CS 6474/CS 4803
Social Computing:
Sociological Foundations II

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Last class: *human social networks have unique characteristic structures*

Structuralist Approach

A collection of human beings does not become a society because each of them has an objectively determined or subjectively impelling life-content. It becomes a society only when the vitality of these contents attains the form of reciprocal influence; only when one individual has an effect, immediate or mediate, upon another, is mere spatial aggregation or temporal succession transformed into society. (Simmel, 1908 [1971], pp. 24-25)

Georg Simmel

Georg Simmel

Born	1 March 1858 Berlin, Kingdom of Prussia
Died	26 September 1918 (aged 60) Strassburg, German Empire
Nationality	German
Alma mater	University of Berlin
Era	19th-century philosophy
Region	Western philosophy
School	Neo-Kantianism *Lebensphilosophie*[1]
Institutions	University of Berlin University of Strasbourg
Notable students	György Lukács
Main interests	Philosophy, sociology
Notable ideas	Formal sociology, social forms and contents, the tragedy of culture,[2] web of group affiliation

Structuralist Approach

- Defining Key Concepts in Network Terms

- Testing an Existing Theory

Structuralist Approach

- Looking at network causes of phenomenon of interest
  - Today

- Looking at network effects of phenomenon of interest
  - Next class

This class: *not just your distance from Paul Erdos or Kevin Bacon, but your network position also matters!*

Social structures, creativity, and innovation

Structural Holes and Good Ideas

Summary

- Role of social network structure on access to social resources

- Burt's observations:

  - Opinions and thoughts within groups are homogenous

  - People who extend themselves across the 'structural holes' between groups are exposed to diverse ways of thinking

- Brokerage across structural holes between groups can lead to greater accumulation of "social capital" – quantitatively defining the *network constraint* measure, that uses the size, density, and hierarchy measures of an individual's egonetwork

  - Hypothesis is tested with a case study of the network structure of managers in a supply chain company

Summary

- Managers asked to come up with an idea to improve the supply chain

- Then asked:
  - whom did you discuss the idea with?
  - whom do you discuss supply-chain issues with in general
  - do those contacts discuss ideas with one another?

- 673 managers (455 (68%) completed the survey)
- ~ 4000 relationships (edges)

Structural Holes
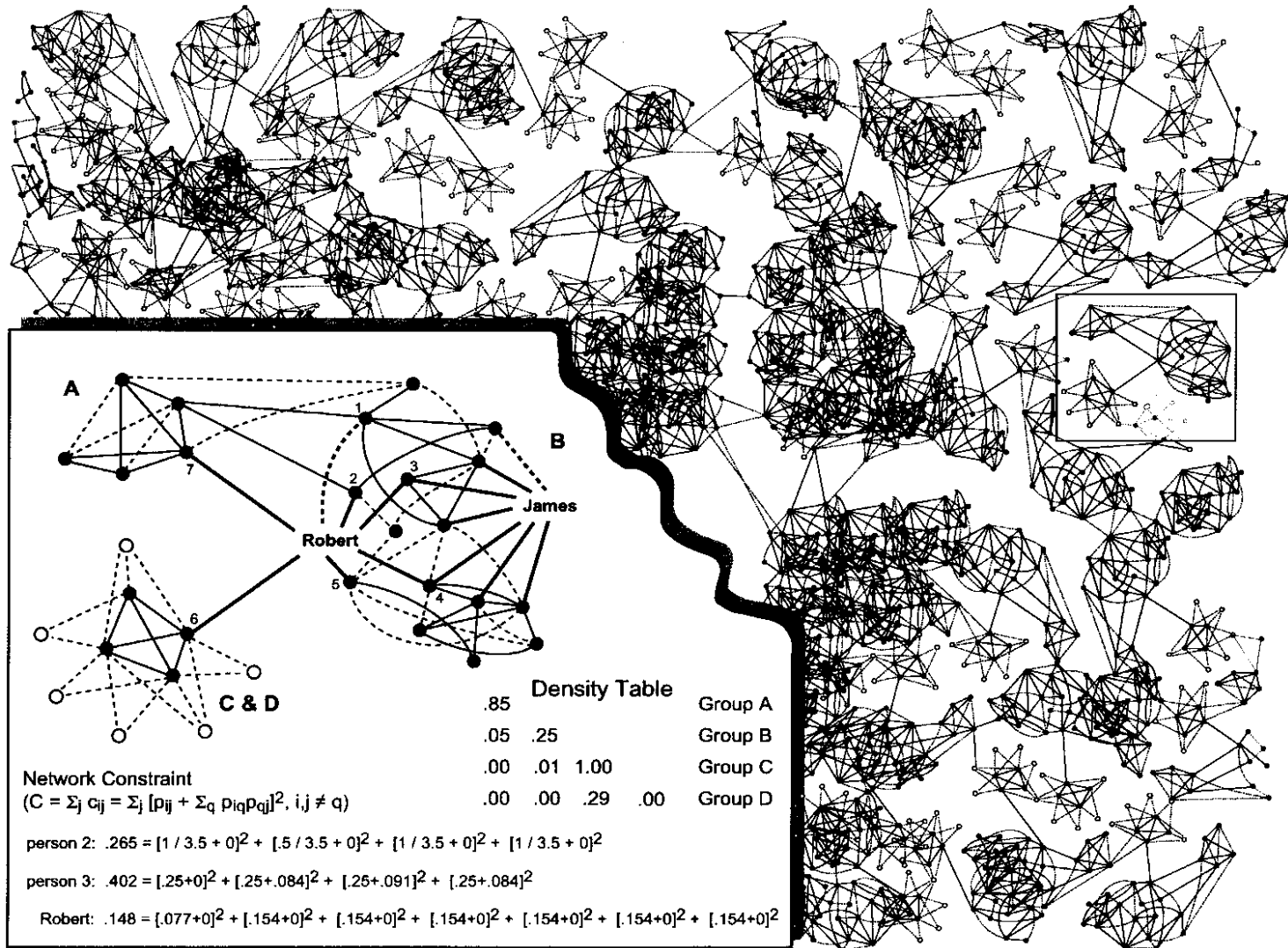
(Figure 1 from Burt 2004)
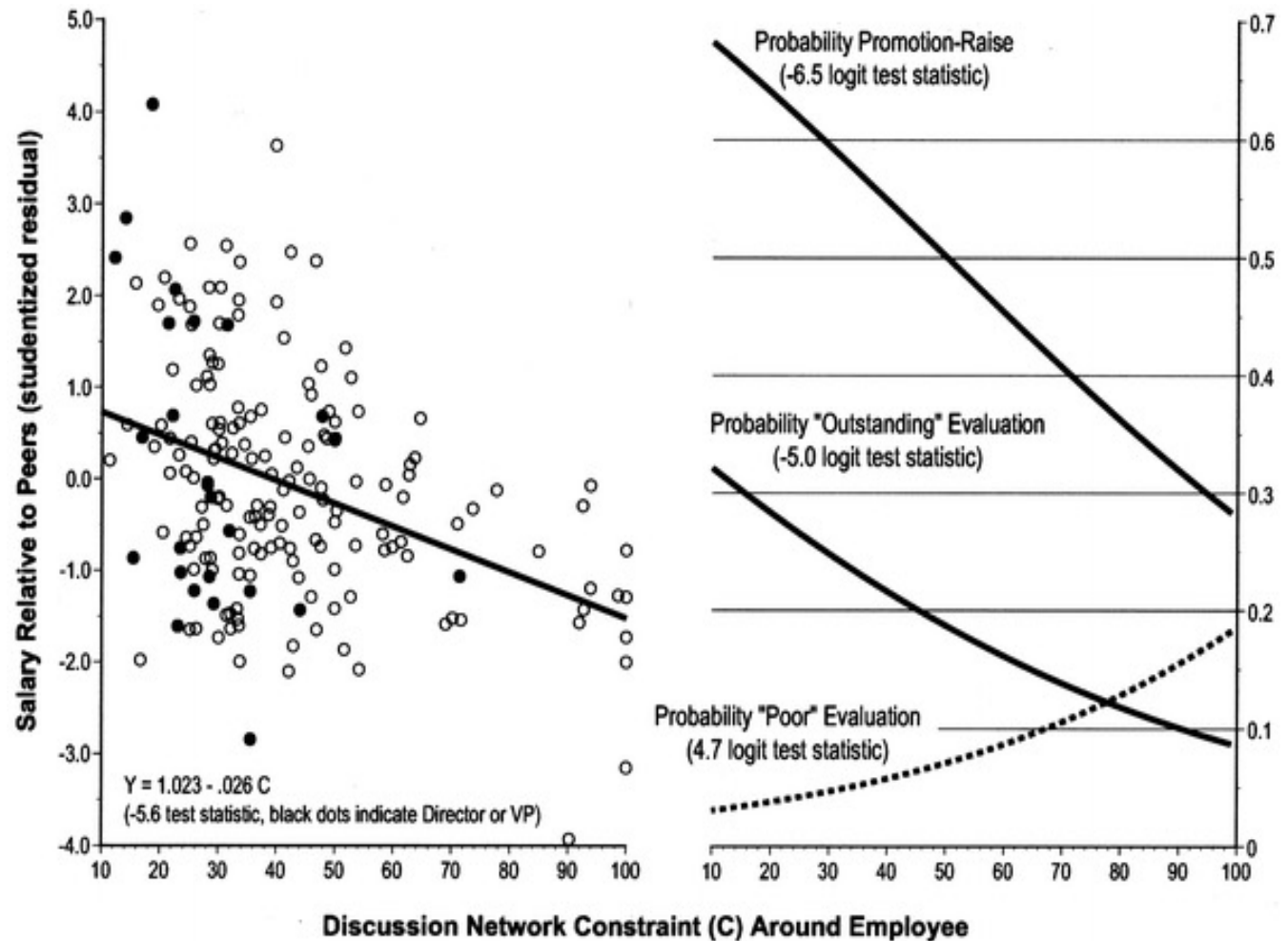
TABLE 1
PREDICTING PERFORMANCE

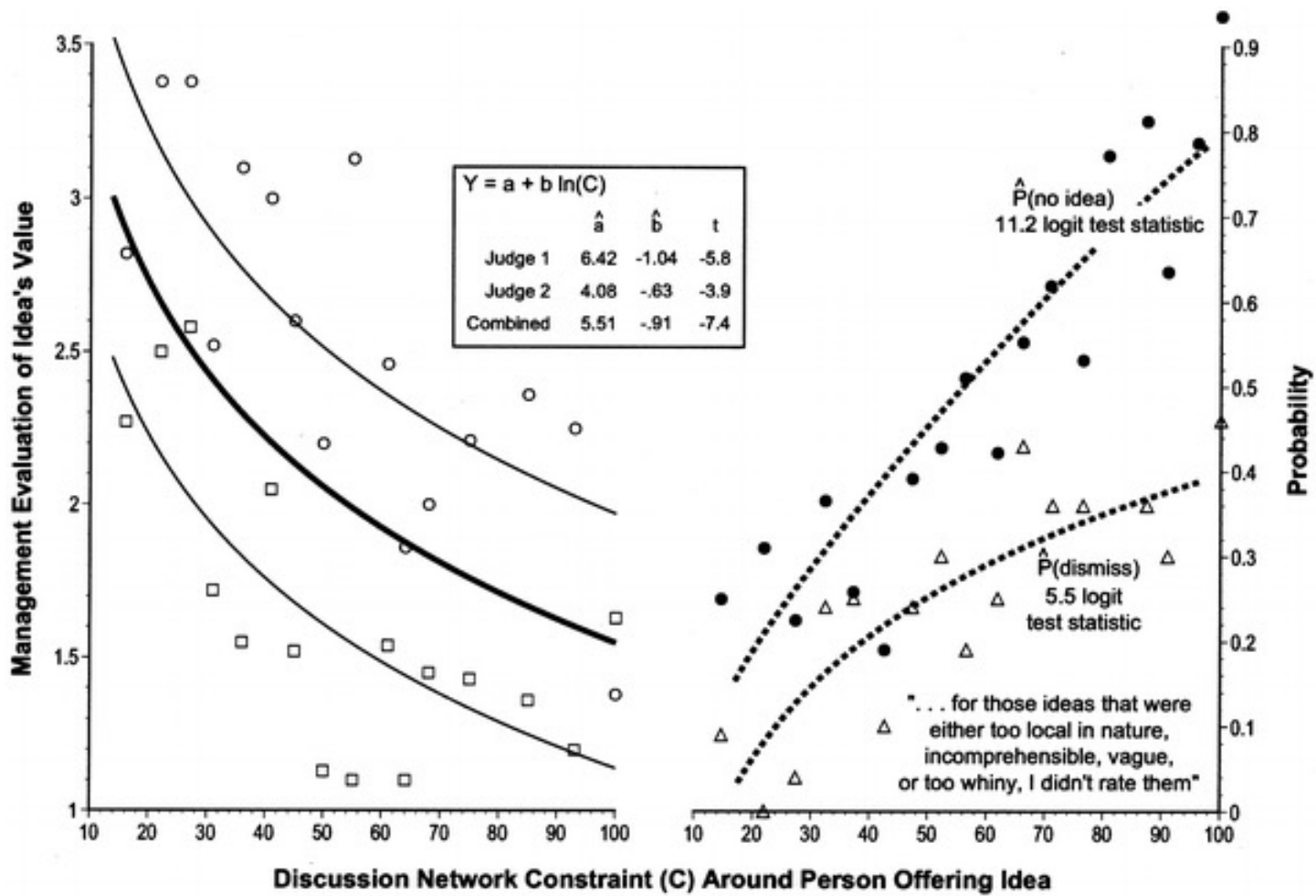|	1 Salary		2 Salary		3 Evaluation		4 Promotion	
Manager 1	−31,099**	(2,882)	−35,707**	(3,498)	−.973	(.678)	.689	(.670)
Manager 2	−16,652**	(2,745)	−19,892**	(3,479)	−.863	(.631)	1.165	(.648)
Manager 3 (reference)	. . .		. . .		. . .		. . .	
Sr. manager	19,638**	(3,782)	15,484**	(4,143)	.116	(.843)	−.635	(.885)
Executive	65,394**	(4,522)	61,930**	(4,835)	.423	(1.01)	.221	(1.08)
Purchasing	754	(1,351)	1,811	(1,884)	.410	(.313)	.478	(.345)
Age	338**	(52)	300**	(71)	−.085**	(.013)	−.084**	(.013)
Bachelor	1,610	(1,003)	200	(1,401)	−.211	(.237)	.118	(.240)
Graduate	734	(864)	−451	(1,155)	−.208	(.203)	.182	(.204)
Hightech	3,516**	(880)	3,150*	(1,189)	.087	(.209)	.162	(.210)
Lowtech	−6,927**	(1,481)	−6,607*	(2,375)	−.351	(.342)	−.409	(.378)
Urban 1	3,613**	(1,046)	3,947**	(1,456)	.423	(.247)	−.152	(.252)
Urban 2	5,049**	(1,010)	5,585*	(1,427)	−.564	(.238)	−.052	(.243)
Network constraint	−7	(25)	−1	(38)	−.014**	(.004)	−.022**	(.006)
Mgr2 × constraint	−19	(35)	−47	(58)	.004	(.008)	−.008	(.009)
Mgr3 × constraint	−47	(38)	−159*	(59)	−.007	(.009)	.003	(.009)
SrMgr × constraint	−214*	(75)	−216*	(84)	−.005	(.017)	.010	(.019)
Executive × constraint	−681**	(124)	−697**	(132)	−.011	(.028)	.024	(.030)
N	673		398		673		638	

NOTE.—Coefficients in models 1 and 2 are change in salary dollars with a unit increase in row variable (respectively .80 and .83 squared multiple correlations; network effect plotted in fig. 4). Coefficients in model 3 predict three levels of evaluation for an ordinal logit model (114.8 χ^2 with 17 df; network effects are plotted in fig. 4 holding age constant). Coefficients in model 4 are for a logit model predicting whether the employee was promoted in the year after the network survey or received an above average raise (100.5 χ^2 with 17 df; network effect is plotted in fig. 4 holding age constant). SEs are given in parentheses.

* $P < .05$.

** $P < .001$.

The results show a strong effect of network constraint on salary, evaluation and promotion, independent of the job/age characteristics related to human capital explanations.

Y = a + b ln(C)

	$\hat{a}$	$\hat{b}$	t
Judge 1	6.42	-1.04	-5.8
Judge 2	4.08	-.63	-3.9
Combined	5.51	-.91	-7.4

$\hat{P}$(no idea)
11.2 logit test statistic

$\hat{P}$(dismiss)
5.5 logit
test statistic

". . . for those ideas that were
either too local in nature,
incomprehensible, vague,
or too whiny, I didn't rate them"

Management Evaluation of Idea's Value

Probability

Discussion Network Constraint (C) Around Person Offering Idea

Four levels of brokerage

Network Constraint

- Measure of the extent to which the people a respondent knows are tied to each other

- High constraint means the network is redundant and recycles information

- Low constraint = bridging between groups = good ideas

Summary

- Main finding – interconnected groups give rise to "better ideas" compared to densely intra-connected groups

- Other findings –

  - 1) organizations that collaborate with partner firms show greater financial growth;

  - 2) higher ranked, high tech, and managers in urban settings came up with better ideas;

  - 3) managers who brokered connections across structural holes were rewarded for brokerage in terms of compensation, performance evaluations, and promotions

To what extent are the findings on the importance of brokerage and structural holes affected by the case studies considered?

What are some of the variables that should have been considered/controlled for in the study?

"Almost always the men who achieve [these] fundamental inventions of a new paradigm have been either very young or very new to the field whose paradigm they change. And perhaps that point need not have been made explicit, for obviously these are the men who, being little committed by prior practice to the traditional rules of normal science, are particularly likely to see that those rules no longer define a playable game and to conceive another set that can replace them."

—Thomas S. Kuhn, *The Structure of Scientific Revolutions*

THINK TANK; Where to Get a Good Idea: Steal It Outside Your Group

By MICHAEL ERARD   MAY 22, 2004

Got a good idea? Now think for a moment where you got it. A sudden spark of inspiration? A memory? A dream?

Most likely, says Ronald S. Burt, a sociologist at the University of Chicago, it came from someone else who hadn't realized how to use it.

"The usual image of creativity is that it's some sort of genetic gift, some heroic act," Mr. Burt said. "But creativity is an import-export game. It's not a creation game."

Mr. Burt has spent most of his career studying how creative, competitive people relate to the rest of the world, and how ideas move from place to place. Often the value of a good idea, he has found, is not in its origin but in its delivery. His observation will undoubtedly resonate with overlooked novelists, garage inventors and forgotten geniuses who pride themselves on their new ideas but aren't successful in getting them noticed. "Tracing the origin of an idea is an interesting academic exercise, but it's largely irrelevant," Mr. Burt said. "The trick is, can you get an idea which is mundane and well known in one place to another place where people would get value out of it."

Mr. Burt, whose latest findings will appear in the American Journal of Sociology this fall, studied managers in the supply chain of Raytheon, the large electronics company and military contractor based in Waltham, Mass., where he worked until last year. Mr. Burt asked managers to write down their best ideas about how to improve business operations and then had two executives at the company rate their quality. It turned out that the highest-ranked ideas came from managers who had contacts outside their immediate work group. The reason, Mr. Burt said, is that their contacts span what he calls "structural holes," the gaps between discrete groups of people.

Structural holes always help? Well it depends

New Contract Revenue			Coefficients[a]		Contract Execution Revenue			Coefficients[a]
	Unstandardized Coefficients					Unstandardized Coefficients		
	B	Std. Error	Adj. R^2	Sig. F Δ	B	Std. Error	Adj. R^2	Sig. F Δ
(Base Model)			0.40				0.19	
Size Struct. Holes	13770***	4647	0.52	.006	7890*	4656	0.24	.100
Betweenness	1297*	773	0.47	.040	1696**	697	0.30	.021

a.   Dependent Variable: **Bookings02**
b.   Base Model: YRS_EXP, PARTDUM, %_CEO_SRCH, SECTOR(dummies), %_SOLO.

a.   Dependent Variable: **Billings02**
b.   N=39. *** p<.01, ** p<.05, * p<.1

Bridging diverse communities is more significant for *landing* new contracts.

Being in the thick of information flows is more significant for contract *execution*.

Source: M. van Alstyne, S. Aral. Networks, Information & Social Capital (formerly titled 'Network Structure & Information Advantage'), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=958158

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	Unstandardized Coefficients				Unstandardized Coefficients			
	B	Std. Error	Adj. R^2	Sig. F Δ	B	Std. Error	Adj. R^2	Sig. F Δ
(Base Model)			0.40				0.19	
Best structural pred.	12604.0***	4454.0	0.52	.006	1544.0**	639.0	0.30	.021
Ave. E-Mail Size	-10.7**	4.9	0.56	.042	-9.3*	4.7	0.34	.095
Colleagues' Ave. Response Time	-198947.0	168968.0	0.56	.248	-368924.0**	157789.0	0.42	.026

a. Dependent Variable: **Bookings02**
b. Base Model: YRS_EXP, PARTDUM, %_CEO_SRCH, SECTOR(dummies), %_SOLO.

a. Dependent Variable: **Billings02**
b. N=39. *** $p<.01$, ** $p<.05$, * $p<.1$

Sending *shorter* e-mail is positively related to both new contracts and contract execution.

Faster response from colleagues is positively related to contract execution revenues.

Source: M. van Alstyne, S. Aral. Networks, Information & Social Capital (formerly titled 'Network Structure & Information Advantage'), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=958158

Structural holes always help? Well it depends

	Revenue $	$ for completed searches	Completed searches	Multitasking	Duration	Duration controlling for multitasking
Size of rolodex (Q50)	-10.2 (60.3)	-22.9 (32.6)	0.000 (0.001)	0.000 (0.001)	-0.013 (0.021)	-0.013 (0.016)

* p < 0.10, ** p < 0.05, *** p < 0.01, Standard err in paren.

Instead, a larger private rolodex is associated with:

- Less information sharing
- Less DB proficiency
- Lower % of e-mail read
- Less learning from others
- Less perceived credit for ideas given to colleagues
- More dissembling on the phone

Recruiters with larger personal rolodexes generate no more or less output

Your thoughts

Brokerage led to promotions, salary hikes, and positive performance evaluations of managers. If brokerage improves "performance" in an online setting, what form of "performance" can it be? On a related note, what would it mean to replicate Burt's findings in online social networks?

Networks and innovation

- **fully connected network** converges more quickly on a solution, but if there are lots of local maxima in the solution space, it may get stuck without finding optimum.

- **linear network** (fewer edges) arrives at better solution eventually because individuals innovate longer

The Hare and the Tortoise

Linear network

Fully connected network

avg score / time

source: Lazer, David and Friedman, Allan,The Parable of the Hare and the Tortoise: Small Worlds, Diversity, and System Performance: http://ssrn.com/abstract=832627