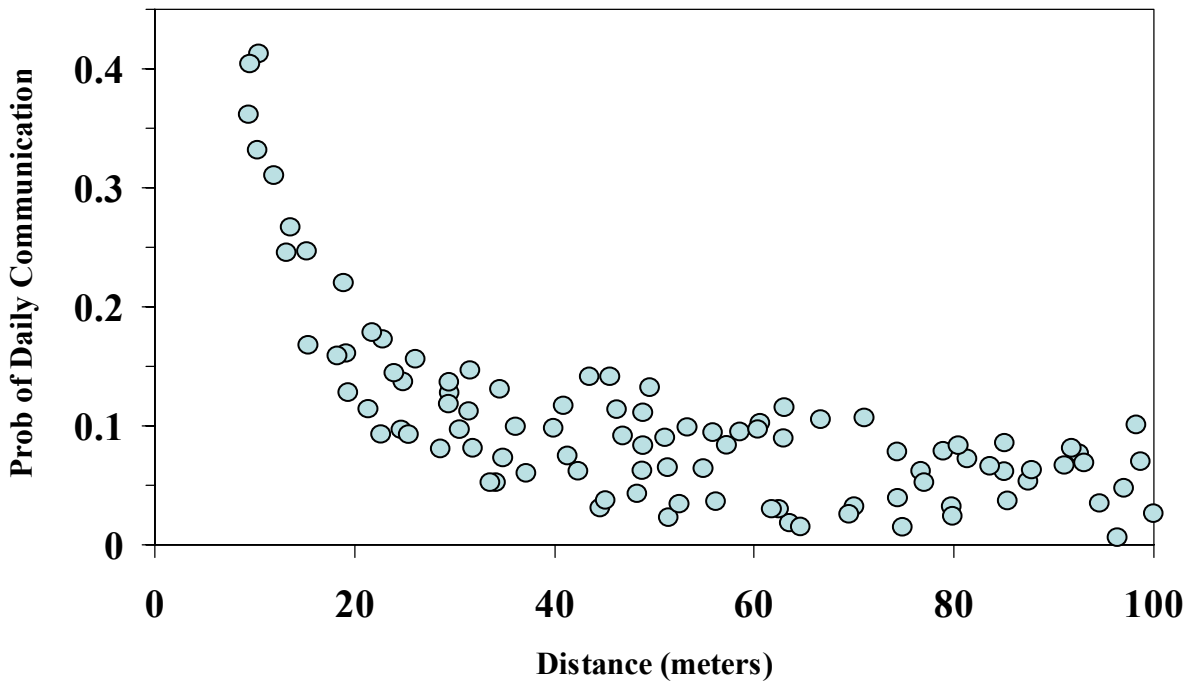
- Knowledge seekers must come together with knowledge holders
  - This is what markets do
- Markets are built on exchange
  - Seeker must have something to offer
- Could be as simple as enhancing the holder's reputation
  - And higher status helpees help the helpers reputation the most
- Reputation is a mechanism for both matching buyers and sellers, and a currency of exchange

Absorptive Capacity

- Ability to absorb new information is a function of existing base of information (Cohen & Levinthal, 1990)
  - Schemas in place to make sense of new information
  - Recognizing potential of new developments in the field
  - Works best when new info is closely related to existing info
- Knowledge accumulation is path dependent
  - Starting down one road makes it easy to acquire certain things, but harder to acquire others
  - Increase in efficiency matched by increase in rigidity, long term
- Also function of links to the outside
  - Alliances with other organizations
  - Academic community
- And function of links inside to disseminate and digest the information

Ties across boundaries

- Homophily strongly structures human interaction
  - Temporal/spatial propinquity
  - Social categories such as age, sex, education, race, religion
  - Organizational categories such as department, unit, division, etc.



Gender

Who do you discuss important matters with?

	Male	Female
Male	1245	748
Female	970	1515

Race

Who do you discuss important matters with?

Race	White	Black	Hispanic	Other
White	3806	29	30	20
Black	40	283	4	3
Hispanic	66	6	120	1
Other	21	5	3	34

Religion

Who do you discuss important matters with?

Religion	Protestant	Catholic	Jewish	None	Other
Protestant	2129	305	22	83	30
Catholic	241	790	24	41	13
Jewish	13	7	68	5	1
None	92	66	12	131	14
Other	27	11	1	4	37

Age

Who do you discuss important matters with?

Age	< 30	30 - 39	40 - 49	50 - 59	60 +
< 30	567	186	183	155	56
30 - 39	191	501	171	128	106
40 - 49	88	170	246	84	70
50 - 59	84	100	121	210	108
60 +	34	127	138	212	387

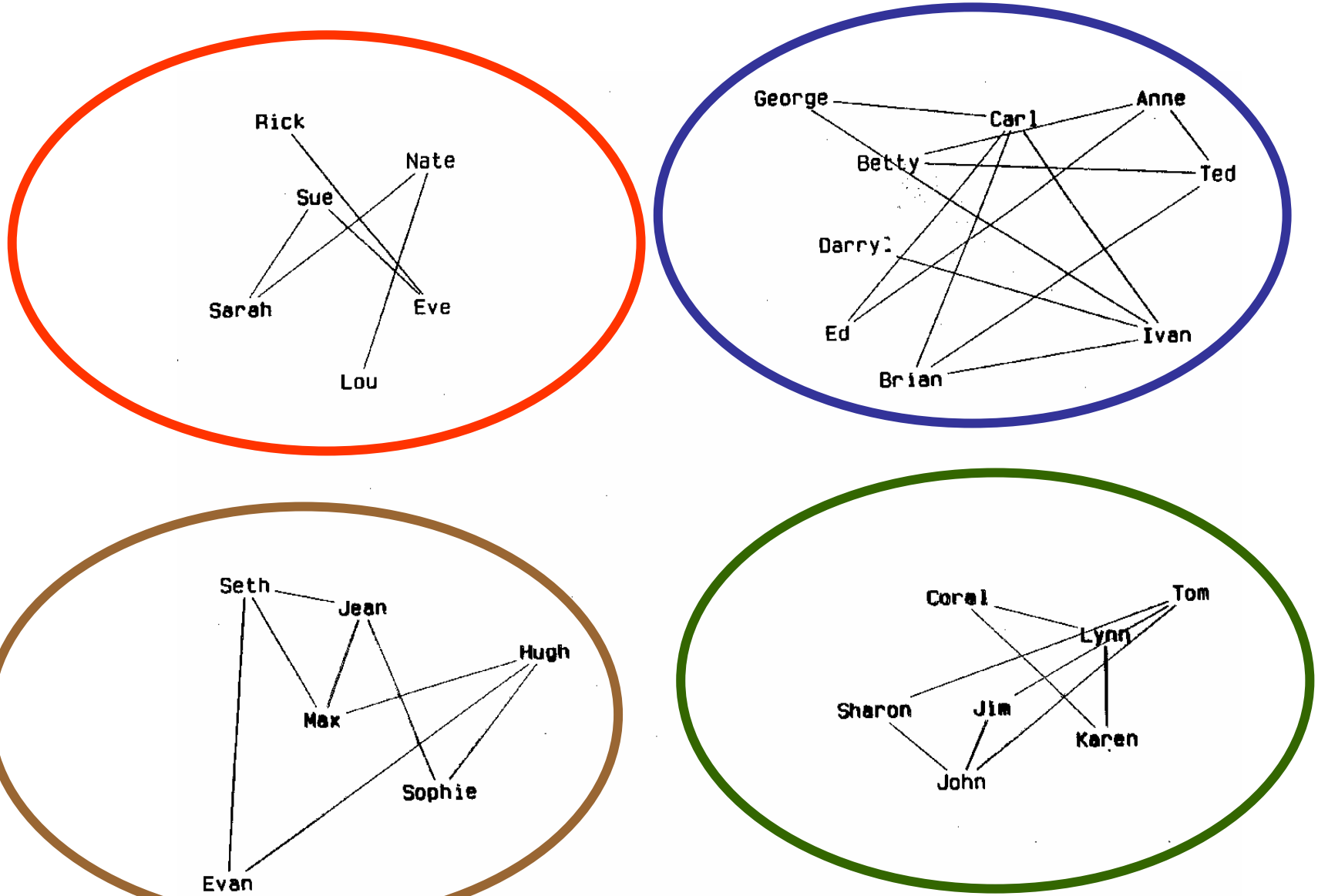
E-I Index

- We can measure the relative homophily of a group using the E-I index

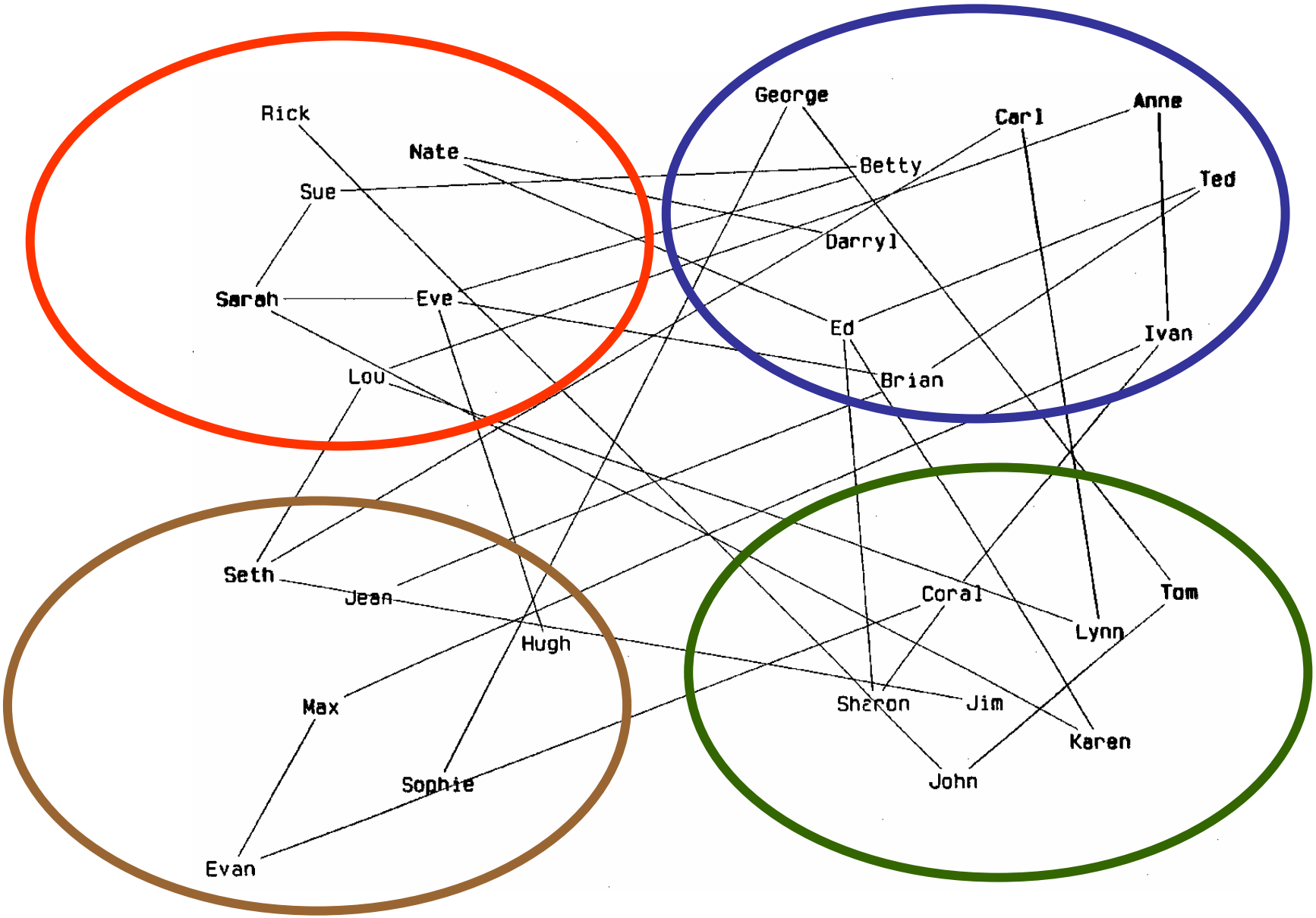
$$\frac{E - I}{E + I}$$

  - E is number of ties between groups (External)
  - I is number of ties within groups (Internal)
- Index is positive when a group is outward looking, and negative when it is inward looking
  - E-I index is often negative for close affective relations, even though most possible partners are outside a person's group

The Natural Organization



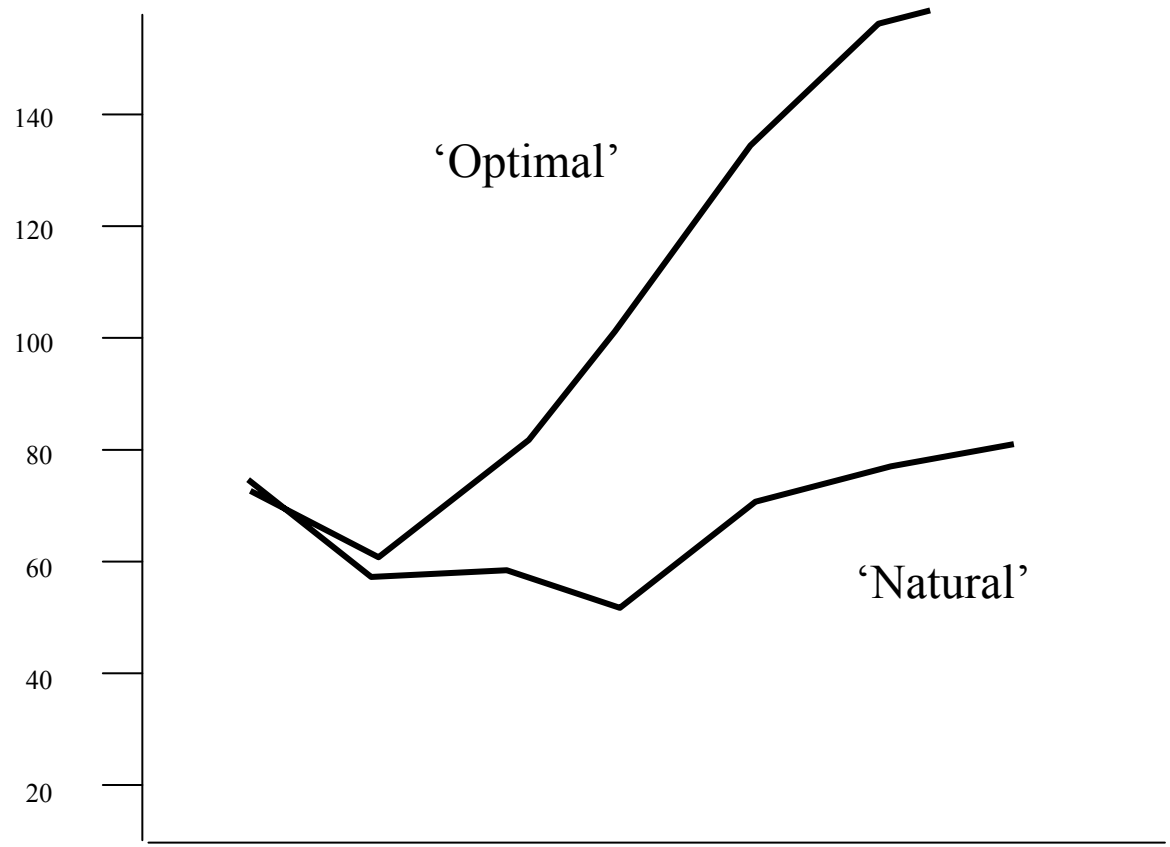
The Optimal Organization



The Experiment - Setup

- Weekend class exercise
- Class divided into two independent organizations
  - Each subdivided into 4 departments, with some interdependencies
- A measure of overall performance which included financial performance, efficiency, and some human resource metrics
- Staffing was controlled by the experimentor
  - “natural org” placed friends together within departments
  - “optimal org” separated friends as much as possible (high E-I value)
- As they went along, the experimenter introduced organizational crises, such as imposing layoffs

Experimental Results



6 trials at 3 universities. Results shown for most dramatic trial.

Why?

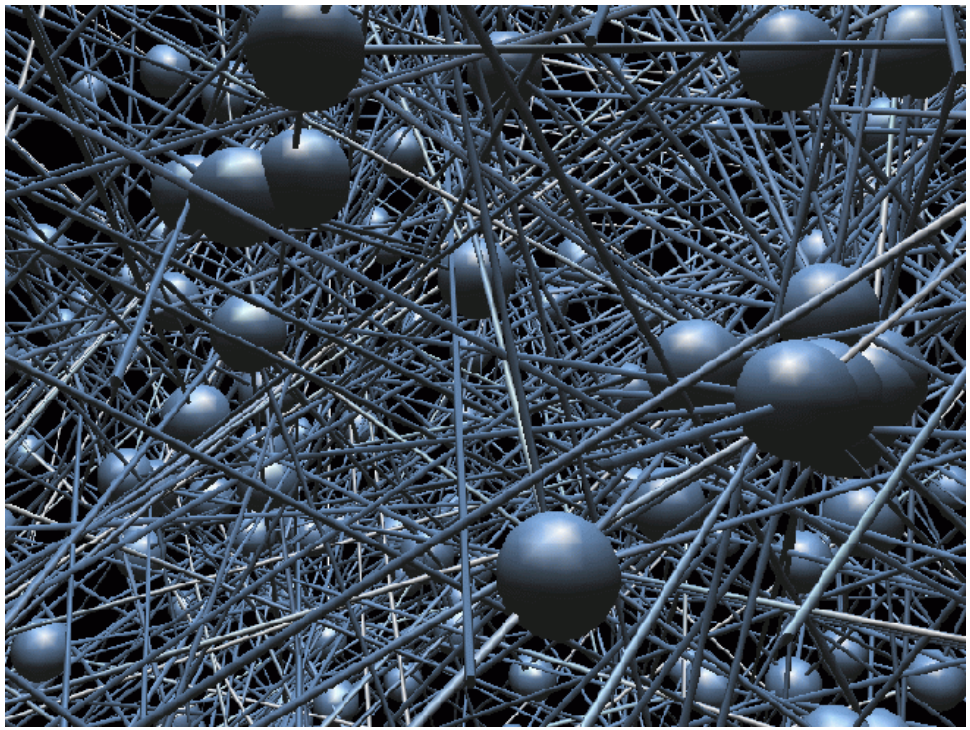
- In crisis, the organization needs to pull together* across departments
- But when you have few close ties across departments
  - The tendency is opposite – start retrenching, pointing fingers
- When you have lots a friends across departments,
  - you trust them not to screw you, and
  - you are more inquiring and willing to share needed information than blaming and hoarding

Summary

- Knowledge is key competitive asset
- Knowledge has tacit, practice-situated & social aspects
- As a result, communities of practice are effective systems for learning and doing
- Countervailing push toward specialization of knowledge – transactive knowledge systems
- Transactive systems require certain relational conditions to be in place to be effective
  - Knowing what people know, having access, shared background
- Natural homophilous tendencies creates silos that are maladaptive in times of crisis

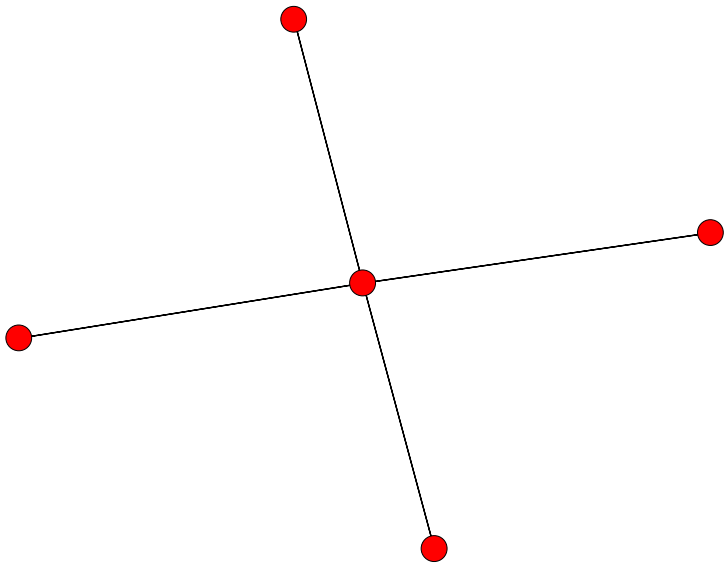
Diffusion of Innovation

- What kinds of communication structures are best for diffusing innovations such as best practices?

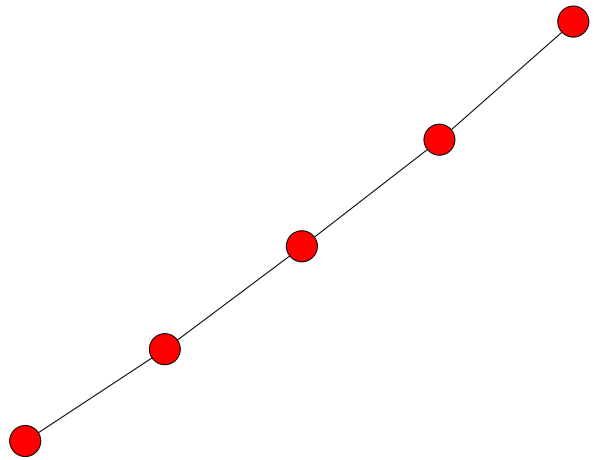


Dense ones!

Minimizing Distance (given density)



Average Distance = 1.6

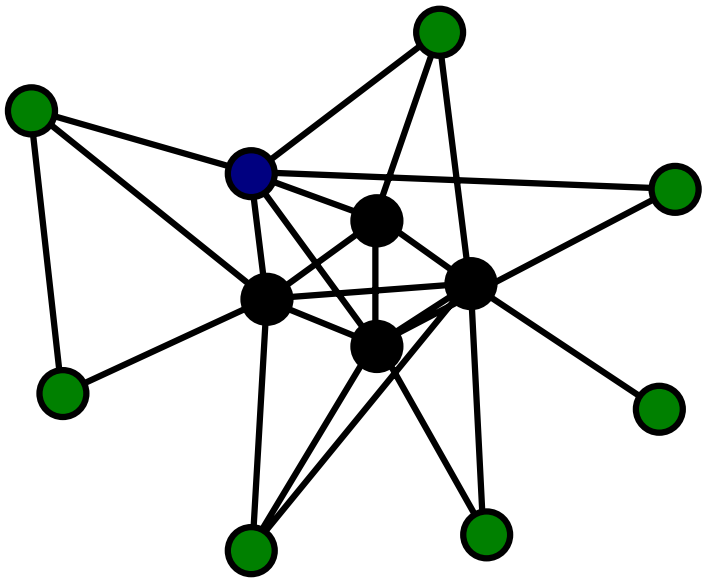


Average Distance = 2.0

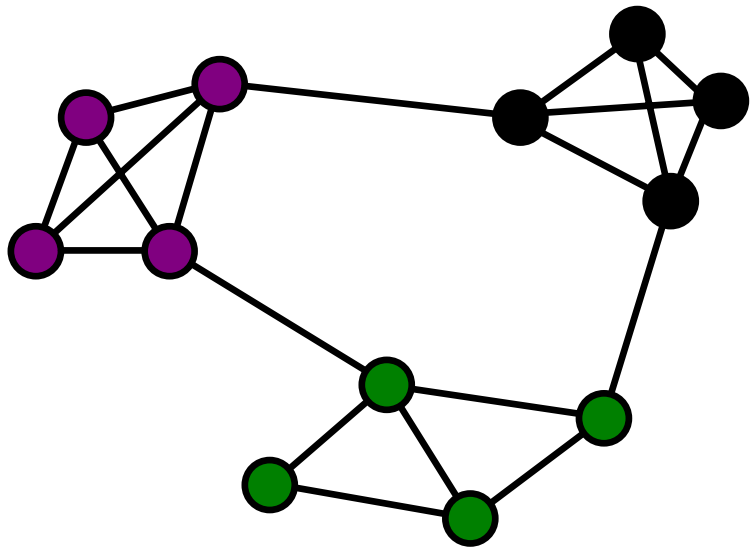
- Presence of hubs drastically reduces distances
- High variance in node centrality

Average Distance

- Average geodesic distance between all pairs of nodes



Core/Periphery
c/p fit = 0.97, avg. dist. = 1.9



Clique structure
c/p fit = 0.33, avg. dist. = 2.4