

Barry Wellman

Ties & Bonds

BBS

Indiana has quickly become a social network hot spot. **Scott Feld** and **Jill Suitor** moved Summer 04 to Purdue Soc from LSU, and **Stan Wasserman** moved from U Illinois to Indiana U Soc & Stats. In addition, Katy Börner is doing network visualization stuff at Indiana U's School of Information. Plus, Maureen Hallinan (Notre Dame Soc), and Art Alderson, Bernice Pescosolido, Elijah Wright, and Eric Wright in Indiana have also been known to work with nets.... **Ron Rice** has moved from Rutgers to an endowed chair in the Communication Studies dept of Cal-Santa Barbara....

Ainhoa de Federico de la Rua has attained her doctorate and has been appointment to the permanent position of Maître de Conférences at the U de Lille, France.... Former INSNA head (and UCINet maven) **Martin Everett** has moved from being a mere departmental chair at Greenwich U to being The Provost at the Marylebone campus of Westminster Univ, right in the heart of London (opposite the Baker Street tube stop and near Regent's Park). There is a cute pix of Martin at http://www.wmin.ac.uk/alumni/Network%20Spring %202003.pdf, p. 7. The same newsletter also shows how travelers can get cheap rooms at the university during the summer months. No mention of special discounts for networkers....

Lynn Smith-Lovin (Duke U) elected VP of Am Soc Assoc.... **Elisa Bienenstock** has been accomplishing many deeds. Married (J.P Hyatt Oct 2002 in LA) — a scholar of skeletal muscle. Elisa herself now is a senior consultant for Booz Allen Hamilton in the Washington area. And she had twin girls May 2004.... **Keith Hampton** (Urban, MIT) is the father of Ian Hampton, May 2004....

Bonka Boneva died suddenly in a traffic accident near Pittsburgh, Sept. 04. A recent PhD out of Carnegie Mellon U's HCI Institute, Bonka was first author on a nice chapter about women online in the recent new book by Wellman and Haythornthwaite....

I've also just learned that **Colin Bell** died March 03 in England. Colin was a great community sociologist. His work, sometimes joint with Howard Newby, strongly informed my own stuff in the 1970s, especially on the need to take class and power considerations into my analysis of community networks. I read *Middle Class Families* and "Community, Communion, Class and Community Action" repeatedly. I also profited from many beers and coffees with Colin while I was on sabbatical in England, 1974-1975. There was a vibrant UK urban community then: I think of such folks as Ray Pahl, Chris Pickvance, Howard Newby, Doreen Massey, Bryan Roberts, Clyde Mitchell and Peter Saunders. Colin was a bold, maverick, magnetic speaker and writer. Therefore I was astonished – but pleased – to learn that he had become a senior University administrator, Vice- Chancellor, first at Bradford and then at Stirling. An English friend writes: "He had become a powerful voice in that world – rather more unorthodox than many of those. I believe he had an unexpected heart attack."A conference 'Whither Community Studies' was held this past March in Colin's memory. I understand that the organizer, Paul Thompson, is hoping to put out a special issue or book, based in part on these papers. Please contact him directly – I have nothing to do with this and don't even have his e-address.

Getting What They Deserve

Russ Bernard (Anthro, U Florida) has received the Franz Boas Award from the American Anthropological Assoc for exemplary service to anthropology. The award notes that during his 40 years of service, his books on research methods have become standard references.

Barry Wellman, U of Toronto Soc, received the 2004 Outstanding Achievement Award from the Communication & Info Tech section of the Am Soc Assoc. The citation said that Wellman "has pioneered, promoted, expanded, and defined a great deal of the social research on the impact of communications and information technologies on social networks and community life. The significance of his work extends across such diverse sociological subdivisions as urban sociology, organizational sociology, the sociology of science, and methodology. Outside of sociology, he has collaborated with and influenced scholars in disciplines as different as social work, transportation planning, and computer science: more than 80 collaborators in several different countries. His many students form the core of the next generation of internet scholars."

Northwestern U Bus school's **Brian Uzzi** won the *Administrative Science Quarterly's* 2003 Award for Scholarly Contribution for "Social Structure & Competition in Interfirm Networks: The Paradox of Embeddedness". It was 1 of the first to consider how economic transactions are embedded in networks. The award credits the March 1997 paper as having the most influence on theory and research in the 5 years following its publication.

Jeffrey Boase (U of Toronto Soc) won the Outstanding Student Paper Prize from the same section. His award said, "Jeffery Boase's paper explores the importance of the Internet in facilitating communication between family members, neighbors, professional associates, and friends. Boase begins by summarizing the debate between utopian and dystopian accounts of Internet use. He argues that both are inadequate and can be replaced by a more empirically-based, holistic understanding. This is an important issue and the paper does a fine job of exploring the nuances by summarizing the results of many empirical studies. In addition, the paper rises above the level of empirical description. Not the least of Boase's strengths are the theoretical refinements he offers to the theory of networked individualism. The arguments are well-organized, and the writing is polished and clear." (from the citation by Grant Blank). Jeff's paper is forthcoming in the *Handbook of Personal Relationships,* edited by Anita Vangelisti & Dan Perlman, Cambridge U Pr.

Allison Gilmore (Math, Washington U) selected 1 of 12 Rhodes scholars for 2004-05. She's at Oxford studying social science. When questioned why the discipline shift, she noted her interest in social network analysis involved both sociology and math. "When I found this field, I couldn't believe it. It was like somebody made it for me." She hopes to become a math prof working with sociologists.[source: Minneapolis *Star Tribune,* 25Nov03, via Gene Johnsen].

Erdös Number for Sale

Hungarian mathematician Paul Erdös (1913-1996) traveled the world co-authoring. Anyone who co-authored with him has an Erdös number of 1. Anyone who has co-authored with someone who has co-authored with Erdös has an Erdös number of 2, etc. (I have a 3, thanks to Ove Frank.) A mysterious eBay ad (4April04) offered to sell a still-valuable Erdös number of 5, with the seller offering to coauthor with the highest bidder.

The ad said in part: "The seller will make his time available to the winner — after payment is received — on a part-time basis not to exceed 40 total hours doled out at a rate of no more than 10 hours per week, distributed to their mutual convenience over the period beginning May 1 2004 and ending on July 31 2004. During that period, the seller will provide expert technical advice on research projects in the fields of evolutionary algorithms, machine learning, agent-based modeling of complex biological and social systems, complex systems research in general, social network theory (including business and marketing applications), engineering design automation using machine learning algorithms, artificial life, and any of a number of other specialties." http://cgi.ebay.com/ws/eBayISAPL.dll?ViewItem&item=3189039958.

On 12Sept04 eBay reports: "Bidding has ended for this item. (madd_greg is the winner)"

Who were the mysterious seller and buyer?
A web site summarizes *Science News:*

"Turns out that madd_gregg was really "Jose Burillo, a mathematician at the Polytechnic University of Barcelona in Spain with an Erdös number of 3 [who — wrote that he had placed the winning bid 'to stop the mockery this person is doing of the paper/journal system' and called the auction a 'travesty.' William Tozier 'whose Erdös number is 4 ... launched the auction as a joke, in his words, 'one morning before I'd had enough coffee.' He used the exercise as an experiment in social networking. He told four friends about the auction and asked them to spread the word, then tracked how the news carried.

"Although the first auction was a bust due to the Burillo sabotage, Tozier is considering running the auction again. He says he would like to use some of the money earned to set up a collaborative community where amateur mathematicians would have the opportunity to work with academic mathematicians and others with similar interests. Tozier said he received more than one hundred responses from non-mathematicians who were interested in his offered collaboration because they feel excluded from any opportunity to discuss their mathematical work with the academic mathematical community."

Source: Sal Towse in: http://www.towse.com/blogger/2004_04_01_archive.htm

Tozier had co-authored a comment on another paper with Mark Newman (Erdös 3). in *Physical Letters A*. Mark writes that "he is a friend of mine from years ago." Tozier is now a grad student (with another prof.) at U Michigan. Tozier's own germane website is at: http://williamtozier.com/slurry/comment/social/ erdosJune.html

As the *Science News* article points out, "An Erdös number of 5 isn't that big of a deal: More than 66,000 mathematicians can claim the honor. Yet in some parts of the world, Burillo says, Erdös numbers are taken very seriously, and mathematicians post their number prominently on their résumés." [Erica Klarreich, "Theorems for Sale, June 12, 2004; Vol. 165, 24: 376 [http://www.sciencenews.org/articles/20040612/bob8.asp]. For more info, see also the *Chronicle of Education* piece: http://chronicle.com/free/v50/i38/38a 01501.htm.

Last I heard, former co-stars of Kevin Bacon were not auctioning off acting gigs.

Organizational Haiku

Written by Lydia Bean of Harvard while studying for her comprehensive exams:

No, Barry Wellman.
My "Intimate Networks" don't
need "liberating."

There's another one linking Mark Granovetter and embeddedness, but as this is a family magazine, I will not reprint it.

Ali Marin, another Harvard grad student contributes this haiku:

Social capital
Use your friends to get ahead
But which friends to use?

The Network War

Follow the Mispuhke: US General Raymond Odierno, whose forces captured Saddam Hussein in Iraq says he realize 6 months before capture that the key lay in figuring out Hussein's clan and family support structures. Odierno had his analysts and commanders build "link diagrams" (aka sociograms) showing everyone related to Hussein by blood or tribe. He said these diagrams led his forces to lower level, but nonetheless highly trusted, relatives and clan members harboring Hussein and helping him move around the countryside. [Source: "Clan, Family Ties Called Key to Army's Capture of Hussein, Vernon Loeb, *Washington Post,* 16 Dec03].

Kathleen and the Jihad: Carnegie Mellon prof Kathleen Carley " has used intelligence data and computer modeling to monitor changes in jihadist networks, including the cell responsible for the suicide bombing of the American Embassy in Tanzania. She found that eliminating the `central actors' — that is, cell members who have the most ties to other cell members and to other groups — has actually spurred terrorists to adapt more quickly, and has been less effective in the long run than eliminating less-central foot soldiers." [*New York Times* Op-Ed piece by Scott Atran extensively and positively discussing the work of Kathleen Carley and Bob Axelrod. 16 Mar04]

"Net-Centric" Warfare supposedly means using computer, communication and social networks to fight an opponent. As usual, the earnings potential of the hardware and software outweighs the social. In the U.S., Boeing is investing $500M in this. "The capabilities are mind boggling. For many years it used to be about force. Now, it's all about networks — who can see can react first," says Jim Albaugh, head of Boeing's Integrated Systems program. Company officials estimate that the market for net-centric systems could reach $200B in 10 years, with communication nets, intelligence, surveillance & recon projects, and command and control integration to provide "global situational awareness." No one in the story says who will provide the sociopolitical brains. ["Boeing Bets on 'Net-Centric' Warfare", *News-Tribune,* via *Yahoo! News,* 7Jul04].

Short Schticks

"Mellon Will Acquire Final 70% of Pareto" said a Wall Street Journal headline this August. Does that mean that Citibank will counter by acquiring 75% of Simmel? [Note: Pareto Partners is 1 of the world's largest currency managers.]

Six Degrees of Copulation: Boston U scientist Luis Amaral reports sample survey findings that "much less than 6 partners" sexually link Swedes "because some people have a very high number of sexual partners" (see *Nature,* vol 411: 907). Nostalgia — the movie was made in 1967, *I am Curious (Yellow)* or, as the Swedes like to say when networking: Jag äär nyfiken.

Are Readers More Clannish Than Talkers? Valdis Krebs' Amazonish research into book buying networks (using Amazon's published info about people who have bought X, have also bought Y, Z,...) was discussed 13 March04 in the *New York Times.*. No less than 4 letters were printed in the March 16 *Times*, most of them missed the point and saw book networks as tightly-bounded groups. They bemoaned the alleged fact that people tended to read within tightly-bounded intellectual orbits. But in fact, although networks certainly do cluster, they often are less bounded and more heterogeneous, i.e., they are leakier than groups.

Divorce as a Feminist Networking Device: "Women, especially women married to rich men, often don't have a network of professional contacts. So they turn to me." [NY divorce lawyer Raoul Lionel Felder quoted by John Cassidy "The Misery Broker," *New Yorker,* 3May04: 76]

Social Support Among Baboons: Baboon mothers with many female friends are more successful parents at raising their young. "They are spending a lot of time and a lot of trouble in maintaining their social contacts. They spend 10% of their day grooming others and that is a big chunk of time for living in the wild. The most sociable females are about 1/3 more likely to rear their infants successfully than were the least sociable females." Silk suggests that evolution favors social networking." [From Paul Recer, Study: Social Baboon Moms are Good Moms," *Associated Press,* 13Nov03, reporting on the article in *Science* by John Silk, Susan Alber8ts, et al.]

<table>
<tr><th></th><th>2004</th><th>2005</th></tr>
<tr><td>JAN</td><td>ACM-SIAM Symposium on Discrete Algorithms
1/11-13: New Orleans, LA, USA

Meeting of the Society for the Anthropology of Lowland South America
1/17-18: Miami, Florida, USA

Annual International Advances in Qualitiative Methods Conference
1/29-31: West Edmonton Mall, Alberta, Canada</td><td>American Politics Group Annual Conference
1/6-8: Christchurch Univ. College, Canterbury, UK

Southern Political Sciences Association Conference
1/6-8: New Orleans, LA, USA

American Politics Group Annual Conference
1/6-8: Christchurch Univ. College, Canterbury, UK

ACM-SIAM Symposium on Discrete Algorithms
1/23-25: Vancouver, BC Canada</td></tr>
<tr><td>FEB</td><td>American Assn for the Advancement of Science
2/12-16: Seattle, WA, USA

Hawai'i Sociological Assn
2/14: Honolulu, Hawai'i, USA

The Society for Human Ecology XII Conference
2/18-21: Cozumel, Mexico</td><td>International Sunbelt Social Networks Conference
2/16-21: Redondo Beach, CA USA

American Political Science Association
2/19-21: Washington, DC USA</td></tr>
<tr><td>MAR</td><td>Academy of Human Resource Development International Research Conference 2004
3/4-7: Austin, Texas, USA –Texas A&M Univ.
http://www.ahrd.org/</td><td>Western Political Science Association
3/17 - 19: Oakland, CA USA

Association for Asian Studies Annual Meeting
3/31-4/3: Chicago, IL USA</td></tr>
<tr><td>APR</td><td>Advanced Simulation Workshop
4/19-23: Univ. of Koblenz-Landau

Western Social Science Association
4/21-24: Salt Lake City, Utah, USA</td><td>NCSM 37th Annual Meeting
4/4-6: Anaheim, CA USA

55th Political Studies Assn Annual Conference</td></tr>
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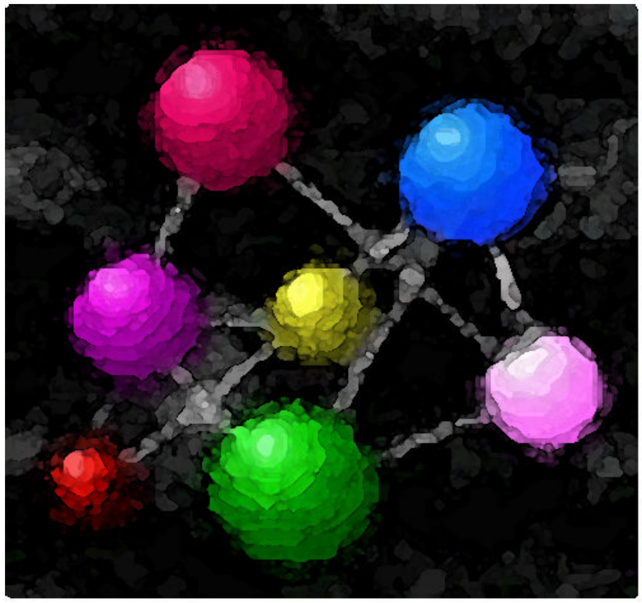
	Society for Economic Anthropology 4/22-24: Atlanta, GA, USA **Society for Cultural Anthropology** 4/29-5/1: Portland, OR, USA	4/4-7: University of Leeds, UK **Association of American Geographers** 4/5-9: Denver, CO USA **European Consortium for Political Research Joint Sessions** 4/14-19:Granada, Spain **2nd Brazilian Symposium on Graphs, Algorithms and Combinatorics** 4/27-29: Rio de Janeiro, Brazil
MAY	**International Sunbelt Social Network Conference** 5/12-26: Portoroz, Slovenia **The Fifth Conference on Human Resource Development (HRD)** 5/27-28: Limerick, Ireland –Univ. of Limerick **3rd Internatnl Workshop on Agent-based Approaches in Economic & Social Complex Systems** 5/27: Kyoto University, Kyoto, Japan **International Communication Assn.** 5/27-31: New Orleans, LA, USA	**The Eighth SIAM Conference on Optimization** 5/15-18: Stockholm, Sweden< **Graph Theory with Altitude** 5/17-20: Denver, CO USA **International Communication Association** 5/26-30: New York, NY USA
JUNE	**International Conference on Computational Science** 6/7-9: Krakow, Poland **4th Proximity Congress Proximity, Networks and Co-ordination** 6/17-18: Marseille, France **Complexity and Integrated Resources Management** 6/14-17: Univ. of Osnabrück, Germany	**4th Global Conference on Business & Economics** 6/26-28: Oxford, UK **National Environmental Health Association** 6/26-29: Providence, RI USA

2004	2005	
SIAM Conference on the Life Sciences 7/11-14: Portland, Oregon, USA	**20th British Combinatorial Conference** 7/11-15: Durham, UK	JULY
Third International Joint Conference on Autonomous Agents and Multi-Agent Systems 7/19-23: Columbia University, New York, NY	**ASAE Annual International Meeting** 7/17-20: Tampa, Florida, USA	
The Eighth Symposium on Nuclei in the Cosmos 7/19-23: Vancouver, BC, Canada	**International Union for the Scientific Study of Population** 7/18-23: Tours, France	
Eleventh International Conference on Intergranular and Interphase Boundaries 7/25-29: Queen's University, Belfast, Northern Ireland	**1st International Conference on Transportation Logistics** July 26-29: Singapore	
	Nordic Political Science Association 8/11-13: Reykjavik, Iceland	AUG
American Sociological Association 8/14-17: San Francisco	**Academy of Management** 8/5-10: Honolulu, Hawaii USA	
18th IFIP World Computer Congress 22-27 August 2004, in Toulouse, France http://www.wcc2004.org	**Apimondia 2005** 9/21-26: Dublin, Ireland	
	Third European Congress on Social Insects 8/22-27: St. Etersburg, Russia	
Conference on Computational Physics 9/1-4: Genoa, Italy	**American Political Science Association** 9/1-4: Washington, DC USA	SEP
Fourth International Workshop on Ant Colony Optimization and Swarm Intelligence 9/5-8: Brussels, Belgium	**European Consortium for Political Research** 9/8-11: Budapest	
7th International Symposium on Cold Region Development 9/13-17: Sapporo, Hokkaido, Japan	**American Sociological Association** 9/13-16: Philadelphia, PA USA	

Sixth ZUMA Simulation Workshop 9/27-10/1: Universität Koblenz-Landau	**Apimondia 2005** 9/21-26: Dublin, Ireland	
Seminaire Mathematiques Discretes et Sciences Sociales: What is natural duality? 10/30: Paris	**11th Congress of Rhinologic Society** 10/25-29: Sydney, NSW, Australia **Vernacular Colloquium 2005** 10/26-29: Puebla, Mexico	**OCT**
3rd International Symposium on Slow Dynamics in Complex Systems 11/3-8: Sendai, Japan	**4th World Wind Energy Conference & Exhibition** 11/2-5: Melbourne, Australia	**NOV**
American Assn for the Advancement of Science 11/17-21: San Francisco	**American Society of Criminology** 11/15-19: Toronto, ON Canada	
Joint meeting: NZIMA Conference in Combinatorics and its Applications & 29th Australasian Conference in Combinatorial Mathematics and Combinatorial Computing 12/13-18: Lake Taupo, New Zealand		**DEC**



International Sunbelt Social Network Conference XXV

February 16-20, 2005

Crowne Plaza Hotel, Redondo Beach
Los Angeles, California

The International Sunbelt Social Network Conference is the major forum for discussion of theory, methods, and applications of social networks. It provides an opportunity for sociologists, anthropologists, behavioral scientists, mathematicians, statisticians, computer scientists, and others interested in social networks to meet and share ideas and research.

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For information see the INSNA website, www.insna.org

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CONNECTIONS 26(1): 9-10

http://www.insna.org/Connections-Web/Volume26-1/2.Kohler.pdf

Weak Ties, Modern Epidemics, and World Society[1]

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Thirty years ago, the May 1973 issue of "The American Journal of Sociology" published Mark S. Granovetter's seminal ideas on "The Strength of Weak Ties" (Granovetter, 1973). This article — with over 1,300 citations in other articles alone for the last eight years (Social Science Citation Index) — emphasizes the often underestimated prominence of weak interconnections between human beings.

Weak ties — defamatory, you could also call them superficial — deserve in the individual's view an investment of less time, less emotion and less intimacy than strong ties. Further on reciprocity is not strongly pronounced either.

Strong interconnections between two friends or relatives bring about overlapping social networks or friendship circles: "My best friend's friend is my friend, too". Weak ties on the other hand can serve as bridges between cliques that are composed of strong ties. If they are cut, then important pathways for flows of information are suddenly out of service or at least information takes much longer than before to travel from one point to the other.

Because of their long range, weak ties can get you through to more people much faster than strong ties. Possibly it could even turn out to be much more difficult to organize a wedding-party with your relatives and close friends than a large mass-demonstration against war in Iraq.

But the strength of weak ties means much more.

The global spread of the infectious disease Severe Acute Respiratory Syndrome (SARS) within week shows the humongously grown integration of world society – an integration based to a large part on said weak ties. The different structural patterns of world society – Rudolf Stichweh calls them "Eigenstructures" (Stichweh, 2003) – like function systems, formal organizations, epistemic communities, networks, markets and world events exhibit a strong affinity to weak ties: Function systems, for example science, economy, religion and so on, rely on keeping the private out and letting impersonal

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media speak. Akin to function systems, formal organizations include an employee's professional know-how and eight hours of work a day but not his or her relatives and acquaintances (Luhmann, 2000). Epistemic communities are as powerful as they are because they are not constrained by social and spatial co-presence and follow universal norms and ethics (Haas, 1992). The strength of networks and the "space of flows" (Castells, 2000) lies in the large number of geographically spread individuals that can interact without meeting in person. Markets on the other hand emerge from interpolating the quality of an Other, for example your competitor, from the sparse information you can accrue (White, 1981). Finally, world events such as world exhibitions or world fairs are being staged to include as many spectators as possible and therefore cannot care for the closeness of their audience's relations.

My point is, that world society based on strong ties would limit the spread of diseases because close friends share a large number of their acquaintances. Thus each new infection adds only a relatively small number of further possibilities or branches for the virus to spread.

In contrast to this, when sneaking through weak ties, the virus crosses a bridge with every new infection and can reach whole new cliques time and again. The only way to contain this spread seems to be turning weak ties into strong ones. House arrest, isolation and restrictions on free travel – epidemics in modern world society paradoxically require a step back in time to the traditional, closely-knit "Gemeinschaft".

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CONNECTIONS 26(1): 11-28 http://www.insna.org/Connections-Web/Volume26-1/3.Baerveldt.pdf

Students' delinquency and correlates with strong and weaker ties: A study of students' networks in Dutch high schools

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The goal of the present study was to investigate three issues in the current debate on youth delinquency: (1) Whether the level of delinquency of adolescents is negatively correlated with the quality of her/his personal networks (as stated by the social inability model) or not (as stated by the social ability model); (2) Whether there is homophily in adolescents' networks regarding degree of delinquency; and (3) Whether homophily regarding the degree of delinquency is more pronounced for strong relationships than for weak relationships. A network survey, the Dutch Social Behavior Study, was carried out on 1,317 students (aged 15 to 17 years) in 20 high schools. Students completed a self-report questionnaire about petty crime and nominated fellow students for ten different types of relationships, both positive and negative and varying from weak to strong. Results showed that (1) the quality of the personal networks of delinquents and non-delinquents did not differ over any positive relationship. Delinquents seemed to avoid others a little more than non-delinquents, but were not avoided more; (2) the level of delinquency of students involved in positive relationships was correlated. This was caused partially by sex segregation; and (3) Homophily in weak-tie networks was not smaller than in strong-tie networks.

INTRODUCTION

Since Sarnecki (1990) published his descriptive study on delinquent networks in Sweden, network research on delinquent behavior gradually has gained popularity (see, for instance, Aseltine, 1995; Baerveldt & Snijders, 1994; Baron & Tindall, 1993; Dishion, Andrews, & Crosby, 1995; Fletcher, Darling, Steinberg, & Dornbusch, 1995; Gilmore, Hawkins, Day, & Catalano, 1992; Haynie, 2001, 2002; Houtzager & Baerveldt, 1999; Poulin, Dishion, & Haas, 1999). Nevertheless, the number of network studies in this field is still small. Network analysis, however, could contribute substantially to the ongoing criminological debate about the significance of adolescents' social relationships for delinquent behavior. For instance, opinions differ about the causal direction of the relationship between having delinquent friends and one's own delinquent behavior, about the social mechanisms involved, and about the quality of delinquents' social relationships (see, e.g. Matsueda & Anderson, 1998; Reed & Rose, 1998; Weerman, 2004). In this paper, we use a network approach to shed light on three issues that are discussed in the criminological debate about social relationships and delinquent behavior of adolescents.

The first of these three issues refers to the delinquent's (in)ability to maintain social relationships. Some authors assume that delinquent adolescents have insufficient social skills to maintain strong relationships with their peers while others argue that delinquent adolescents do not have less skills than non-delinquents. These perspectives have been labelled the "social inability" model and the "social ability" model by Hansell and Watriowski (1981). Both viewpoints are also present in classical criminological theories, such as Hirschi's (1969) social control theory, and Sutherland's differential association theory (Sutherland, 1947; Sutherland & Cressey, 1974). According to Hirschi, delinquent behavior is possible when the bond to society is weakened or broken. Strong social bonds with conventional people and institutions prevent delinquent behavior. Delinquents never developed such bonds, and according to Hirschi, they are unable to develop strong attachments to their peers. Although Hirschi (1969) recognized that delinquent adolescents often report friendships with each other, he stated that these relationships are superficial and of poor quality. The mutual bonds of delinquents are explained through selection: these adolescents have chosen each other because of their similarity in attitudes and behavior, but that does not imply that these relationships are strong and influential. According to Sutherland's differential association theory, delinquent behavior is learned through social interaction within intimate personal groups. Criminal norms, values and know-how are passed on through normal socialization processes. People who have more associations with delinquent others are more likely to become delinquent themselves. Social relationships with delinquent peers therefore precede delinquent behavior, and the quality of these relationships does not necessarily differ from that of non-delinquent adolescents. Although various criminologists have tried to build theoretical bridges between both models, (for example, see Reed & Rose, 1998; Thornberry, Krohn, Lizotte, & Chard Wierschem, 1993; Vitaro, Tremblay, Kerr, Pagani, & Bukowski, 1997) the discussion so far has mainly been determined by the supposed theoretical incompatibility of the two models (Gilmore et al., 1992).

The second issue concerns similarity or homophily with respect to the level of delinquency. As noted before, from both the social inability model and the social ability model it can be predicted that the level of delinquency of related adolescents is correlated. Apart from the question which processes cause the homophily (e.g., selection processes as stated by the inability model or influence processes as stated by the ability model), the debate in criminology concentrates on the reliability of many results with respect to homophily. Some (e.g., Aseltine, 1995; Kandel, 1996) suggest that methodological flaws may lead to overestimation of homophily.

The third issue relates to the kind of relationships that are important for the explanation of delinquent behavior. Theorists in this field use very general and vague terms to define which kind of relationships play a role, they use terms like "delinquent peers" (Akers, 1973), "delinquent friends" (Hirshi, 1969) or "intimate personal groups" (Sutherland, 1947). This has led to a wide variety of empirical operationalizations of social relationships between adolescents. In many cases questions are used about "one's peers" or "your friends," but sometimes respondents are asked to think of their five best friends. In some cases respondents are questioned about their schoolmates or their best friends in school, whereas in other cases research is focused on gang or group membership. It is unclear which kinds of relationships are most relevant for delinquent behavior among adolescents. Especially strong and weak ties (relationships) between adolescents may play different roles with regard to delinquency (see, e.g., Warr, 2002).

Most criminologists emphasize the importance of close relationships, and this is also the case for some well-known classical criminological theories. According to Sutherlands' differential association theory, criminal definitions and techniques are learned in "intimate personal groups". He also explicitly states that associations which are more intense than others (and also associations that are more frequent, longer-lasting and older) have more significance than associations that are less intense. These assumptions would mean that the similarity in behavior is strongest for adolescents with strong mutual ties, whereas the similarity in behavior should be weaker for adolescents with weaker ties. In the logic of Hirschi's social control theory, stronger social bonds with relevant conventional others are more protective than weak relationships. As described before, Hirschi did not expect delinquents to have strong bonds with other delinquents. Therefore, social networks would consist of clusters of delinquents with weak relationships, and of non-delinquents with weak and strong mutual relationships, and only few and weak relationships between the clusters. As a consequence, one would expect similarity in weak-tie networks, but it remains unclear what the consequences are for the similarity in strong tie-networks.

However, not all criminologists assume that close, intimate relationships between adolescents are most significant for delinquent behavior. In his recent book, Warr (2002) describes a large number of possible mechanisms for peer influence, adding to those described in the existing criminological theories. All these mechanisms are assumed to operate especially during adolescence when peers and belonging to peer groups are central to the life of youths. The most important mechanisms through which adolescents conform to other law breaking adolescents or through which their own delinquent behavior is magnified, are fear of ridicule, the desire to show loyalty and the desire to maintain status. Other mechanisms mentioned by Warr are the diffusion of responsibility in groups, pressures to maintain consensus in the groups or to gain acceptance by the group, groups as means for protection and groups as source of potential co-offenders. Most of these mechanisms might be more relevant for larger collectivities of adolescents with relatively weak relationships, and for some of these mechanisms it is hard to imagine how they could operate in intimate dyads or triads of close friends. For some of these mechanisms, Warr explicitly offers empirical support for the notion that peer influences occur in larger collectivities rather than within close intimate friendships. This implies that similarity in behavior might be stronger for relatively weak ties than for strong mutual ties between adolescents.

Consequences for networks

The above debates lead us to formulate three research questions about the relation between delinquency and social relationships:

- Q1 Is the delinquency level of adolescents negatively correlated with the quality of her/his personal networks or not?
- Q2 Is there homophily regarding degree of delinquency in adolescents' networks, i.e., do positively related adolescents have similar levels of delinquency?
- Q3 Is homophily regarding the degree of delinquency more pronounced for strong relationships than for weak relationships?`

Non-network criminological research has not been decisive on the quality of relationships of delinquents compared to non-delinquents. A small number of non-network studies have been conducted on this topic. Giordiano et al. (1986) investigated a large number of friendship characteristics, and concluded that delinquent and non-delinquent adolescents were similar rather than different in their social relationships. The most important difference was that delinquents reported more conflicts and disagreements. No differences were found between delinquents and non-delinquents in stability and frequency of their contacts, and more important, there were no differences in trust, caring and self-confirmation. Delinquent respondents even reported a slightly higher level of loyalty and self-disclosure. Claes and Simard (1992) reported no differences between incarcerated delinquent adolescents and non-delinquents in trust and communication, and also in a measure of intimacy (based on items about self-disclosure, empathy, sharing, affection and loyalty). They did find important differences with regard to conflict, however, and they mentioned that delinquents reported more feelings of being different than others, being ganged up, ridiculed and rejected by their group. Marcus (1996), who reviewed a number of relevant studies, reached an opposite conclusion than that of Giordano et al.: According to him the available research suggest substantial differences between delinquents and non-delinquents. However, Marcus also relied on research about personal characteristics of delinquents (like higher levels of aggressiveness and impulsivity) to reach this conclusion. The results of direct research on the friendships of delinquents may be well interpreted in a different way. Moreover, in all of the relevant studies, the quality of personal relationships is measured only by the adolescent's response. This implies that the data contain perceptions about the quality of relationships rather than direct measures of actual quality. The present study investigates entire students' networks in order to avoid these drawbacks.

With regard to the second question, it is generally accepted in criminology that delinquents have relationships mainly with other delinquents (Bender & Lösel, 1997; Elliot, Huizinga, & Ageton, 1985; Jussim & Osgood, 1989; Ploeger, 1997; Reed & Rose, 1998; Thornberry, Lizotte, Krohn, Farnworth, & Jang, 1994; Vitaro et al., 1997), but there is debate about the strength of this correlation. It is general practice to ask respondents to give information about their own behavior as well as that of their friends (Brownfield & Sorenson, 1993; Bruinsma, 1992; Frauenglass, Routh, Pantin, & Mason, 1997; Gardner & Shoemaker, 1989; Gilmore et al., 1992; Hayes, 1997; Heimer, 1997; Hundleby & Mercer, 1987; Kandel & Davies, 1991; Kandel, 1996; Keenan, Loeber, Zhang, & Stouthamer Loeber, 1995; McCarthy, 1996; Mears, Ploeger, & Warr, 1998; Ploeger, 1997; Reed & Rose, 1998; Warr, 1993; Warr & Stafford, 1990; White, Johnson, & Garrison, 1985), but this practice has been strongly criticized (Aseltine, 1995; Haynie, 2001; Jussim & Osgood, 1989; Kandel, 1996; Reed & Rose, 1998). According to the critics, people tend to homogenize the images of themselves and of their social environment. With respect to delinquency, this tendency may be strong because it is socially less desirable behavior and exact information about such hidden behavior of others is not always available. For example, we should expect non-delinquents not to admit readily that they have delinquent friends. The result is that the similarity between the delinquent behavior of the respondent and his friends is overestimated. According to critics such as Aseltine (1995) and Kandel (1996), social network research produces more reliable estimates of the similarity between the behavior of respondent and peers. The present study analyses this similarity using network data from 20 high schools.

Up until now the third question has not received much attention in empirical research. This parallels the theoretical vagueness in the criminological literature: it is unclear what kind of relationships are involved, and how theories relate to more specific relationships such as social support, participating in common activities, communication, and specific power relationships. In almost all empirical research in criminology, concepts such as "peers" and "friendship" are not defined. It is often left to the respondents how to interpret the relationships. This was for instance the case in the influential National Youth Survey in the United States, from which data are used in many criminological studies (i.e., Agnew, 1991; Elliot et al., 1985; Elliott & Menard, 1996; Haynie, 2001; Matsueda & Anderson, 1998; Reed & Rose, 1998). The problem is that adolescents can interpret the concept of friendship in many different ways. The criteria for friendship differ, for instance, between boys and girls (Houtzager & Baerveldt, 1999). However, some criminological studies are available comparing different kinds of relationships. For instance, some studies addressed the difference between having delinquent friends and being member of a delinquent gang (Battin, Hill, & Abbott, 1998; Morash, 1983). A few criminological studies are available in which the interactive effects of friendship variables on delinquency are investigated (Agnew, 1991; Warr, 1993). These studies indicate that stronger relationships (as reported by respondents) and more time spent with friends lead to a stronger effect of these friends on one's own delinquent behavior. The social network approach offers many advantages above traditional research to answer the third question. It enables the researcher to distinguish between different kinds of relationships and to identify stronger and weaker ties. The use of these possibilities in the study of deviant behavior has been extremely rare thus far. One study on drug and alcohol use is available in which network methods are used to distinguish between friends and best friends (Urberg, Degirmencioglu, & Pilgrim, 1997). This study suggests that in general similarity was slightly stronger for best friends than for other friends, except for getting drunk. Social network studies with regard to delinquent behavior only presented either friendship networks or best friendship-networks but never both at the same time. Consequently, correlations of delinquency of positively related people are never compared between different tie networks. In the present network study several stronger and weaker relationships are studied and compared.

METHODS

Study design

This study was part of the Dutch Social Behavior Study (DSBS, see Baerveldt, 2000; Houtzager & Baerveldt, 1999). The main data source for the DSBS was a two-wave survey in classrooms in Dutch urban high schools. In this article we only report about the second wave, comprising data from 20 schools. All students in the fourth grade of the intermediate educational level (MAVO) of these schools were selected, resulting in a sample of 1,317 students between the ages of 15 and 17 years. A network consisted of all the 4th grade MAVO students within a school and ranged from 41 to 102 students. The sample was equally divided between boys (49.5%) and girls (50.5%). One third of the students had at least one parent who was born outside the Netherlands, mainly in Surinam, Morocco, Turkey, or the Dutch Antilles.

The project elaborated on an earlier study by the first author (Baerveldt, 1992; Baerveldt & Snijders, 1994) on similar students, in which the items on delinquency and personal backgrounds and one network item (best friends) had already been tested. The procedure –the students completed the questionnaire during a one-hour session– was repeated. After introducing the researchers, the teacher left the classroom. The researchers emphasized privacy, and answered any questions. They also completed a process paper about the way the class behaved during the session (time used for completion; number of questions; problems with students). Class behavior did not appear to be correlated with the mean class scores on key variables (delinquency, networks). Most students reported to enjoy answering the questions, wrote a personal story at the end, and no disruptions were reported.

Measures

Delinquency. Delinquency was measured by a self-report questionnaire that had been used and tested in an earlier study (Baerveldt, 1992). The respondents were asked how many times they had committed 23 minor offences, such as shoplifting, petty theft, vandalism, and unarmed fights over the last twelve months (see Table 2). The total number of offences was used as a scale; it had sufficient internal consistency (Cronbach's Alpha = .91) and was sufficiently one-dimensional (Eigenvalues factor analysis 8.6, 1.5, …).

Social relationships. The existence of different types of relationships was measured by the social network items in the questionnaire. All the network items focused exclusively on relationships with other students in the same grade. The procedure was as follows: each student was given a personal code and a code list for fellow students in the same year. The students gave their own identification code on the form. For the network items the respondents were instructed to complete the codes for other involved students for each item (up to a maximum of twelve codes).

The network items concerned ten types of relationships or ties (see Table 3). Relationship (t1) was a negative relationship: "With whom do you absolutely not want to associate?" while (t2) represented a functional relationship for misconduct: "With whom do you do things that are not allowed, like bullying or playing truant?". In descending order of frequency were: (t3) "Who are your best friends?"; (t4) practical support given: "Which students do you help with practical problems such as doing homework, organizing a party, or completing a difficult form?"; (t5) practical support received: "Which students help you …"; (t6) emotional support given: "Which students do you help when they are depressed, for example, after the end of a love affair or when they have a conflict with other people?"; (t7) emotional support received: "Which students help you …"; (t8) "Who do you compare your school results with first?"; (t9) "Who do you also see outside school?". Finally (t10) was "With whom do you talk about personal problems?". The frequency of the relationships can be used as a proxy for their strength, assuming that the stronger a relationship is the less frequent it will occur.

Students sometimes nominated alters who were not at school during the survey, because they had switched schools, were sick or playing truant. When these alters were excluded, the number of nominations dropped by about 10%. In the analyses we used only the relationships with alters who also filled in the questionnaire.

The support items were formulated both in terms of receiving and giving, which facilitates checking the reliability by comparing the scores of the responses from egos and alters. Table 1 shows that about 80% of the support relationships received by an ego was also reported as being given by an alter, and vice versa. If egos reported no received support, the chance that alters reported support given was less than 1%. We therefore concluded that the reliability of the items was satisfactory.

Table 1. Reliability of Social Support Items: Comparison of Scores of Ego and Alter

Practical support		Ego indicates that he/she receives practical support from alter		
		No	Yes	Total
Alter indicates that he/she gives practical support to ego	No	44,138 *(99.1%)*	271 *(16.4%)*	44,409 *(96.2%)*
	Yes	381 *(0.8%)*	1,381 *(83.6%)*	1,762 *(3.8%)*
	Total	44,519 *(100%)*	1,652 *(100%)*	46,171 *(100%)*
Emotional support		Ego indicates that he/she receives emotional support from alter		
		No	Yes	Total
Alter indicates that he/she gives emotional support to ego	No	44,586 *(99.7%)*	314 *(22.0%)*	44,900 *(97.2%)*
	Yes	156 *(0.3%)*	1,115 *(78.0%)*	1,271 *(2.8%)*
	Total	44,742 *(100%)*	1,429 *(100%)*	46,171 *(100%)*

Control variables. Each adolescent answered some additional questions about his or her sex, age, acculturation and the relative importance of school friends versus friends outside school. Acculturation was measured by a scale of four items regarding the use of the Dutch language and Dutch media at home (Van Hemert, Baerveldt, & Vermande, 2001).

Indicators of the quality of the personal network. The personal network characteristics can be divided up in three sets: size, structure, and homophily (see Table 4). These network characteristics were calculated for each of the relationships. The Utrecht Network Analysis Program was used to calculate these variables. As indicators of the size of ego's network we used the outdegree (Out), indegree (In) and total degree (Deg) for each of the relationships, as well as ego's connectedness (Con). Connectedness was calculated as the proportion of the actors in the network that ego could reach, directly or indirectly. For positive relationships, the size of the personal network might be viewed as an indicator of its quality. This is especially the case for strong relationships. It should be noted that connectedness is meaningless for the avoidance relationship (t1).

The structure of one's personal network is measured by several indicators. Reciprocity was operationalized as both the number of reciprocal relationships (Rec1) and the number or reciprocal relationships as proportion of the outdegree (Rec2). It is often used as an indicator of the quality of positive social relationships. Transitivity (Tra) was operationalized as the proportion of transitive triads ego was involved in. Note that we consider to be transitive only those triads in which ego closes the transitive structure. For instance, a triad in which ego → alter 1, alter 1 → alter 2, and ego → alter 2 is considered transitive, but one in which alter 1 → ego, ego → alter 2, and alter 1 → alter 2 is not.[1] Transitivity is used as an indicator of network quality in balance theory. Segmentation (Seg) pertains to the extent that short (length=1) and long path distances (length ^{3} 4) dominate the network and that medium path distances are relatively rare (Baerveldt & Snijders, 1994). However, while the original segmentation measure was calculated over the entire network, we here calculated it at the individual level. The segmentation of a personal network is a quality indicator because it indicates whether the ego is member of a close group. Further, we also looked at the structure of the ego-network of the student. We included both the density and reciprocity of the relationships among those alters who were nominated by ego or who nominated ego as indicators of the closure of the group to which ego belongs (Den and RecL, respectively).

Homophily in the personal network (Hom) regarding delinquency was measured using the following index (H):

$$H_i = \frac{\frac{1}{n_N - 1}\sum_{j \in \{A_N\}} \left(x_j - x_i\right)^2 - \frac{1}{n_L - 1}\sum_{j \in \{A_L\}} \left(x_j - x_i\right)^2}{\frac{1}{n-2}\sum_{j \neq i}^{j} \left(x_j - x_i\right)^2}$$

where H_i is the score on the homophily index for i (ego), x_i the delinquency score for ego and the x_j-s those for the alters; $\{A_L\}$ is the set of alters with whom ego has relationships (receiving or sending), n_L the number of alters in this set, while $\{A_N\}$ and n_N refer to those alters with whom one has no relationships, and n is the size of the network. This homophily index measures to what extent those persons ego has relationships with are more like ego in terms of delinquency compared to those whom ego has no relationships with. A zero score on the homophily index indicates the absence of homophily for ego, while a positive score indicates that one has relationships with alters who are

[1] Using the Hummell and Sodeur(1987) labeling of triads, following triads are considered transitive: P11, P15, P22, P29, P33, and P36.

more similar to ego than those without relationships with ego. A negative score indicates a tendency towards heterophily. Note that the maximum and minimum values for H are not +1 and –1, but $(n-2)/(n_N-1)$ and $-(n-2)/(n_L-1)$, respectively. The homophily of a personal network is a quality indicator because it indicates whether the ego is member of a homogenous group.

ANALYSIS

In the analysis one needs to distinguish between positive and negative relationships. As social network analysis developed with positive relationships in mind, we need to consider whether all network parameters are equally meaningful for positive and negative relationships. For instance, transitivity in positive relationships is consistent with the balance model, in negative relationships it is not: an enemy of an enemy should be an ally, not an enemy. Likewise connectedness and segmentation have little meaning for negative relationships. One cannot expect the presence of chains of negative relationships.

Table 2. Delinquency among *MAVO*-4 Students in 20 Dutch High Schools

Offence	*Percentage that have committed this offence at least once in the past year*	
	Girls	*Boys*
Shoplifting	31.5	48.6
Changing price tags	29.4	37.2
Dodging fare	48.2	60.4
Bought stolen articles (receiving)	22.5	48.4
Stole things from school	25.9	43.1
Stole money from home	23.0	21.9
Stole money from students	1.0	5.9
Stole a coat from student	0.0	2.4
Burglary	2.9	18.7
Stole bikes	6.7	28.0
Stole mopeds	0.2	9.3
Stole something else	6.1	14.4
Graffiti	25.7	37.4
Vandalism on public transport	7.3	18.1
Vandalism on the street in public	8.6	35.4
Started a fire	14.6	46.3
Damaged a bike	11.5	38.6
Damaged a car	9.0	28.5
Damaged something at school	10.9	27.6
Broke a window	6.7	33.1
Broke something else	2.9	7.7
Kicked or hit someone	22.1	46.1
Threatened someone with a knife/other weapon	4.4	14.4

For the analysis we relied mainly on correlational analysis as we made no assumptions about the causal relationship between delinquency and social relationships. The data used here do not allow us to distinguish between selection and influence processes. Each of the network characteristics was correlated for each of the relationships with the respondent's delinquency score. In a first phase we controlled only for school, later on we added other control variables to check whether observed correlations were not due to differences in the relational patterns and delinquency rates of various groups. The control variables included were: age, sex, importance of friends outside school, ethnicity and acculturation. To test for overall homophily regarding delinquency (question 2 and 3) we also ran a spatial correlation analysis for each school over each of the relationships (see the Results section).

RESULTS

Delinquency. 86.7% of the students had committed at least one minor offence in the past twelve months, although most offences were very light (see Table 2 for an overview). Moreover, the delinquency rate of MAVO students in urban schools is known to be relatively high. As expected (see the Introduction), petty crimes were reported more often by boys than by girls (t=13.76, df=1312, p<.001). The boys' delinquency score was about 2.5 times that of girls.

Peer relationships. With regard to the network items, we observed that the percentage of students who nominated at least one alter varied from 29.9% for misbehaving together, to 66.7% for discussing personal problems, to 88.8% for best friends. These frequencies show that students are not secretive about their relationships. This was also illustrated by the fact that 63.2% of the students reported having at least one fellow student whom they avoid. The frequencies of the positive items roughly reflect the scarcity and emotional value of the relationships, which partly validated this set of items. Table 3 shows that the frequencies of the weak relationships (t3 thru t5) were higher than of the stronger ones (t6 thru t10). However, the order of frequencies for boys is slightly different than for girls. As Table 3 shows, girls had more social support relationships and intimate friendships, but boys nominated more "best friends". This indicates that boys and girls have different kinds of networks. Boys also nominated more alters with whom they got into mischief, which is in line with the finding that they commit many more offences. We could not find any significant differences between boys and girls as regards avoidance relationships.

Table 3. Mean Number of Peers Nominated by *MAVO*-4 Students for Ten Types of Relationships

	Type of relationship	*Girls*	*Boys*	*Total*	$T_{girls.boys}$ (*df* = 1312)
t1	(Neg. relationship) ego avoids alter	2.62	2.38	2.50	1.41
t2	Ego misbehaves with alter	0.44	0.73	0.59	-4.28**
t3	Ego calls alter his/her best friend	3.27	4.00	3.64	-4.80**
t4	Ego gives practical support to alter	2.80	2.26	2.53	3.90**
t5	Ego receives practical support from alter	2.90	2.36	2.63	3.87**
t6	Ego gives emotional support to alter	2.67	1.64	2.16	8.43**
t7	Ego receives emotional support from alter	2.36	1.45	1.91	8.51**
t8	Ego first compares marks with alter	1.81	1.78	1.79	0.31
t9	Ego also has contact with alter outside school	1.73	1.84	1.79	-1.26
t10	Ego discusses intimate affairs with alter	1.71	1.04	1.38	8.28**

* p<.01, ** p<.001; two-tailed.

The relative importance of friends in and outside school. For most students their friends at school really matter. 1,296 out of 1,317 students answered the question "Which friends are more important: friends at school or outside school?". For 61.7% of the students both friends are equally important and for 10.1% friends at school were more important. However, for 28.2% of the students, friends outside school were more important. The students who stated that their friends outside school were more important committed more offences than those for whom friends outside school were less important (t=2.96, df=1242, p<0.01). In addition, they also nominated significantly fewer fellow students for items about positive social relationships (t varies between 3.70 and 5.66, df=1,294, p<.001). This is why we had to take the possible effects of these differences into account in our analysis and interpretation of these aspects.

Delinquency and the quality of personal networks (Q1). From the inability model it may be expected that delinquency is negatively correlated with the quality of personal networks (question 1). As said before, we studied three different aspects of network quality: the size, the structure and the homophily within the personal network. We correlated delinquency with those network characteristics. Hirschi(1969) and other adherents of the model, generally state, or implicitly assume, that these correlations are independent of background variables. Also, some of these variables: namely sex, age, ethnicity, acculturation, and the importance of school friends, are correlated with delinquency or with network quality or both. We controlled the correlations for all these variables, because, while delinquency generally does not differ much between these types of schools, networks do (Baerveldt, 1992). In Table 4, the partial correlations are shown.[2]

Table 4. Partial Correlations of Delinquency with Network Quality Indicators over Ten Types of Relationships for *MAVO*-4 Students, controlled for School, Sex, Age, Ethnicity, Acculturation and the Importance of School Friends (significant ($p<.01$) correlations in **bold**).

	Type of relationship	Network characteristic*										
		Size				*Structure*						*Hom*
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
		Out	In	Deg	Con	Rec1	Rec2	Tra	Seg	Den	RecL	Hom
t1	(Neg. relationship) ego avoids alter	**.20**	.01	**.12**	**.12**	.08	**.12**	**.15**	**-.15**	-.03	-.05	.08
t2	Ego misbehaves with alter	**.26**	**.19**	**.20**	**.24**	**.25**	**.30**	**.18**	**-.16**	.10	--	-.00
t3	Ego calls alter his/her best friend	.01	**.08**	.03	-.06	.07	-.01	.03	.06	.03	.00	-.00
t4	Ego gives practical support to alter	.07	-.02	.04	-.03	.03	.05	.05	.02	.03	-.02	.00
t5	Ego receives practical support from alter	.07	-.02	.05	-.03	.04	.07	.01	-.02	.02	-.02	-.01
t6	Ego gives emotional support to alter	.05	.04	.07	-.04	.05	.06	.03	-.00	.00	.06	.01
t7	Ego receives emotional support from alter	.06	.04	.07	-.03	.01	.06	.02	.01	.01	.02	.04
t8	Ego first compares marks with alter	.01	.00	.02	-.06	.01	.02	.03	.04	.03	.02	.04
t9	Ego also has contact with alter outside school	**.10**	**.11**	**.11**	.03	.06	.07	.03	-.06	-.04	-.01	.03
t10	Ego discusses intimate subjects with alter	.05	.04	.03	-.01	.05	**.09**	-.00	.02	-.03	-.03	-.01

* See text for explanation of the abbreviations. -- cannot be computed

According to the inability model (more) delinquent adolescents can be expected to have fewer relationships with their peers than less delinquent ones. The correlations in columns 1 to 4 of Table 4 do not support this prediction. For positive types of relationships the correlations between the level of delinquency of the respondent and the size of his/her network are not significant. The only significant correlations, regarding (t9) (contact also outside school) are in the wrong direction. Significant, but positive, correlations were found between delinquency level and the network size indicators for misbehaving with alters (t2), indicating that delinquency often occurs within a group context. Worth noticing is also that delinquent students tend to have larger avoidance (t1) networks

[2] As a matter of fact, controlling did hardly change the results.

than non-delinquent ones. However, this difference seems entirely due to the outdegree and not to the indegree. In other words, delinquent students are not more avoided at school, but tend to avoid more of their classmates than non-delinquent students. All in all, our findings with respect to size are at odds with the inability model.

According to the inability model we can also expect that the structural quality of the personal network of delinquent students is poorer than of non-delinquent ones. Again the results provide no support for this prediction (see Table 4, columns 5-10). For the more positive relationships (t3-t10) no significant association was found between the structural quality of the relationships and the level of delinquency. Only regarding the avoidance (t1) and misbehaving together (t2) relationships did we find significant correlations with delinquency. The results in Table 4 do show that reciprocity of avoidance relationships is somewhat stronger for delinquent students. This means that for delinquent student, the chance that they avoid alters who are avoiding them, is larger. The significant correlations between delinquency level and the other structural quality indicators for avoidance relationships are more difficult to interpret. Note, however that these effects might be to some extent effects of the delinquent's larger outdegree for avoidance relationships. The results for misbehaving together relationships point to the existence of groups that engage in delinquent behavior. Such finding is more supportive of the ability rather than of the inability model.

The results in Table 4 (column 11) indicate that the homophily of the personal networks with respect tot delinquency did not vary with the level of delinquency for any of the relationships. Thus, delinquent students are not part of groups which are more heterogeneous with respect to delinquency than non delinquent students.

In sum, our results did not support the inability model, and are much more in line with the ability model.

Peer relationships and similarity regarding petty crime (Q2 & Q3). We used spatial correlation coefficients for testing the similarity of delinquency rates of related students (question 2). A spatial correlation of a quality V over a relationship R indicates how far the scores on V of egos in a network correspond with those of the alters to which they are connected through a relationship R, in comparison with the scores of individuals not related to each other. The literature (Cliff & Ord, 1973; Sprenger & Stokman, 1989) offers two possible measures: Geary's C and Moran's I. Our analysis showed that the differences between both measures were minimal for our data, and we will only present Moran's I here. In case of homophily, Moran's I is expected to be positive for positive social relationships, and negative for the avoidance relationship (t1)).[3] Moran's I is independent of the mean and variance of delinquent behavior, the size of the network (the number of students) or the density of the network (the mean number of relationships per student) and it is possible to test the statistical significance. Our analyses showed that it makes hardly any difference whether spatial correlations were calculated according to the asymmetric (directed) variant or not, or whether strong or weak criteria for symmetry were used. For the sake of comparability of Moran's I with regard to the different types of social relationships, we will only present the results of the directed variant in the tables.

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[3] A positive I over relationship R does not always indicate that the behavior of adolescents with a relationship R is more similar than the behavior of adolescents without this type of relationship. According to the statistical model, there is a positive connection when Moran's $I > -1/(N-1)$, in which N represents the number of students per network. N varies in this study between 41 and 102, so that there is a positive relationship connection if $I > -.025$, even with the smallest network (N=41). In our study Moran's I was never significant if $-.10 < I < .10$. This implies that when Moran's I is significant, the value of I indicates whether it concerns a positive or negative connection.

Because Moran's I applies to a single network, it was calculated separately for each school. Since 20 schools were involved in the study, 20 spatial correlations were calculated for each of the ten types of relationships. The relatively high standard deviation of the spatial correlations between positive social relationships and petty crime indicate that they differ substantially from school to school. However, the correlations are generally positive, and for most schools significant ($p<.01$). All mean correlations above .10 are significant. Table 5 shows the mean of Moran's I over all schools. We placed the avoidance relationship (t1) and misbehaving together (t2) at the top of the table. Below we placed the positive relationships (t3 thru t10) . The arrangement of these relationships corresponds with their frequency: the least frequent relationships are listed at the bottom. These are also the relationships that may be assumed to be the closest or strongest (Houtzager & Baerveldt, 1999).

Table 5. Mean Spatial Correlations (Moran's *I*) and Standard Deviations of Sex and Delinquency over Ten Types of Relationships for Dutch *MAVO*-4 Students (N = 20 Schools; significant (p< .01) correlations in **bold**).

	Type of Relationship	*Spatial correlation of Sex* (1)		*Spatial correlation of Delinquency* (2)		*Spatial correlation of Delinquency controlled for Importance of school friends* (3)		*Spatial correlation of Delinquency controlled for Importance of school friends and Sex* (4)	
		m	*sd*	*m*	*sd*	*m*	*sd*	*m*	*sd*
t1	(Neg. relationship) ego avoids alter	**0.25**	(.13)	**-0.09**	(.15)	-0.01	(.16)	**-0.11**	(.16)
t2	Ego misbehaves with alter	**0.66**	(.20)	**0.61**	(.40)	**0.54**	(.47)	**0.42**	(.42)
t3	Ego calls alter his/her best friend	**0.64**	(.14)	**0.24**	(.10)	**0.23**	(.12)	**0.15**	(.13)
t4	Ego gives practical support to alter	**0.63**	(.13)	**0.23**	(.11)	**0.21**	(.13)	**0.14**	(.12)
t5	Ego receives practical support from alter	**0.62**	(.13)	**0.24**	(.11)	**0.22**	(.12)	**0.15**	(.13)
t6	Ego gives emotional support to alter	**0.63**	(.16)	**0.20**	(.14)	**0.19**	(.15)	**0.11**	(.13)
t7	Ego receives emotional support from alter	**0.63**	(.15)	**0.19**	(.12)	**0.18**	(.12)	**0.11**	(.14)
t8	Ego first compares marks with alter	**0.70**	(.12)	**0.29**	(.15)	**0.25**	(.18)	**0.19**	(.16)
t9	Ego also has contact with alter outside school	**0.66**	(.13)	**0.30**	(.16)	**0.28**	(.19)	**0.22**	(.20)
t10	Ego discusses intimate subjects with alter	**0.70**	(.17)	**0.22**	(.15)	**0.20**	(.17)	**0.14**	(.17)

Table 5 shows the means of the spatial correlations of relationships with four different variables. Column 2 shows the mean correlations with delinquency. We found the highest spatial correlation for delinquent behavior over the misbehaving (t2) relationship. This was not a surprise, as both types of behavior are closely related and may well overlap. The mean spatial correlation over avoiding is about zero, indicating that students who differ with respect to delinquency do not avoid each other more than those with similar delinquency scores. The mean spatial correlations with positive relationships are positive. This means that the delinquency scores of students with a positive relationship are more similar to each other than between students without this type of relationship. The pattern that might be expected from the inability model was that the correlations would be higher for stronger relationships (question 3). However, this was not supported by the results. There may even be a slight tendency towards the opposite: the stronger the relationship, the lower the spatial correlation for petty crime tends to be.

As already stated, some students think that their friends outside school are more important than their friends at school. We have already considered why it is necessary to control the spatial correlation for the impact of the importance of school friends. Following Leenders (1995), first, a bivariate regression analysis of the importance of school friends on delinquent behavior was carried out. The residual terms of this regression equation can be used as a delinquency score corrected for the importance of school friends. Secondly, the spatial correlation for these residual terms was calculated and the results are reported in column 3 of Table 5. The table shows that controlling for the importance of school friends hardly changes the results. The mean spatial correlations in column 3 are slightly lower than in column 2, but the picture remains the same.

One of the most consistent findings in criminological research is that boys commit offences much more frequently than girls. This was also the case in this study: the boys' delinquency score was about 2.5 times higher than that of girls. In addition, boys and girls had different patterns of relationships (an overview is given by Benenson, Apostoleris, & Parnass, 1998; , and Rubin, Bukowski, & Parker, 1998). For example, we saw that boys nominated more "best friends", but that girls nominated intimate friends at least 1.5 times more often than boys. This is sufficient reason to control for sex differences. An investigation into the sex homogeneity of the networks reinforced this conclusion. The first column in Table 5 shows the mean spatial correlation coefficients for sex over the various social relationships. The mean spatial correlations for sex over avoidance relationships (t1) were positive, which implies that students avoided alters of the same sex more than alters of the other sex. The spatial correlations for sex over the positive social relationships are positive. In addition, they are much stronger than the correlations for petty crime. This means that the networks of *MAVO*-4 students are quite sex-homogeneous. However, we cannot reproduce the slight tendency noticeable in columns 2 and 3, that is to say, the weaker the correlations, the closer the relationships. Sex homogeneity seems quite strong and stable for all positive relations.

If sex can have such a great influence on the network, it seems advisable to investigate what remains of the connection between social relationships and delinquent behavior after controlling for sex (question 2). This control was carried out in the same way as for column 3: by calculating the spatial correlations with the residual terms from the regression of delinquent behavior on sex and the importance of school friends. Column 4 shows the results. The mean spatial correlations of petty crime over positive social relationships usually remain positive, but they are substantively lower than they were before controlling for sex and importance of school friends. This means that at least part of the similarity in delinquent behavior of related students can be explained by observed sex differences in delinquency combined with the sex homogeneity of social relationships.

CONCLUSIONS

Results showed that (1) the quality of the personal networks of delinquents and non-delinquents did not differ over any positive relationship. Delinquents seemed to avoid others a little more than non-delinquents, but were not avoided more; (2) the level of delinquency of students involved in positive relationships was correlated. This was caused partially by sex segregation; and (3) Homophily in weak-tie networks was not smaller than in strong tie-networks.

DISCUSSION

Most criminologists assume that in adolescence friends tend to display similar levels of delinquent behavior. However, research in which adolescents give information about the behavior of their friends ("perceived delinquency") has been severely criticized on methodological grounds. Various critics prefer research using social networks. Using social network data it is possible to measure the delinquent behavior of adolescents independently of that of their peers. In addition, the quality of the relationships and both strong and weak relationships can be included in the analysis, as was shown by the present study.

The results of this study are explicitly limited to petty crime since other processes may play a role in serious, persistent crime. According to our expectations, adolescents who maintained positive relationships with each other often had corresponding delinquency scores. The spatial correlations for delinquent behavior were substantial but weaker than the spatial correlations for sex. This suggests that associations established in mainstream research overestimate the reality (as also argued by Kandel, 1996).

Nevertheless, the finding that the spatial correlation coefficients vary substantially over the schools is an important qualifier. This indicates that it makes a considerable difference to which network adolescents belong: in one network the similarity in behavior is apparently stronger than in another. This also suggests that the strength of selection and/or influence differs between networks, even when nodes and ties are of the same type. We think that further research and development of theories in this context would be desirable (see also Haynie, 2001).

Contrary to expectations, we did not find that the similarity in delinquent behavior between ego and alter was larger for stronger than for weaker relationships. It is unclear what this means for the inability model because, according to that model, delinquents can't maintain strong ties. However, it contradicts the ideas of most ability model adherents. For instance the differential association theory states that social learning of delinquent behavior takes place in small, tight-knit groups. In other words, our findings contradicted important assumptions of both models. It seems that strong and close relationships may be less important in explaining minor delinquency than many criminologists assume. Perhaps the development of criminological theories should focus more on the strength of weak ties (see, e.g., Warr, 2002) or on the role of social capital.

We studied the association between delinquency and several indicators (size, structure and homophily) of network quality. The indicators for positive relationships were not negatively correlated with students' delinquency, most correlations were even positive. Some indicators of the avoidance relationship correlated positively with delinquency, others were negative or zero. The positive correlations were all based on outdegree measures. While delinquents were not avoided more by other students, they seemed to be more selective themselves. All in all the differences are small, which does not correspond with the inability model.

The existence of similar delinquent behavior among adolescent friends might be explained by two different processes: influence (according the ability model) and selection (according the inability model). When adolescents influence each other's level of delinquency, the level of delinquent behavior of adolescents who already have a social relationship with each other converges. When the delinquency level is a criterion for social selection, relationships develop between adolescents who have a more or less similar level of delinquent behavior. Because we analyzed cross-sectional data, we cannot discriminate between influence and selection; longitudinal research is required for firm conclusions about influence and selection.

Nevertheless, our cross-sectional analysis gives some clues about the strength of influence and selection processes. Our findings indicate that selection and influence processes are probably weaker than suggested in the literature. After controlling the spatial correlation for sex, we got some idea of the upper limits for influence and selection processes. When the spatial correlation was controlled for sex, the coefficients decreased substantially. By controlling for sex, one accounts for both the strong tendency towards sex homophily in the sample and for differences in delinquency levels for boys and girls. As boys tend to be more delinquent than girls, and relationships are overwhelmingly within-sex, this inflates the spatial correlation for delinquency. Because the networks are practically separated in boys' and girls' networks, delinquency based selection and influence processes operate generally within these single-sex networks. Therefore, the controlled spatial correlations are a better indication of the (maximum) strength of delinquency based influence and selection than the original ones. The fact that the raw and adjusted spatial correlations differ substantially, indicates that much similarity regarding delinquency can be attributed to sex homophily: boys interact with boys, girls with girls. To summarize, controlling for sex makes clear that delinquency based selection and influence processes are substantially less powerful than uncontrolled similarity indices suggest.

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Measuring the Social Capital of Brokerage Roles

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Several researchers (Burt, 1995; Marsden, 1982, 1983; Granovetter, 1973; Homans, 1951, 1974) have stressed the importance of actors who occupy strategic positions in social networks to explain aspects of diffusion processes in social structures: If contacts between two parties are only possible through a third party, the latter can be regarded as being in control of resource flows. Such transmitting actors – often referred to as brokers – play a decisive role in the connectedness of social structures and hence, in determining the existing amounts of social capital available to the members of a network. Although attempts at classification and operationalization of brokerage roles have already been made (Gould and Fernandez, 1989), the integration into a broader theoretical framework – such as social exchange theory – is still to be achieved. Before we redefine to this purpose the Gould and Fernandez' typology of broker roles by making use of Hummell and Sodeur's (1987) census of triadic role patterns (see also Burt, 1990), several aspects of physical capital (such as accumulation, conversion and decay) will be analyzed with regard to their meaning in the different concepts of capital in social sciences (e.g. human capital, cultural capital, social capital). Finally, the validation of the proposed instrument for measuring social capital will be discussed against the back-ground of some empirical evidence.

INTRODUCTION

One reason for the attractiveness of the idea to treat relations as if it were capital is that it offers the possibility to treat the resources of human action in a common conceptual framework. In this regard, the notion of *social production* (Lindenberg, 1989) points to the fundamental meaning of social processes for the thorough understanding of phenomena such as *markets*. Another yet related reason may stem from the possibility to make use of economic concepts such as *price theory* which take into account the dynamical aspects of an actor's deployment of resources to certain ends. In his book *Foundations of Social Theory* James S. Coleman (1994) states that the notion of human capital (Becker, 1993), which stands for the capabilities, knowledge and habits of an individual, is one of the most important and fruitful concepts of the last decades. With regard to the production of human capital, Coleman as well as Bourdieu (1980) stress the productive aspects of social structures, which can therefore also be described as social capital.

In general, two aspects of productivity of social capital need to be distinguished: Whereas authors like Putnam (1995) or Fukuyama (1995) are mainly interested in the collective goods aspect of social capital, other researchers study the way in which social capital may serve as a resource to the individual (Burt, 1995; Lin, 1986) - the assumption here is that "something about the structure of the player's network and the location of the player's contacts in the social structure of the arena provides a

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competitive advantage in getting higher rates of return on investment" (Burt, 1995, p. 8). As Borgatti, Jones and Everett (1998) have pointed out, both distinctions need be made. This has implication in the formulation of a measure for social capital. Until now, tentative efforts in this regard have mostly lead to single measures of social capital exclusively focused on aspects of a network's *closure* or *betweenness* respectively. If one accepts the view that the production of collective goods (such as "trust") often involves strong ties[2], whereas provision of private goods implies more often *weak ties*, two relational aspects are identified which are equally decisive for the formulation of a genuine measure of social capital.

Given the evolutionary primacy of mechanisms of social integration which involves strong ties (that is to say that something needs to be integrated before it is differentiated), the question is raised of how different kinds of social capital come into existence and how they are connected in order to produce an overall integrated structure. Regarding the relation between denser social units, Georg Simmel sometimes used the image of intersecting circles. If the intersection is brought about by a single actor one deals with what might be called a "broker". In this regard brokers are actors that allow or enhance resource flows between otherwise unconnected or only weakly connected actors; as a result they able to gain advantages due to their strategic positions in social networks.

Within the past two decades a number of publications tried to cast light on central aspects of social capital (e.g. Bourdieu, 1980; Coleman, 1988, 1994; Lin, 1982, 1988; Flap and De Graf, 1986; Burt, 1992). Against the background of some of these works it seems that exchange theory as a common theoretical framework for social capital could be of high relevance for the integration of a number of research attempts. With regard to the meaning of the concept of social capital within such a common theoretical setting, the relationship between different concepts of capital (e.g. physical capital, human capital, cultural capital or social capital) need be clarified and similarities as well as differences underlined. In the discussion about the nature of social capital (closure vs. betweenness), two sorts of social capital – support and leverage capital – finally emerge that account for the different relational contents in social networks.

In a second step the characteristics of social capital are used to reformulate the typology of ideal types of brokerage roles of Gould and Fernandez (1990) against the background of Merton's (1968) examinations on Local and Cosmopolitan influentials. In combining the concept of different sorts of social capital with the results of Merton's analysis, the basis for an operationalization of these broker roles is arranged within the framework of Hummell and Sodeur's census of triadic role patterns. After having operationalized different broker roles, the instrument is calibrated by applying it to a small fictitious data set so devised as to take into account a number of difficulties that could impede the identification of brokers. By means of a discriminant analysis the instrument is finally validated before use in the context of an empirical application.

Different Conceptions of Capital

If we accept the idea that human action is generally carried out by using different kinds of resources, the overall importance of the capital concept becomes clear: the notion of capital is a means to

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[2] In this regard one has to differentiate between decentralized and centralized solutions to the collective action problem. Homans (1974, p. 104) describes the strong tie mechanism for the provision of collective goods in a decentralized case: "If multiple individual exchanges among the members of a group are rewarding enough, that fact may increase the similarity among members in the sense that more of them conform to a group norm than we should have expected if the direct reward of conforming, that is, the attainment of a collective good, were the only one at work." The centralized solution is represented through institutions which can be regarded as a "rule enforcing mechanism" in case of absence of strong ties (Elster, 1990, S. 147). See also Flache (1996) for a discussion on the provision of collective goods within dense groups.

explain factors of production when describing social action. As Wellman and Wortley (1990, p. 558-59) have stated, the

> [...] social support that community members provide is a principal way by which people and households get resources, along with market exchanges (as purchases, barter, or informational exchanges), institutional distributions (by the state or bureaucracies as citizenship rights, organizational benefits, or charitable aid), and coercive appropriations (by interpersonal or institutional bullies).

Lindenberg (1989, 1986) has in this regard pointed to the fact that production as well as distribution of status and income as resources for the individual depend on different social structural realities. Furthermore, Lindenberg states that human behavior can be understood as being oriented towards the attainment of two main goals: *physical well-being* and *social approval*. To achieve these two goals, individuals use resources on which they have either direct control or to which they have indirect access through other persons. The notion of capital accounts for the variety of different resources. It unites them in a single category that allows an analysis of aspects such as accumulation or substitution of resources for the benefit of a person's situation with regard to the main objectives: physical well-being and social approval.

For a more systematic idea of social capital characteristics, the similarities and dissimilarities of different capital concepts are studied followed by the examination of aspects of capital like *accumulation*, *duration of accumulation, possibilities of substitution, duration of decay and transferability*.

Human Capital

Examples of the use of economic concepts in the field of social phenomena were often provided by economists themselves. Gary Becker's (1993) formulation of the human capital concept for example tries to explain social phenomena in terms of the neoclassical terminology of markets. In this context, the private household is not solely regarded as a place of private consumption but it occupies a productive function in the economy, too: By making use of different resources it contributes to the socialization of individuals.[3] Therefore, in a manner similar to enterprises, households can be regarded as investors in fixed assets, long lasting goods and capital thus ensuring to household members a part on the labor market. The human capital stock of a person is the result of the knowledge and capabilities acquired in the family as well as on the education or labor market. The amount of human capital a person accumulates is therefor the result of his "overall" market behavior. In other words, individual decisions on investment and consumption are decisive as regards the size of a person's human capital stock. From this perspective time is held as a scarce resource for individual productivity in relation to human capital. As Becker (1982) states, not only is it important to acknowledge that productivity of non-market time influences consuming behavior but also that the effect of human capital on the non-market production is a source of returns from investments in human capital.

Wellman and Berkowitz (1988, p. 11) comment on the concept of human capital and point to one of its major shortfalls with regard to its explanatory power for structural analysis:

> If social factors enter into conventional studies of mobility at all, it is because persons with similar attributes possess similar resources and motivations and hence move through social systems in similar ways. Human capital theory (Becker, 1975) and the

[3] Becker (1993, p. 21) points out that "No discussion of human capital can omit the influence of families on the knowledge, skills, values, and habits of their children. [...] Large differences among young children grow over time with age and schooling because children learn more easily when they are better prepared".

> classic Wisconsin studies of intergenerational mobility (Sewell, Haller and Portes, 1969) are based on this model. Although such models often deal with large aggregates, their underlying assumptions are derived from the experiences of persons moving through the system as apparently isolated individuals.

This criticism underpins the necessity of taking into account an actor's connections (as well as the relations between those contacts) in order to arrive at a proper structural account of social phenomena – this aspect is at the core of the proposed measurement procedure for social capital which will be clarified further in the discussion.

Clearly, the general possibility of *accumulation* of human capital exists in a manner similar as to physical capital. The same seems to hold for the *duration of decay* of capital stocks; as with physical capital high rates of human capital decay seem possible - for example one may think of drastic shifts in labor market demand, often requiring additional or even totally new qualifications of former job holders. However, one difference between human and physical capital is the *higher duration of accumulation* in human capital. A higher education starts to pay off only from the moment one gets the right job whereas physical capital is immediately active and effected by the dynamics of markets. A human capital stock is ultimately associated with a certain actor, human capital as an objective quality exists only in connection with its bearer. This is why human capital is considered of limited *transferability* and *substitutability*. The question of how far human capital can be transferable rests on the similarity of fields of investment. Something similar to transferability of human capital exists only if knowledge and skills acquired in one field of action can be used in other fields.[4] For the same reasons there are limited possibilities for substitution of human capital; because of the scarcity of the production factor time, individuals cannot substitute human capital as easily as physical capital.

Cultural Capital

In the fields of neo-Marxism Bourdieu and Passeron (1977, p. 30) formulated the concept of cultural capital which refers to the "cultural goods transmitted by the different family PAs (pedagogical actions) whose value qua cultural capital varies [...] within different groups or classes." From this* perspective capital is interpreted as being attached to social characteristics such as status or social class. The emergence of cultural capital has thus to be thought of in the context of the development of social classes. In the theoretical tradition point of view of the Marxist doctrine, availability of capital in general is just a problem of being a member of a certain social class which determines the quantity that can be accumulated by an individual. Prevailing inequalities with regard to possession of cultural capital lead to an intensification of property conditions. Therefore, not only the generation, but also *accumulation* and *transferability* of cultural capital are regarded as being phenomena immanent to social strata.

Because the dynamic processes between social classes always lead to a reproduction of certain distribution patterns of resources, the existing power structure is continuously reestablished. The pedagogical work in education is understood as a means by which the leading class designates the governed people social positions.[5] Bourdieu also uses several other capital terms in this context like symbolic or linguistic capital (Bourdieu, 1992) which can be understood as productive factors for

[4] The principle non-transferability of human capital is also stressed by Milgram and Roberts (1993, p. 313):"A person's skills and knowledge are assets that can only be owned by the person alone. In the absence of slavery, workers are not free to transfer ownership rights permanently to someone else. The non-transferability of human capital is problematic when those skills are specific to an organization or physical assets."

[5] Diekmann (1993) refers from this apparent proximity to human capital theory that cultural capital can be understood as a specific form of human capital.

cultural capital. In this regard an official language may be seen as linguistic capital that assures certain people symbolic power. Because these factors can be interpreted as having by and large properties similar to cultural capital, they are not dealt with seperately. Accordingly, cultural capital may – in opposite to physical capital – be characterized by its enormous *time span of decay* since it passes on from one generation to the next in certain classes.

Against the background of this short summery it is clear that s*ubstitution* of cultural capital seems almost impossible. The acquired competencies of individuals are determined through the membership of a social class. One possible substitution of cultural capital in the Marxist theory may be found in the idea of a revolution that unifies cultural capital in a classless society. The transfer of cultural capital also seems impossible due to its specificity; the members of a social class have no possibilities to use their cultural capital on other markets.

Social Capital

For Coleman (1988) the concept of social capital holds the promise of reconciling the social structural aspects that are stated in sociological theories with the rational choice model of economics in a common conception.[6]

Based on a theory of rational action in which every actor has a) control over some resources and b) interest in resources that are controlled by others, social capital is a special resource that allows – as with physical and human capital – certain actions that would otherwise have been impossible. The concept of social capital is fundamentally based on *relational* aspects of actors as opposed to human capital which describes a given equipment of resources as an individual attribute. By connecting the idea of social capital with insights from behavioral psychology, Homans (1974, p. 363) stresses the general importance of social capital in the development of institutions:

> All of these innovations, whether at the top of society or at the bottom, possess the following characteristics. They require some form of social capital before men can attempt them at all, for their payoffs at best are not immediate but deferred. The capital must increasingly take the form of generalized rewards like money or status, generalized in the sense that leaders can distribute them so as to induce people to perform some mix of a wide variety of activities.

Social capital like physical capital can be found in different sectors and in diverse forms. The common characteristic is always the idea that the available quantity of such resources determines the scope of human activity. Whereas physical capital as a quality can exist distant from specific individuals, social capital refers to different social structural characteristics of individuals. In addition to its emergence as collective goods, social capital also accounts for the quantity of relations that an individual might manipulate to specific ends. Therefore, two sectors of social life are differentiated: in one sector, social capital is generated and maintained as an unintended consequence of human action. This kind of social capital is often called "support capital." Support capital is constituted of relations between people socially similar and serves mainly as the emotional stabilization of individuals.

In the other sector, social capital appears as an instrumental resource that allows actors to make use of it to certain intended ends, so as to improve their occupational carriers (N. Lin, M. Ensel and J.C. Vaughn, 1981); in this case the term "leverage capital" is frequently used. By connecting this dichotomy with the previously mentioned idea of Lindenberg of the universal goals of human action, one

[6] Coleman (1988, p. 95) regards social capital as part of a general theoretical strategy in which we are "taking rational action as a starting point but rejecting the extreme individualistic premises that often accompany it. The conception of social capital as a resource for action is one way of introducing social structure into the rational action paradigm."

could say that social approval is the core of support capital and that the strive for physical well-being is the basic ingredient for leverage capital. More will be said about this systematic in the context of a discussion on broker roles.

Support capital is typically generated in informal groups with dense relations that are the result of a high frequency of interaction between socially similar persons. Therefore, such a setting allows only modest possibilities for an *accumulation of support capital,* due to restricted time resources of individuals. The expression of a high similarity between the group members suggests that in addition there are no large status differences within such groups because of a similar resource access for all members. The *time span of decay for support capital* is assumed, for the same reasons, to be very lengthy. Because of the high time consuming investment in socio-emotional relations, people are little inclined to break up such relations. Lastly, *transferability* and *substitution* of support capital are both problematic. Again, the fact of having a restricted time budget gives way to the assumption that support capital can be transferred only under considerable time commitments. With regard to substitution, one possible compensation can be an intensification of other existing relations in a socio-emotional context. Nonetheless, possibilities for substitution of support capital appear to be rather scarce.

Leverage capital comes into existence when an increasing differentiation of a group (as a result of its size) leads to growing distances with less frequent interactions between some of the group members. With widening gaps between smaller groups of high internal density, structural holes (Burt, 1992) come into existence allowing actors that bridge such gaps to exploit weaker relations for their own sake. Because of a lower time expenditure necessary for keeping often highly formal relations going on, *accumulation of leverage capital* seems much easier than is the case of support capital, and also leaves more space for status differences. Since one of the main reasons to keep up relations that serve instrumental interests is the flow of scarce resources, the *time span of decay for leverage capital* is assumed to be relatively short.[7] The moment one can obtain the same resources for a lower commitment, the former relation is likely to break up. Contrary to what has been said with regard to support capital, *transfer* and *substitution* of leverage capital can broadly be understood as being unproblematic and somehow close to what defines physical capital. Their transfer for use on different markets seem possible.

Table 1 on the next page adds up the aspects of the different capital conceptions discussed so far.

Brokerage Roles and Social Capital

The idea of different sectors or spheres of social action also plays an important role in Merton's (1968) research on brokers (or "influentials" in his terminology) in an American community ("Rovere-town"). Due to their structural embeddedness, Merton distinguishes two sorts of brokerage roles refered to as *Locals* and *Cosmopolitans.* The difference between these two types stems from how they are oriented towards Rovere:

> The Localite largely confines his interests to this community. Rovere is essentially his world. Devoting little thought or energy to the Great Society, he is preoccupied with Local problems with the virtual exclusion of the national and international scene. [...] Contrariwise with the Cosmopolitan type. He has some interest in Rovere and must of course maintain a minimum of relations within the community since he, too, exerts influence there. But he is also oriented significantly to the world outside Rovere, and regards himself as an integral part of that world. (Merton, 1968, p. 447).

With regard to the dynamics of social process it can be assumed that Locals are particularly important in the integration of a group while the Cosmopolitan comes into existence as a result of social differ-

[7] Burt (2001) speaks in a similar vein of "bridge decay."

entiation: In this sense, the Local guarantees the group members a common base to interpret the "outside world" by highly frequent interactions. As the group becomes larger, the number of contacts between its members drops down as a result of scarce time resources. With the departure of individuals who now find themselves members of different groups, gaps or structural holes appear filled out by Cosmopolitans. If the Cosmopolitan is the only possible connection between groups and if some resources become scarce (e.g. *information*), then the returns for the Cosmopolitan are increased, having provided resources, and his status raised.

The differences in the orientation of the two types of influentials are equally reflected from their positions on the network as well as their exchange relationships. Whereas the Local stands in the center of frequent exchange relations to socially similar others, visible to one another, exchanging similar resources (hence, not scarce), the Cosmopolitan connects to more remote actors themselves unable to reach one other. As the actors connected to Cosmopolitans are not directly reachable, the resources flowing from one to another via a Cosmopolitan can be regarded as scarce resources. The Local is engaged in exchange relations with actors connected to one another who dispose of similar resources. Thus, because all concerned are socially similar, the possibilities of realizing social capital gains that allow accumulation are restricted. The social capital of a Local is a specific group resource which is the result of reachable connecting actors, but not perfectly connected - possibly due to minimal time commitments.[8] Therefore, the Local can be perceived as having mainly control over the previously mentioned support capital which is a productive factor for social approval.

Table 1: Characteristics of different capital conceptions

	Possibility of Accumulation	Relative Time Span of Accumulation	Relative Time Span of Decay	Degree of Generalization
Physical Capital	Yes	Short	Short	High
Human Capital	Yes	Long	Short	Low
Cultural Capital	Restricted	Long	Long	Low
Social Capital as Support Capital	Restricted	Long	Long	Low
Social Capital as Leverage Capital	Yes	Short	Short	High

(Due to their significance in the degree of generalization of capital, transferability and the possibility of substitution are treated here as one category.)

From what has been said hitherto, it appears that two defined sorts of social capital can be attributed to two kinds of brokerage roles: In the context of socio-emotional relations in particular, Locals are brokers making extensive use of support capital, whereas relations of a higher instrumental content establish leverage capital handled by Cosmopolitans.[9]

Obviously, to measure the social capital of Locals and Cosmopolitans one needs information on their relations as well as on the actors with whom they are connected; more detailed descriptions of brokerage roles are necessary.

[8] In this sense the fact of not being (strongly) connected is not a matter of structural peculiarity – the option to build or intensify such a direct relation exists for both actors while it is in a latent state.

[9] Of course, differentiating between socio-emotional and instrumental contents of relations is rather a gradual more than a categorical affair.

Concepts of Brokerage Roles

As previously mentioned, if actors with whom the Cosmopolitan relates are amongst themselves not directly reachable, then a scarce resource is formed utilized by the Cosmopolitan. Hence, because of his competence to control resource flows between actors, the Cosmopolitan can realize higher rates of return in his exchange relations than the Local. With regard to the distinction of different sorts of social capital, one may say that the Cosmopolitan has leverage capital at his disposition which is a productive factor for physical well-being.

The integration of both sorts of social capital within a network results from the relational connection between Locals and Cosmopolitans: The fact that the Local is more interested in high *quantities* of relations (which constitute his support capital stock), he likely will maintain contacts with actors unconnected to the rest of the members of his group. This opens up the opportunity to contact the Cosmopolitan, who is in turn more interested in the *quality* of a contact. In comparison to a Local, the Cosmopolitan gains remote access to the group without being an immediate member of it. Until now, the notion of a "group" has been used in an undefined manner. In order to clarify the relational contexts of brokers, sociometric "cliques" are described as entities of higher relational densities which constitute larger groups. From this point of view, Cosmopolitans are considered as *brokers between different cliques.* They equally connect these cliques indirectly via relations to Locals as *brokers within such cliques.* Together with the theoretical relational characteristics of the Local, a Clique is defined as a *recursive 2-clique*: In this clique, each member can be reached by the others with a maximum of two steps, whereby all paths of length two involve identical third actors. Thus, while the Local might reach *every* clique member in one step and vice versa, clique members sometimes contact one another through the Local (two steps).

Because a proper analysis on influence relations has to take into account the direction of resource flows, the following operationalization of broker roles is based on directed relations. In general such relations can be differentiated according to their strength. Following Granovetter's (1973, p. 1361) definition, the strength of a tie "is a (probably linear) combination of the amount of time, the emotional intensity, the intimacy (mutual confiding), and reciprocal services which characterize the tie." By adopting this view and relating it to the above mentioned dichotomy of social capital, strong (symmetric) relations can be distinguished from weak (asymmetric) relations, whereas the former – in the sense of support capital – accounts for a higher degree of these factors, the latter – in the sense of leverage capital – refers to smaller amounts.

The operationalization of brokerage roles is unterstood in accordance with Marsden's statement (1982, S. 202) that "any brokered exchange can be thought of as a relation involving three actors, two of whom are the actual parties to the transaction and one of whom is the intermediary or broker." By taking up Gould and Fernandez' (1989) typology of broker roles and conceptualizing it within the *census of triadic role patterns* (Hummell and Sodeur, 1987; Burt, 1990) the position of an actor is described on the basis of his relations to two alters as well as the relation between those alters.

The Local

To begin with the Local type two triadic positions[10] are identified depicting the relations of a Local within the previously defined clique:

[10] All numberings of triadic positions correspond to Burt's (1990) representation of the census of triadic role patterns. All positions are described from the perspective of "ego" as the underlined actor on the left.

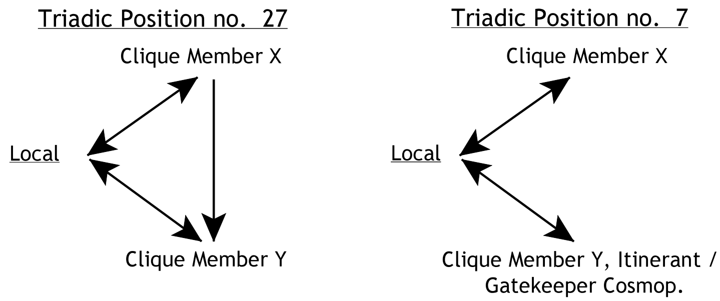

Figure 1. Triadic positions of Local in relation to clique members within a recursive 2-clique and in relation to an Itinerant / a Gatekeeper Cosmopolitan.

Against the background of the above description of the relational characteristics of a Local, we defined symmetric relations between this broker and the clique members. The broker potential stems from weak (position no. 27) or nonexistent relations (position no. 7) between socially similar alters.

In anticipation of the operationalizations of cosmopolitan roles, two triadic positions are referred to (no. 7, which has already been shown above, and no. 10) that depict the relation between a Local, a clique member and different types of Cosmopolitans. Depending on the kind of Cosmopolitan role with which a Local has contact, the relation can be described as symmetric (strong) or asymmetric (weak).

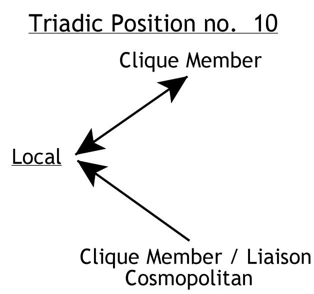

Figure 2. Triadic position of Local in relation to clique members and Gatekeeper / Liaison Cosmopolitan.

Due to the reflections on the relational characteristics of a Local, two kinds of brokers are differentiated:[11]

- Locals without contacts with Cosmopolitans; in this case, according to Gould and Fernandez they are known as ***Coordinator*** Locals (which deal with "isolated" cliques);
- Locals in relation to Cosmopolitans, which are called ***Representative*** Locals.

The Cosmopolitan

Depending to what degree a Cosmopolitan is able to monopolize his capacity to connect otherwise unconnected Cliques, he can realize higher rates of returns in providing scarce resources, which is constitutive of a higher status. An important characteristic between the high status of a Cosmopolitan and of a Local lies in the continuous provision of scarce resources by the Cosmopolitan, whereas the returns in form of support capital are transmitted out of the clique via the Local only from time to time.

[11] It should be stated, however, that these Local roles are practically identical. The only distinguishing aspect lies in the existence or non-existence of a relation to a Cosmopolitan.

However, in case of availability of alternative Cosmopolitan services for Locals the returns for Cosmopolitans drop off rapidly due to the diminished scarcity of the goods provided. In this situation the Cosmopolitan – for whom the relation is still advantageous even if his returns are reduced – might compensate losses in gain from purely instrumental leverage capital by substitution of leverage capital through an increase of socio-emotional support capital. Concerning the relational characteristics of a Cosmopolitan, this compensation takes place by turning weak (asymmetric) outgoing ties (which characterize the higher Cosmopolitan status) to the Locals into strong (symmetric) ties (which account for no particular status differences). This process results from the availability of alternative Cosmopolitan services to Locals. In other words, subject to the offer of Cosmopolitan services, mechanisms of integration can become active leading to the establishment of a strong tie between Cosmopolitan and Local.

As a consequence of these substitution effects, different Cosmopolitan roles of various respective status seem possible. The more a Cosmopolitan maintains (asymmetric) relations of high instrumental content (leverage capital), the higher his status. Contrariwise, the more leverage capital becomes substituted through (symmetric) relations of socio-emotional content (support capital), the more the status of the Cosmopolitan declines. A general characteristic of all Cosmopolitan roles lies nonetheless in the unconnectedness of the Representative Locals to whom they are directly connected.

To begin with a Cosmopolitan of a high status level, the ***Liaison*** Cosmopolitan, the following triadic positions can be identified:

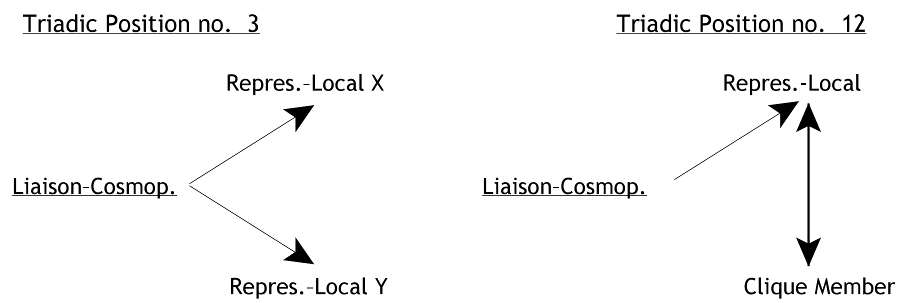

Figure 3. Triadic positions of a Liaison Cosmopolitan.

Due to the fact that the Liaison Cosmopolitan often provides scarce resources for Locals who are themselves not connected, his relations are described as asymmetric outgoing relations (position no. 3).[12] Position no. 12 describes the relation between the Liaison Cosmopolitan, a representative Local and a respective clique member from the perspective of the Cosmopolitan (see above also position no. 10 for the same aspect from the perspective of the Local).

In case of substitution of leverage capital through support capital in relation *to only one* representative, a second version of the Cosmopolitan appears who, according to Gould and Fernandez, is called the ***Gatekeeper*** Cosmopolitan shown in Figure 4.

[12] To be certain, the depiction of these relations as asymmetric does not imply that the Cosmopolitan receives nothing in return for his services. The support capital supplied by cliques from time to time (via a Local), may be used by the Cosmopolitan as an instrumental resource on another "market" - to clarify this, one may think of a Cosmopolitan as a politician that supplies scarce resources for certain interest groups (cliques). In return for his services the local might spread the slogan for whom to vote while the members of the interest groups vote at a given moment for the favored politician. From the perspective of the respective clique members, the Cosmopolitan provides leverage capital for which they provide support capital in return. Note however, that this support capital may be used by the politician as leverage capital for gaining access to certain formal positions.

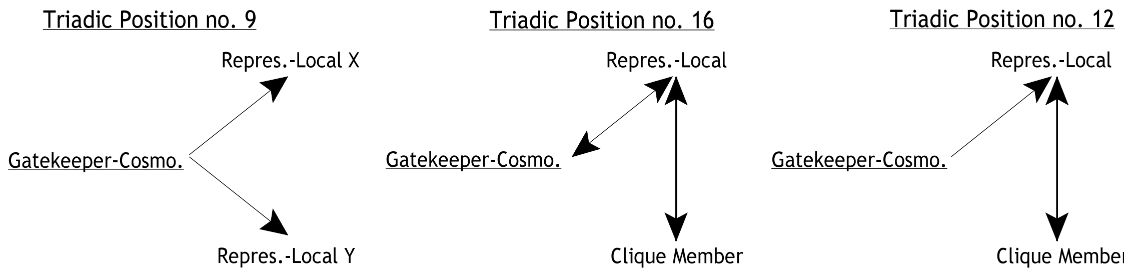

Figure 4. Triadic Positions of Gatekeeper Cosmopolitan in relation to two representative Locals, and in relation to representative Local and respective clique member (with either symmetric or asymmetric relation to representative).

Position no. 9 reflects the generic relational situation of a Gatekeeper Cosmopolitan in relation to Representative Locals. Position no. 16 depicts the relation between a Gatekeeper, a representative and a clique member situated in a symmetric relation (more socio-emotional content / support capital) between the Gatekeeper and the representative, while position no. 12 shows the same actors situated in an asymmetric relation (leverage capital) between the latter two. Partly due to substitution of leverage capital through support capital, the Gatekeeper is of lower status than the Liaison Cosmopolitan.

Finally, if the substitution of leverage capital through increasing amounts of support capital takes place simultaneously in relation to more than one Representative, the Cosmopolitan has a low status level that it appears - with regard to his resource settings - almost similar to all other clique members. This is the case for the ***Itinerant*** Cosmopolitan shown in Figure 5.

Because of the high integrative forces to which the Itinerant cosmopolitan is exposed, this Cosmopolitan role is not likely to be very stable. In fact, on the basis of Cartwright and Harary's (1956) generalizations of Heider's (1946; 1958) Theory of cognitive balance, one could suppose that in this setting a tendency to establish a relation between the unconnected representatives is shown.[13] Once the direct contact between the former unconnected representative Locals is initialized, the Cosmopolitan role ceases to exist.

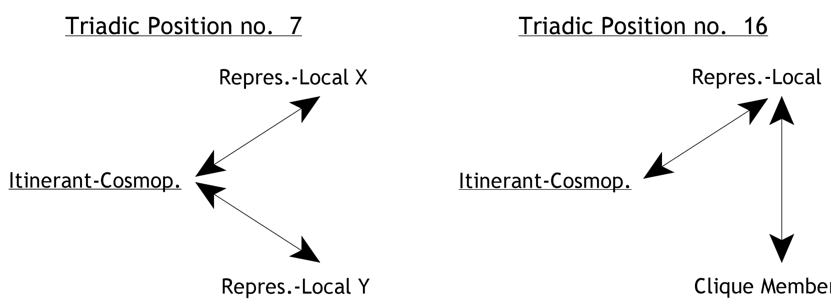

Figure 5. Definition of triadic positions of Itinerant Cosmopolitan

[13] In addition to the depiction of the relations of an Itinerant Cosmopolitan to two Representatives, position no. 7 was also used above to account for the relations between a Local and clique members. In fact, there seems to be something like a "supra clique" in the integration process of an Itinerant Cosmopolitan, which can equally be understood as a process of integration of different cliques into a new social entity. The supra clique seems to establish the core of a new Clique with the former Itinerant Cosmopolitan in its middle, probably as the Local of the new clique (for a more detailed account, see Täube, 2001).

Adjustment of the instrument

In the course of the operationalization of the ideal types of broker roles, a number of identical triadic positions are used to account for different aspects of different brokers. Because the above-defined positions for each respective broker have to be united in a multivariate analysis, identification problems for broker roles should considerably be reduced. However, the instrument will be tested on a small fictitious data set which was constructed around possible misinterpretations in the context of detecting the defined triadic positions. Problems may arise because of non-systematic distortions, which can result from the relations of actors of no particular interest in our analysis (e.g. relations of clique members or brokers to otherwise isolated actors in the network), or from the previously stated definition of identical triadic positions of some broker roles (Local-Itinerant / pos. 7, Itinerant-Gatekeeper / pos. 16).

We constructed a thirteen person network in order to clarify further these problematic issues. The graph for the network is shown in Figure 6 and a binary matrix is in Table 2.

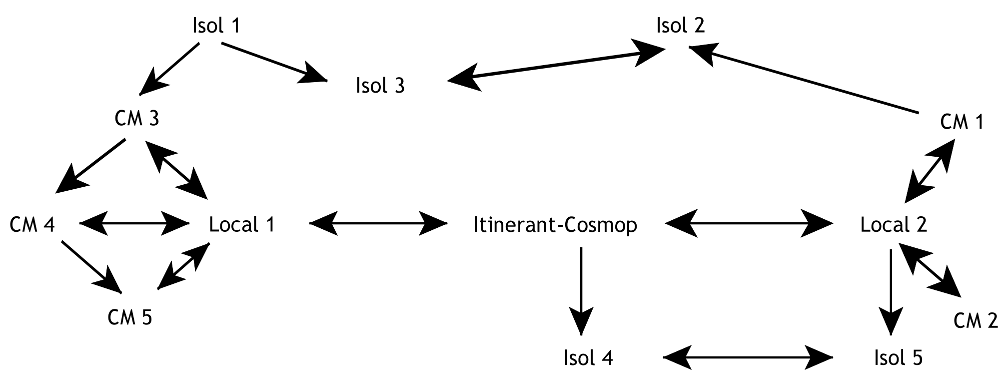

Figure 6. Fictitious thirteen-person network with problematic triads

Legend: Isol = isolated actor (no clique member)
CM = ordinary clique member (no broker)

As can be seen in the graph, the network is constructed around three recursive 2-cliques:

<u>(Supra-)Clique 1:</u> Local1, Itinerant-Cosmopolitan, Local2

<u>Clique 2:</u> Itinerant-Cosmopolitan, Local1, CM3, CM4, CM5

<u>Clique 3:</u> Itinerant-Cosmopolitan, Local2, CM1, CM2

Whereas brokers Local1, Local2, and the Itinerant can – following our definitions – be identified as *de facto* brokers, a number of actors appear erroneously in triadic positions of brokers:

Problem 1) - Iso1 (appears as Liaison): In triadic position no. 3 (relation to CM3/symmetric and Iso3/asymmetric); in triadic position no. 12 (symmetric relations between CM3 and Local1; null-relation between Iso1 and Local1; or, symmetric relation between Iso3 and Iso2 and null-relation between Iso1 and Iso2).

Problem 2) - Local2 (appears as Itinerant and Gatekeeper): In triadic position no. 7 (symmetric relations to Itinerant, CM1 and CM2); in triadic position no. 16 (relation between Itinerant and Local1); in triadic position no. 9 (symmetric relations to Itinerant, CM1 and CM2, asymmetric relation to Iso5); in triadic position no. 12 (asymmetric relation to Iso5, symmetric relation between

Iso4 and Iso5, and null-relation between Local2 and Iso4); in triadic position no. 16 (symmetric relation between Itinerant and Local1, and null-relation between Local1 and Local2).

Problem 3) - CM1 (appears as Gatekeeper): In triadic position no. 9 (relation to Iso2/symmetric and Local2/asymmetric, null-relation between Iso2 and Local2); in triadic position no. 12 (asymmetric relation to Iso2, symmetric relation between Iso2 and Iso3, and null-relation between CM1 and Iso3); in triadic position no. 16 (symmetric relation between Local2 and Itinerant, null-relation between CM1 and Itinerant).

Problem 4) - Itinerant Cosmopolitan (appears as Gatekeeper): In triadic position no. 9 (symmetric relation to Local1 and Local2, asymmetric relation to Iso4); in triadic position no. 12 (asymmetric relation to Iso4 and null-relation to Iso5, null-relation between Itinerant and Iso5); in triadic position no. 16 (symmetric relations between Local1, CM3, CM4, CM5 and null-relations between Itinerant and CM3, CM4 and CM5, symmetric relations between Local2, CM1, CM2 and null-relations between Itinerant and CM1, CM2).

Having acknowledged these potential problems as to the detection of broker roles through the census of triadic role patterns, our constructed network will now be analyzed by means of the defined triadic positions from the user perspective.[14] Consequently, we hope to gain further insight into the reliability of the classification procedure.

Clique Detection

Before being able to calculate the recursive 2-Cliques within *UCINET* (Borgatti, Everett and Freeman, 1992), one has to symmetrize first the original binary matrix of the network (which contained symmetric and asymmetric relations) and deleting the remaining asymmetric relations.[15] Then one calculates (1-) Cliques in *UCINET* in order to get the recursive 2-Cliques. The results are shown on the next page.

Table 2. Binary table of a fictitious 13 actor network (Figure 6) with problematic triadic positions.

Person Id.	Loc1	Loc2	Itin.-C.	CM1	CM2	CM3	CM4	CM5	Iso1	Iso2	Iso3	Iso4	Iso5
Loc1	0	0	1	0	0	1	1	1	0	0	0	0	0
Loc2	0	0	1	1	1	0	0	0	0	0	0	0	1
Itin.-C	1	1	0	0	0	0	0	0	0	0	0	1	0
CM1	0	1	0	0	0	0	0	0	0	1	0	0	0
CM2	0	1	0	0	0	0	0	0	0	0	0	0	0
CM3	1	0	0	0	0	0	1	0	0	0	0	0	0
CM4	1	0	0	0	0	0	0	1	0	0	0	0	0
CM5	1	0	0	0	0	0	0	0	0	0	0	0	0
Iso1	0	0	0	0	0	1	0	0	0	0	1	0	0
Iso2	0	0	0	0	0	0	0	0	0	0	1	0	0
Iso3	0	0	0	0	0	0	0	0	0	1	0	0	0
Iso4	0	0	0	0	0	0	0	0	0	0	0	0	1
Iso5	0	0	0	0	0	0	0	0	0	0	0	1	0

[14] It should be noted that the Local, Itinerant, Clique members etc. names are kept for our actors even if one pretends ignoring their present function in the network.

[15] The preparation of the binary matrix to use in *UCINET* was done in *NEWSTEP* (Sodeur, 1984).

CLIQUES

```
Max Distance (n-): 1
Minimum Set Size:  3
```

3 1-cliques found:

```
   1:  Loc1 Itin.-C CM3 CM4 CM5
   2:  Loc1 Loc2 Itin.-C
   3:  Loc2 Itin.-C CM1 CM2
```

Group Co-Membership Matrix

```
                                    1 1 1 1
             1 2 3 4 5 6 7 8 9 0 1 2 3
            LoLoItCMCMCMCMCMIsIsIsIsIs
             - - - - - - - - - - - - -
 1     Loc1  2 1 2 0 0 1 1 1 0 0 0 0 0
 2     Loc2  1 2 2 1 1 0 0 0 0 0 0 0 0
 3 Itin.-C   2 2 3 1 1 1 1 1 0 0 0 0 0
 4      CM1  0 1 1 1 1 0 0 0 0 0 0 0 0
 5      CM2  0 1 1 1 1 0 0 0 0 0 0 0 0
 6      CM3  1 0 1 0 0 1 1 1 0 0 0 0 0
 7      CM4  1 0 1 0 0 1 1 1 0 0 0 0 0
 8      CM5  1 0 1 0 0 1 1 1 0 0 0 0 0
 9     Iso1  0 0 0 0 0 0 0 0 0 0 0 0 0
10     Iso2  0 0 0 0 0 0 0 0 0 0 0 0 0
11     Iso3  0 0 0 0 0 0 0 0 0 0 0 0 0
12     Iso4  0 0 0 0 0 0 0 0 0 0 0 0 0
13     Iso5  0 0 0 0 0 0 0 0 0 0 0 0 0
```

HIERARCHICAL CLUSTERING

```
                              1 1 1 1
Level   1 2 3 4 5 6 7 8 9 0 1 2 3
-----   - - - - - - - - - - - - -
    2   XXXXX . . . . . . . . . .
    1   XXXXXXXXXXXXXXX . . . . .
    0   XXXXXXXXXXXXXXXXXXXXXXXXX
```

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Figure 7. UCINET-output for detection of cliques.

The "Group Co-Membership Matrix" gives an overview of the frequencies in which each pair of actors appears in one or more of the three cliques. As can be seen under the column "hierarchical clustering", there seems to be a relative high degree of resemblance between actors no. 1, 2 and 3 *due to their pair wise affiliation to cliques*.

Detecting Brokers with the census of triadic role patterns[16]

After having detected the cliques of our 13 actor network, the census of triadic role patterns is calculated in *NETZDIAL*. By applying a multivariate classification procedure such as k-means cluster, a first impression is given of the classification power of the census: If brokers can be seen as actors with certain structural characteristics that are described within a triadic setting, identical broker roles must be contained within the same clusters. In this sense, actors are grouped on the basis of their resembling ties to their structural environment. At first, the results of the procedure with five clusters are presented as they are able to account for Liaison, Gatekeeper and Itinerant Cosmopolitans as well as for Locals and Non-Brokers.

As is evident in Table 3, the differentiation of broker roles based solely on triadic positions is not overall successful. Besides the fact that the two Locals appear as members of different clusters, CM1 and the Cosmopolitan also occur in a common cluster.[17]

From these results the conclusion is that some additional defining characteristics for broker roles are needed. These additional characteristics introduced *centrality measures* should supplement the census of triadic role patterns in order to increase the power of the instrument.[18]

[16] Although the presented 13 actor network here only shows the Itinerant Cosmopolitan, the actual analysis was repeated with the Gatekeeper and the Liaison, located at the same place in the network as the Itinerant. These settings showed no substantial differences between Itinerant and Liaison Cosmopolitans and only slight differences for the Gatekeeper with regard to the presented results.

[17] From the perspective of ignoring the actual functions of the members in the network, it is not certain that Cluster no. 4 contains no other brokers. Therefore, the original analysis proceeded by reducing the number of clusters to four and, finally, to three clusters allows further differentiation.

[18] With the introduction of centrality measures we pass from triadic on to dyadic characteristics of actors.

Table 3. K-means cluster classification on the basis of triadic role patterns with five clusters.

Case Number	Actor	Cluster	Distance
1	Local1	1	0
2	Local2	2	0
3	Itinerant	3	0
4	CM1	3	2.466
5	CM2	5	2.424
6	CM3	5	1.405
7	CM4	5	2.096
8	CM5	5	2.424
9	Iso1	4	0
10	Iso2	5	0
11	Iso3	5	0
12	Iso4	5	0
13	Iso5	5	0

The Inclusion of Centrality measures

For the purpose at hand, the measure of closeness-centrality (Freeman, 1979) was chosen as well as betweenness-centrality (Sodeur, 1987). Firstly, closeness centrality is used for the general distinction between brokers and non-brokers on one hand and for the differentiation between Locals and Cosmopolitans on the other hand.[19] To calculate the closeness-centrality, longer geodesic distances play a smaller role than do short geodesics. Therefore, Locals are expected to show higher closeness-centrality values due to their capacity to reach all members of their clique within one step, whereas Cosmopolitans need at least two steps to reach clique members. In addition to the previously defined triadic positions, the following descending succession of actors is expected with respect to closeness-centrality values:

1. Local
2. Cosmopolitan
3. Non-Brokers

The calculation of betweenness centrality which is based on geodesics can erroneously lead to higher betweenness values of Locals compared to Cosmopolitans. Thus, one refers to a betweenness-centrality measure that counts geodesics between two actors on which a third person lies, but that also rests on *all contacts* of a person realized through third (intermediate) persons. Such a betweenness measure is provided in *NETZDIAL* (Sodeur, 1987). In the case of the Liaison Cosmopolitan, no members of a clique can reach those of another clique via this Cosmopolitan. Therefore, we make use of this betweenness measure mainly to differentiate the Itinerant from the Gatekeeper Cosmopolitan. With regard to the described ability to connect different actors, the following descending order of betweenness-values is expected for actors:

1. Itinerant
2. Gatekeeper
3. Local
4. Liaison / Others

[19] Closeness centrality has been calculated by means of UCINET IV. (Borgatti, Everett and Freeman, 1992).

Through repeated cluster analyses using triadic role patterns *and* closeness measures with different numbers of clusters (5, 4 and 3 clusters), solutions were found, of which only the main one is presented:

Table 4. K-means cluster classification on the basis of triadic role patterns and closeness measures with three clusters.

Case Number	Actor	Cluster	Distance
1	Local1	1	0
2	Local2	1	0
3	Itinerant	1	0
4	CM1	2	2.466
5	CM2	2	2.424
6	CM3	2	1.405
7	CM4	2	2.096
8	CM5	2	2.424
9	Iso1	3	0
10	Iso2	2	0
11	Iso3	2	0
12	Iso4	2	0
13	Iso5	2	0

As is evident in Table 4, Locals and Cosmopolitan are grouped within a common cluster in a setting with three clusters. The assignment of actor no. 9 (Iso1) to a proper cluster is still problematic and could indicate the presence of another broker in the network.

The last step in the procedure consists in the examination of the relational characteristics of the individual actors which were so far identified as potential brokers.[20] At this point in the analysis, a potential Local is regarded as true if he has the kind of relations to or from a Cosmopolitan which has already been described through the triadic positions above. In turn, a certain Cosmopolitan can be perceived as true if he shows the respective relations to or from a Local.[21] This procedure allows one to finally determine the different kinds of brokers that actually exist in the network.

For the possible brokers of the 13 actor network shown in Table 3 the following *incoming* relations can be noted:

<u>Actor no.1 (Local1)</u>
Incoming relations node no: 1
From actors: 3, 6, 7, and 8

<u>Actor no. 2 (Local2)</u>
Incoming relations node no: 2
From actors: 3, 4, and 5

<u>Actor no. 3 (Itinerant-Cosmo)</u>
Incoming relations node no: 3
From actors: 1, 2

<u>Actor no. 9 (Iso1)</u>
Incoming relations node no: 9
From actors: none

Obviously, actor no. 1 (Local1) and actor no. 2 (Local2) show one incoming relation from a possible broker (actor no. 3 / Itinerant Cosmopolitan). Because actor no. 9 shows no incoming relations, the only possible broker role for this actor might be the Liaison role.

[20] The identification of incoming and outgoing relations was conducted by means of *NETZDIAL*.

[21] This procedure resembles the determination of an actor's coordinates on the Eigenvectors.

The *outgoing* relations of these actors are as follows:

Actor no.1 (Local1)
Outgoing relations node no.: 1
To actors: 3, 6, 7, and 8

Actor No. 2 (Local2)
Outgoing relations node no.: 2
To actors: 3, 4, 5, and 13

Actor No. 3 (Itinerant-Cosmopolitan)
Outgoing relations node no.: 3
To actors: 1, 2, and 12

Actor No. 9 (Iso1)
Outgoing relations node no.: 9
To actors: 6, 11

Actors no. 1 (Local1) and no. 2 (Local2) show respectively only one outgoing relation to a possible broker and therefore have to be classified as Representative Locals. Actor no. 3 (Itinerant Cosmopolitan) shows two outgoing relations to the potential Representative Locals and can thus be identified as an Itinerant Cosmopolitan. The remaining actor no. 9 (Iso1), till now regarded as a potential Liaison Cosmopolitan shows no outgoing relations to actors identified as possible Locals, and consequently has to be classified as a non-broker.

In order to evaluate the discriminating power of the first two main classification steps (determination of the census of triadic role patterns plus centrality measures) a discriminant analysis will be made presently.[22]

To show the importance of the single characteristics the results of the tests of equality of group means will be given first. Values of Wilk's Lambda vary from 0 to 1.0 with the small values showing the largest differences between groups. As the relative high Lambda values for the variables "triadic position no. 10", "betweenness" and "closeness" indicate, these variables only contribute on a low level to the separation of the groups, despite their highly significant values:

Table 5. Tests of Equality of Group Means.

	Wilks' Lambda	F	df1	df2	Sig.
Pos3	0.23	61.128	4	73	0
Pos7	0.268	49.876	4	73	0
Pos9	0.551	14.882	4	73	0
Pos10	0.812	4.233	4	73	0
Pos12	0.251	54.507	4	73	0
Pos16	0.485	19.416	4	73	0
Pos27	0.542	15.442	4	73	0
close	0.814	4.180	4	73	0
between	0.657	9.528	4	73	0

Fig. 9 shows a visual representation of the classification results in a territorial map which is based on the first two classification functions that account for 93.1% of the explained variance as can be seen in Table 5 on the next page.

[22] Because at least two cases were needed in each possible class for this procedure, the 13 actor network was doubled and the two identical nets were connected via an outgoing relation from relation between Iso26 and CM2 to one network of 26 actors. This enlarged network was produced three times with each of the respective Cosmopolitans (Liaison, Gatekeeper and Itinerant) in the place of the Itinerant Cosmopolitan in Fig. 6.

Table 5. Explained variance by discrimination function

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	70.587	77.5	77.5	0.993
2	14.175	15.6	93.1	0.996
3	5.399	5.9	99	0.919
4	0.91	1	100	0.69

First 4 canonical discriminant functions were used in the analysis.

Although all classes of brokers are close to at least three other classes of actors, the tangential points of the Gatekeeper class with that of the Liaison, the Itinerant and the non-brokers seem to be specially distinct.

Another problematic issue is the situation of the centroid of the Itinerant class (marked through an asterisk besides the digit row 5555334 in the upper right quarter of the map) which seems to be situated within the Itinerant class. This detail is interpreted as the result of the conceptual proximity of the two broker roles as well as the result of an inclusion of solely two of the four identified classification functions in this representation and is therefore not of a substantial weight.

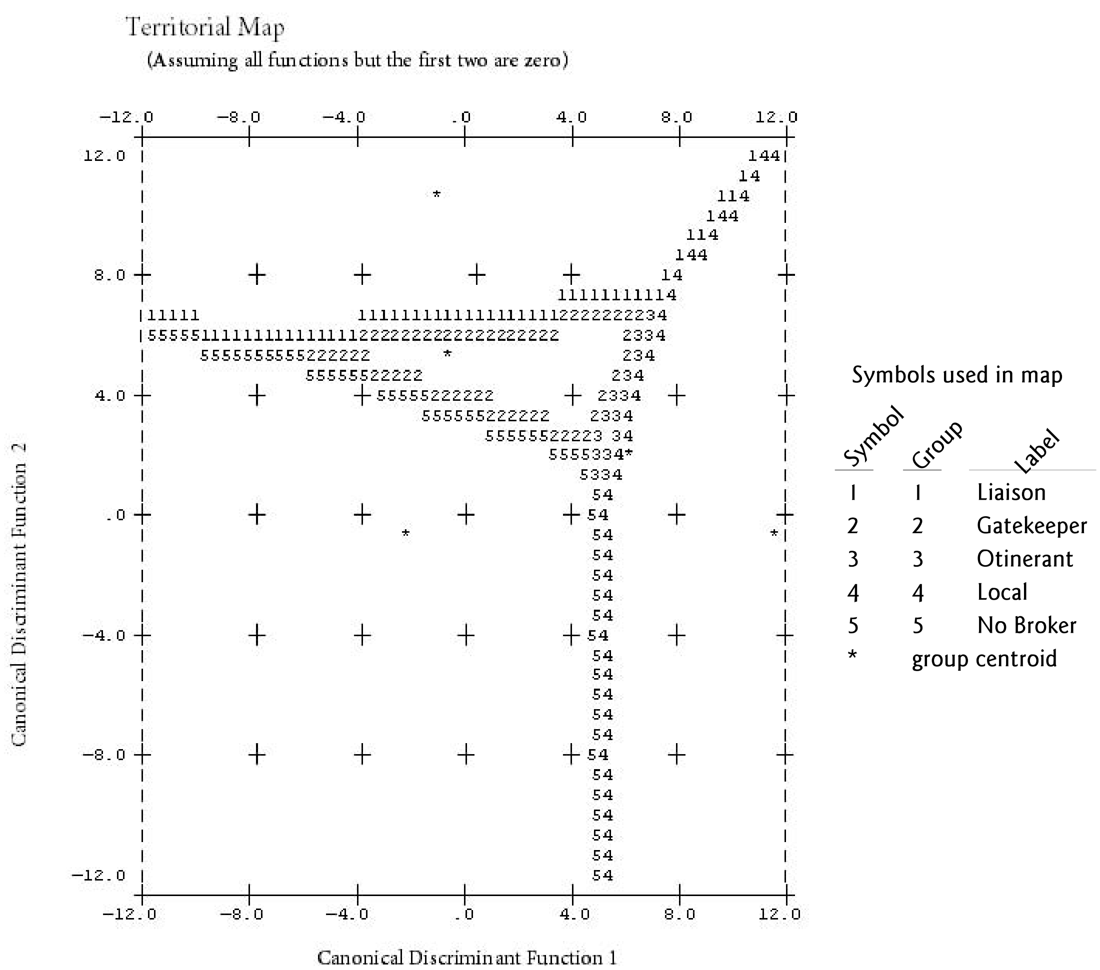

Figure 9. Classification results based on the first two classification functions.

Results of an Empirical Application: Newcomb's Student Fraternity

Some empirical results will now be discussed that stem from an application of the instrument to the well known Newcomb Fraternity, a network that consists of 17 students living together in a hostel. The development of the network was followed up for 15 weeks except for a holiday break of one week between the ongoing weeks 9 and 10. Every week the students were asked to list all other 16 students with regard to their preferences in friendship.[23]

Instead of reproducing the whole classification procedure which has already been shown, focus will now be on the presentation of some results against the background of certain characteristics of the social capital of brokers.[24]

Table 6. The brokers of the Newcomb fraternity

Broker Role	*Actor No. (Ongoing Week No.)*
Liaison Cosmopolitan	None
Gatekeeper Cosmopolitan	6 (1), 13 (12),
Itinerant Cosmopolitan	13 (2), 1 (12), 9 (12)
Representative Local	4 (1), 9 (1), 12 (1), 13 (1), 1 (2), 17 (2), 9 (10), 17 (10), 6 (12)*, 17 (12)*
Coordinator Local	2 (1), 12 (1), 7 (2), 4 (2), 9 (2), 12 (2),13 (2), 1 (3), 4 (3), 6 (3), 7 (3), 9 (3), 13 (3), 17 (3), 1 (4), 4 (4), 7 (4), 9 (4), 13 (4), 17 (4), 1 (5), 4 (5), 9 (5), 17 (5), 1 (6), 4 (6), 9 (6), 13 (6), 17 (6), 4 (7), 9 (7), 17 (7), 4 (8), 9 (8), 13 (8), 17 (8), 12 (9), 17 (9) 1 (11), 6 (11), 9 (11), 17 (11), 4 (12), 13 (13), 17 (13), 9 (14), 17 (14), 4 (15), 6 (15), 9 (15), 17 (15)

** are connected indirectly through two Cosmopolitans with other Locals*

The fact that the Newcomb fraternity represents a *friendship network* is of importance for the interpretation of the results of the analysis. Following what has been said with regard to the distinction between the two sorts of social capital, friendship ties are expected to be of a higher socio-emotional content and hence contain rather more support capital. This leads to the conclusion that if the above depiction of the different sorts of social capital is in any way substantial, then the Cosmopolitan roles, which drew on leverage capital, especially in highly differentiated structures, will less probably appear

[23] The comprehensibility of such a small network and facilitation of access to the data for possible reproductions of the results (which are part of *UCINET II.)* were reasons that guided the choice for this data set as a means of demonstration.

[24] For the analysis, the number of choices was fixed to an average of three per week. Although more could be said about problems with arbitrarily fixing outdegrees, the principle results of the empirical analysis are maintained.

in the Newcomb fraternity. As it can be inferred from the detection of recursive 2-cliques in the Newcomb data, there seems to be a strong overlap of cliques, which supports the assumption of a highly integrated network. Against this background, the appearance of cosmopolitans within the first two weeks of observation and after the holiday break (between week 9 and 10) in week 12. These occurrences seem to reflect the dynamics of the network: in the beginning there is a disintegrated structure as a result of unsteady individual investment decisions (time investment in relations to potential brokers) followed by an increase in homogeneity up to week 9. A new decrease in the number of relations seems to be the result of the holiday break later followed by an increase in the number of relations due to the group's integration.[25]

Against the background of what has been said about the different aspects of Social Capital (see Table 1), a closer look will be taken at the brokers shown in Table 9. Contrary to a Cosmopolitan, the resources a Local provides are not scarce. This is the reason why a Local can only realize small gains for his services and, because of the nature of support capital, only long after having delivered services. Longer time commitments to accumulate support capital as well as a long time span for its decay presumably result in a *relatively high persistence* of these roles.

Even if the total number of Locals per week varies between a frequency of 2 (weeks 9, 10, 13 and 14) and 7 (week 3) over all 15 observation weeks, especially actors no. 1, 4, 9, 13 and 17 appear more or less continuously as Locals.[26]

As opposed to the Locals, the Cosmopolitans occur only during short periods: Actor no. 6 as a Gatekeeper connects four cliques in week 1. Already in week 2, actor no. 13 (as an Itinerant) has taken the place of a Cosmopolitan for just another week. In the following weeks 3, 4, 6 and 8 the same actor no. 13 appears as a Local, which can be interpreted as evidence for the assumed integrative forces, that renders the Itinerant role unstable.

After the holiday break between the 9th and 10th week, actors no. 9 and 1 occur as Itinerants and actor no. 13 as a Gatekeeper. All three actors disappear as Cosmopolitans in weeks 13 to 15, totally or occur once more as Locals.

Even if a certain evidence for the assumed ***time courses for accumulation and decay of social capital*** of brokers seem to hold, the early appearance of Cosmopolitans contradicts somehow the idea of occurrences of Cosmopolitans as the result of a differentiation process *after* the integration of a group. Instead, with regard to the high overlap of cliques, it seems that Cosmopolitan brokers come into existence already in the early stages of the development of social structures and contribute to the integration of cliques. It remains unclear whether this result is particular to a friendship network.

Aspects from economic price theory are discussed with regard to ***substitution of social capital***. In the context of the description of cosmopolitan roles different social structural scenarios can be inferred depending on the offer and demand of broker services. In this sense, the transition of a broker role into another is described as a substitution of purely leverage capital through an increase of support capital. In turn, this is interpreted as being the result of increased competition between Cosmopolitans (given a constant demand from clique members for these services). In other words, a drop in prices (in units of social subordination) for Cosmopolitan services, will lead to an increasing substitu-

[25] In this sense a higher density of relations signifies more common evaluations of group members on time investments into brokers (see also Blau, 1964).

[26] Actor no. 17 appears in all 15 weeks as a Local, actor no. 9 in 12 weeks, actor no. 4 in 10 weeks, and actor no. 1 in 6 weeks.

tion of leverage capital through support capital. As a consequence of price cuts, clique members and Cosmopolitans become more equal with the latter probably passing through different phases of development (Liaison – Gatekeeper – Itinerant). The probable result will be the integration and finally the absorption of the former Cosmopolitan into the clique, where he may become a new Local.[27]

Because the high status level Cosmopolitans, like the Liaison, do not appear in the Newcomb fraternity, the examination of a possible conversion of Cosmopolitan roles into Local roles is limited to the appearance of the Gatekeepers (actor no. 6 / week 1 and actor no. 13 / week 12) and Itinerants (actor no. 1 / week 12; actor no. 9 / week 12 and actor no. 13 / week 2).

Before checking for the individual relations of potential brokers, the Gatekeeper in week 1 (actor no. 6) was also classified as an Itinerant in week 2 but was removed as such due to a symmetrical relation between the two Locals. In week 3, actor no. 6 appeared then as a coordinator. With the exception of a missing Itinerant role in week 2, actor no. 6 seems to follow the predicted transition from a Cosmopolitan to a Local role.

Equally, the change of actor no. 13 from an Itinerant in week 2 to a Local in week 3 and, later in week 12 from a Gatekeeper to a Local in week 13 shows some evidence for the assumed tendency of substitution of social capital. However, it is problematic that actor no. 13 occuring as an Itinerant in week 2 is classified as Local in week 1 (see footnote 24). On the contrary, the appearance of actor no. 13 as a Gatekeeper in week 12 seems less problematic because of his lost Local role in week 8 already.

The fact that actors no. 1 and 9 are classified as Itinerants in week 12 while both actors occur in week 11 as Locals also contradicts the assumed dynamic with regard to the impossible direct transformation of a Local into a Cosmopolitan. Furthermore, actor no. 9 only occurs as a Local two weeks after having been an Itinerant in week 12, and actor no. 1 never turns out to be a Local during the observation period at all. Because the appearance as a Local was not defined as a *necessary* characteristic, the latter two observations seem irrelevant.

Lastly, the ***transfer of social capital*** was a means to account for the use of such capital in contexts other than those in which it was accumulated. The theoretical reflections mentioned above lead us to the assumption that transfer of social capital is only possible in the case of leverage capital. In this regard, we interpret the relations passing from identical Cosmopolitans to different Locals as an indication for the transfer of leverage capital. This is the case for actor no. 13 (Itinerant), which shows in week 2 relations with actors no. 6 and 17 (Locals), whereas actor no. 13 as a Gatekeeper in week 12 shows relations with actors no. 1 and 17 (Locals).

Conclusions

Apart from the small number of Cosmopolitan brokers in the Newcomb data, which we attribute to fact that one deals with a friendship network, the results of a first empirical application are worthy of note: In accordance to the theoretical expectations, only modest status differences occurred as can be seen from the total exclusion of Liaison brokers in all 15 observation weeks. The identifiable Cosmopolitans were found in the early development stages of the network within the first weeks of observation or after the holiday break between week 8 and 9. Furthermore, in line with the theoretical

[27] Whereas the descending dynamic from a Cosmopolitan with high status to a Local with lower status seems to be possible, the inverse development - from a Local to a Cosmopolitan – appears to be less probable, due to a lack of possibilities for accumulation of leverage capital.

reflections on the dynamic of differentiation and integration, some of the identified brokers showed the assumed tendencies of role transitions.

The unsatisfactory high number of Coordinators may be more the result of high overlapping structures than of isolated cliques in the network. Consequently, the concept of the Coordinator in our theoretical scheme as well as in the context of the operationalization through triadic positions should be reconsidered. Of course, the small sample of brokers allows statements on tendencies only and is far from being conclusive.

The Census of Triadic Role Patterns as an instrument of analysis has proven to be a suitable means - partly in addition to centrality measures and control of individual relations - of accounting for different structural aspects of actors in broker roles. This point has been specially underlined by Hummell and Sodeur (1987) as the decisive criteria for its evaluation from a practical point of view: How far can the different positions of two persons be reproduced in the overall relational network with sufficient clarity?

If we follow Wasserman and Faust (1994, p. 5) in their assessment that "the key feature of social network theories or propositions is that they require concepts, definitions and processes in which social units are linked to one another by various relations," the importance of the instrument for the description of social processes becomes clearer: Assuming that the representation of the relational settings between three actors gives a proper account of structural relevant aspects, then the census of triadic role patterns is an instrument which allows an operationalization of concepts such as social capital within an exchange theory and makes them applicable to networks of different sizes. However, the workability of the proposed measurement procedure for social capital remains to be confirmed as well as its applicability in the context of larger networks.

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Phone notebooks as data on personal networks

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This study assesses the nature of data on personal networks derived both from personal paper phone notebooks as well as from the mobile phone electronic notebook. It is illustrated by data on author's personal network between 1993 and 2000 and in 2002. The text emphasizes the subjective and biographical aspects of this data and suggests that studies based on mobile phone network data may contribute to the literature on the interaction between communication technology and sociability.

INTRODUCTION

When I entered the University of Helsinki in 1976, like all of my fellow Helsinki university freshmen, I got a calendar from the university's student union with an attached and non-removable section for writing down phone numbers. I thereafter faced the yearly task of transferring the preceding year's phone numbers of fellow students, friends, relatives and acquaintances to the note book section of the next years' calendar. Name by name, I had to reflect on the value and durability of the social ties in my personal network: Will it pay to transfer Anna's name and phone number to the new notebook? Do I really have anything in common with Antti any more? When was it I last met with Pertti? As a consequence of this annual task and my obsession with collecting the used note books, I have a personal archive of 19 calendar-phone notebooks with the lists of phone numbers and names of the alters of my personal network between 1976 and 2000.

In this methodological experiment I will mainly focus on my personal 'Phone Notebook Network' (PNN) data covering the eight years 1993-2000. In the second section I will first contextualize my story by giving some quantitative information about the evolution of my network. In the third section I try to assess the nature of PNN data compared to other means of collecting data on personal networks. In the fourth section I will evaluate the changes brought about by the increasing availability of mobile phones.

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My first aim is to show the usefulness of both PNN data and mobile phones as a source of data on personal networks. Second, I want to argue for the subjective and constructed nature of this seemingly innocent and 'naturally occurring' personal network data. I try to show through an actual example how the PNN data should be considered as a particular type of autobiography irrevocably embedded in the ego's life history.

EVOLUTION OF MY PERSONAL NETWORK 1993-2000[2]

The size of my personal network between 1976 and 2000 varied from 13 names in 1976 to a peak of almost 200 names in 1986. Upon my arrival in Helsinki in 1976 from my Northern Finnish hometown to study export marketing, I knew virtually nobody in the capital. This situation is reflected in the modest number of my phone network members. The 13 recorded names consisted mostly of relatives from my home town as well as freshmen at the university, two of whom were my schoolmates and friends from the North. Like other migrants, I had to start building a new network out of the very few contacts I had in the capital.

The size of the network increased slowly up to my graduation and during my years as an assistant at the department of export marketing. My decision to quit the department and to start studying sociology in 1983 caused another rupture in the network and led to reconstruction of a new web of connections in a new (but still academic) milieu. The 1990s were marked by my work as a researcher at the Department of Sociology, getting married and having and raising kids.

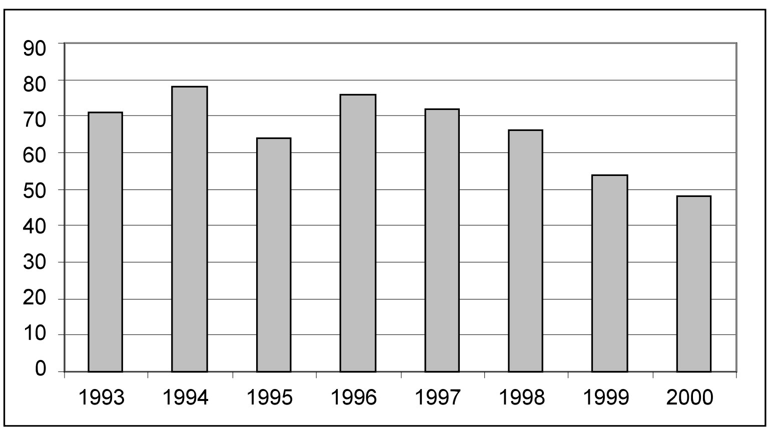

Figure 1. The evolution of the size of my phone network between 1993 and 2000.[3]

Understandably the bars in the figure hide an important turnover of individual alters. First, there were 149 different alters among the total of 529 notebook entries recorded during 1993-2000. Second, only 23 people were recorded both in 1993 and 2000. These 23 alters were all recorded without exception during the eight years and they accounted for 32 % of my network ties in 1993 but already

[2] The quantitative information presented in this sector is understandably not meant to be representative in any sense. It is presented as background material for further considerations in the following sections. For another example of analysing one's own personal network, see Barth 1978).

[3] In preparing the network data for analysis, I transferred the names from the notebooks to Excel, removing double names of the same person, and the names of organizations. Where there was a particular person representing an organization s/he was included in the analysis. For the couples or families only the spouse who had been the origin of the contact (and who was usually the one with whom I was in touch) was registered, save my parents and parents-in-law who were all recorded. Otherwise the calendar data was recorded 'as is'. That is, even if for one reason or another I had not registered the names of some close persons for couple of years, they were not added afterwards.

48 % in 2000. They can be regarded as my 'core network' (cf. Morgan et al. 1996) which has gradually gained importance at the expense of the more 'peripheral' parts of the network.

The slow decrease in size of the network is easily explained by the tight time budget of a working family with small children corroborating the general argument on the connection between personal networks and the ego's life events (cf. e.g. Families and Social Networks 1988, Wellman et al. 1997, Stueve and Gerson, 1977, Morgan & March, 1992).

Figure 2 shows the composition of my network ties during 1993-2000. In order to trace the evolution of the network, the coding of the type of alter was done by the origin of ties. Thus each alter was coded according to the way (or milieu) through which s/he had entered my network (e.g., work, family and kin, studies). This kind of coding based on the origin of ties is more useful for my purposes than the one based on the alters' present status (e.g., friend) since it pays special attention to ego's life course and to the evolution of the network through specific social contexts.

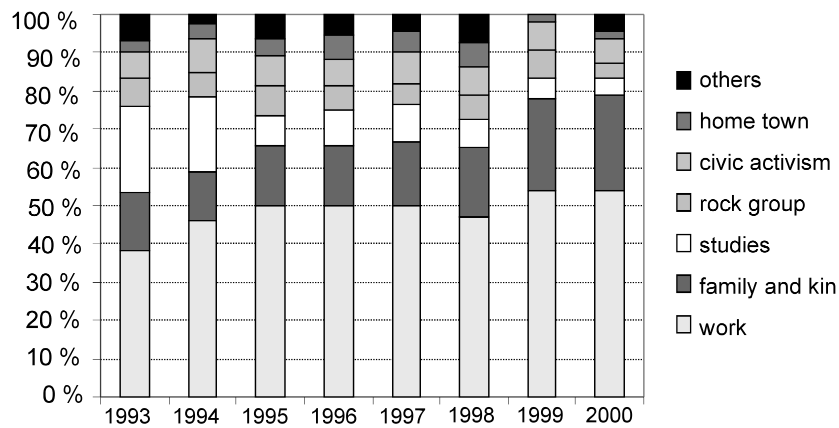

Figure 2. The composition of my phone network by the origin of ties 1993-2000.

Figures 1 and 2 reveal two obvious tendencies. First, the size of my network in the 1990s had been steadily decreasing, as a result of a more family and work-oriented life. As a consequence, the ties mediated by family, kin and work were increasingly accounting for the bulk of my network ties through the whole of the 1990s. While in 1993 work or kin -based relations together accounted for 54% of all recorded alters, this proportion reached 79% in 2000 (Figure 2).

Various hypotheses have been proposed about the questions of network evolution /maintenance. Why do some ties persist and others not? (cf. Suitor, Wellman and Morgan 1998, 4). The type or strength of the tie, homophily between ego and alter or the alter's position in the network structure have been proposed to explain the maintenance of a particular alter in the network. However, this kind of reasoning could be complemented with the search for an underlying principle or logic guiding the evolution of the whole personal network. As will be suggested in the next section, such a logic might have to do with the construction of ego's identity. While not denying the merits of structural explanations, from this 'subjective' angle the reason for the persistence of certain ties might be found in the simple fact that they are the main actors in the story ego wants to tell of his/her life.

Moreover, it is well known that the omission of one central alter may seriously distort the analysis of the network structure. In a similar vein the composition of my present-day network is a result of an evolutionary process in which some people have occupied a central role in introducing several alters into the network. Hence the need for in-depth qualitative studies paying particular attention both to these ‘middlemen’ as well as to the temporal dimension of the personal networks.

Reflections on the subjective nature of PNN data

At first glance, the PNN data seems both easy to obtain and 'naturally occurring' in the sense that they have been produced only for the personal uses of egos themselves, not for the use of social researchers. Many if not most people in industrialized countries do keep phone notebooks; they are easily available, may be collected cheaply by researchers and, at least in countries with high phone density, give an interesting perspective on an ego's social life.

However, from the self-reflection on my own network I argue in this section that PNN data (like many other types of network data) is profoundly subjective and socially constructed. Out of the pool of all possible alters (“underlying network”, cf. Morgan, Neal and Carder, 1998, 16) only certain alters get recorded in the notebooks and others are excluded according to subjective but not completely haphazard criteria. I claim that it is precisely this constructed and subjective nature which renders this network data interesting.

The reason for the following observations was my own astonishment when browsing through the names I had recorded in my notebook during the eight years. Some names seemed to belong to my phone networks quite ‘naturally’, while the inclusion of others was difficult, even impossible to understand. Moreover, some of the people who ‘should have been’ there in my opinion were unaccountably missing.

In order to understand the process of recording the names in my notebook, I reconstructed in retrospect a list of the criteria of inclusion.[4] To the best of my knowledge I used these criteria unconsciously since the idea of participating in my own network research never occurred to me at the time. The following categories should not be considered as complete and mutually exclusive. Rather, they express the various aspects of social relationships which may exist as single stranded ties but often are combined into more or less multiplex relations (Mitchell 1969, 22).

1. Emotional closeness. This seemingly natural category contains my friends and selected adult members of my family and kin. Compared to imaginary data on my ‘significant others’ or ‘best friends’ acquired through name generators, my phone network would, however, overlap only partially. While my phone notebook network also contained weak ties, such as phone numbers exchanged with occasional fellow travelers on trips or for some other random reason without any intention to keep in touch on a more regular basis,[5] it did not necessarily cover all of my significant social ties. During some years I neither registered the phone number of my close relatives (since I knew them by heart), nor did I register my small children who did not yet have a phone.

2. Frequency of contact. The frequency of interaction was another one of the ‘obvious’ criteria for recording names and numbers in my phone book. Again the PNN data does not adequately reflect my daily interaction network. First, the phone numbers of some of the people whom I encountered on a regular basis were also learned by heart and thus not written down. Second, the numbers of the people encountered daily (such as my colleague next door at the department) were not necessarily written down since I could talk to them face-to-face.

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[4] One should not forget the criteria of *exclusion*. These were mostly negations of the inclusion criteria but were sometimes dictated by very practical questions. To save notebook space (and my hand) the names of whole families were often written down under one name only.

[5] At the same time it is clear that some of these ties may either form durable ones or function as 'weak ties' to other social milieus.

3. Instrumentality. My phone book also contained phone numbers of people whom I needed only for some clearly limited task (such as learning Russian, or purchasing motorcycle parts). These names were not well connected to the rest of my network and often disappeared after couple of years.

4. Practical reasons. This category contains many numbers of my close Russian friends and colleagues which were hard to get through long distance information services.[6] These people, whom I met couple of times a year, often survived through the whole 1993-2000 period in my notebook.

5. Hazard. This category includes the people met by chance, such as traveling companions encountered on a trip abroad. Even behind these seemingly haphazard social ties one may find a certain order, since the exchange of phone numbers with these alters was often the consequence of a discussion already testifying to a shared discursive world or common interest.

6. Identity ties. This category includes quite a lot of people from my past, with different backgrounds and origins. With some of these I had very close relations (in fact, many are still my friends) and with others I was keeping in touch more or less regularly. What was puzzling were those alters for whom I recall having asked year after year, 'Do I see them any more?' 'Does it pay to write them down?' And still I wrote them down though we had no contact nor would I have called these ties particularly close ones.

From the point of view of this text, the last type of alter in this category is the most interesting one since, by maintaining these people in my network, I was in retrospect trying to reconstruct myself as 'an activist' (by maintaining alters from a radical group of civic activists), 'rock-musician' (my mates from a rock group), or the like. My doubts about keeping these names in my notebook lately reveal that the tension between the 'identity' and 'interaction' networks was becoming too visible. An academic middle-class family life with small kids does not in the end go too well with intense activism and rock life. In short, this type of alter in this category shows how I was involved – by transferring these names to my calendar year after year - in a heavy 'identity work' to keep up a certain image of myself.

It is the category of the identity ties especially which reveals the subjective and constructed nature of the PNN data. This data cannot be considered simply as a 'fact' corresponding to my web of actual contacts 'out there' in the real world, but rather as unconsciously constructed image of myself. Since a personal network is a cumulative result of one's life-course, the network data – whether naturally occurring or otherwise obtained - is irrevocably embedded in ego's biography. Consequently, each informant in a network study is involved in this kind of 'identity work' through recalling some people and forgetting others.

Finally, beside the seemingly obvious alters such as friends, relatives and close colleagues, my PNN data contained another interesting category, namely, the completely forgotten people, 'zombies'. Some of these were simply impossible to recall, but my efforts also revealed the working mechanisms of the memory in a very practical manner. Trying desperately to recall a particular person, I browsed through the list of the names of other alters registered in the phone notebook in the same year. One name led to another which was in turn associated with a third, and so on. Piece by piece my memory reconstructed a network pattern and sometimes resulted in a 'hit', but only after having rebuilt the context for this particular 'zombie'. This context might be a social circle, a place or an event, but the decisive clue was sometimes foreign handwriting or the particular ink with which the name was written down in the notebook. Thus it became very clear that to 'forget' somebody means to 'de-contextualize' him/her).[7]

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[6] Today St. Petersburg still lacks a phone directory with the phone numbers of individual citizens.

[7] The first implication is a need to combine psychological studies on memory with research on networks. Moreover, it is (continued...)

In sum, these observations seem to render the PNN data unreliable from the point of view of analysing the network structure, since leaving out only one central alter might distort the whole network, not to mention the difficulties in reliable reconstruction of interconnections between alters by the ego. Neither can PNN data be called ‘objective’, and its validity in terms of covering either significant others or interaction networks may be questioned for the reasons mentioned above.

However, for a researcher emphasizing the subjectively constructed nature of the personal network and its relation to an ego’s identity building, naturally occurring and easily available PNN data seems to offer interesting opportunities. It is this subjectivity and self-construction - and the rules governing it - which suggest room for combining network studies with biographical analysis as well as with comparative studies, since these rules are probably culturally variable classifications.[8] Looking at personal networks from this angle might pave the way for incorporating culture in general (Emirbayer and Goodwin 1994) and the concepts of narrativity and identity in particular (Somers 1994) into the analysis of social networks.

Moreover, the heterogeneous nature of PNN data, including both significant others, interaction networks and weak ties may be seen not only as a weakness but an opportunity to study the of ego’s view on totality of his/her different social ties (cf. Gribaudi 1998, Lonkila 1999). If we accept the claim that the role or meaning of a particular social tie in one’s personal network can only be understood in relation to all the ego’s various social ties, the PNN data may offer a necessarily partial and subjective approximation for this. Second, such data may help in the search for a unifying logic - such as the ordering work of an ego’s habitus - creating coherence in the chaos of the ego’s social ties.

Comparing PNN data with data obtained from the mobile phone (MP) notebooks

Many of the shortcomings of the PNN data may be avoided by turning to the data obtained from an ego’s mobile phone. Having purchased a mobile phone (a used Nokia 3210) in 2001, I still went on keeping my paper notebook. Quite soon the double work of recording numbers and names in two places appeared to be too much and I gave up the notebook. Consequently, the chance of tracing the annual evolution of my network through paper phone notebooks had come to an end.

Compared to many other Finns I was a latecomer in the world of mobile telecommunications, since in 1999 80 % of Finnish households had a mobile phone (Mäenpää 2001).[9] My use of an MP – as is the case with most technological innovations – was largely learned through the ties of my personal network.[10] By observing more and more of my friends and colleagues purchasing an MP, I too started to appreciate its advantages (while being quite innocent of the disadvantages). Much as steamboats replaced sailing boats the MP notebook replaced my paper phone notebook as a more effective and easy means of storing and retrieving the phone numbers of my alters (and ultimately phoning or sending a SMS message to them). Simultaneously, my criteria for registering alters in the MP memory were loosened up, with the sole limitation of the memory space.

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[7](...continued)
suggested that the name generators and/or prompts and clues during the recall interview should pay particular attention to the social or other contexts or milieus where the ties get formed. See Brewer (2000) for a more thorough discussion on recalling/forgetting alters.

[8] For example, the pilot interviews carried out by my Russian colleague seem to suggest different status and practices related to PNN data in Russian culture. (Gladarev 2000).

[9] In younger age groups in 2001 the proportions of mobile phone owners were already close to 100 % (see: http://www.tilastokeskus.fi/tk/yr/tietoyhteiskunta/matkapuhelin_oma_kuvasivu.html)

[10] I owe this point to Pasi Mäenpää.

In October 2002, my MP notebook contained 107 numbers altogether. After the elimination of numbers of institutions etc. (see preceding section on data storage), my mobile phone network comprised 73 alters.[11] It is notable that of the 34 'extra numbers', many were those of the same people who were now recorded not only by home and office numbers but also by mobile phone. Since most people are more easily contacted at their MP numbers, the tendency is clearly towards fixed phones being replaced by MPs.[12]

What was lost in terms of tracking the annual network evolution was regained in the new opportunity for network research through the use of MP notebook data. Since recording numbers with an MP is easier than digging up your paper phonebook and looking for pen or pencil, the weak ties, such as an acquaintance encountered in the street, get registered more often. But all of the strong ties (who have a phone) also get recorded on the MP because of the ease of phoning through 'short-cut dialing'. The numbers known by heart which were not included in the paper phone notebook did get included in my MP notebook.

Another specifically MP-related criterion for recording names in my MP notebook was the widespread use of SMS messages in Finland. I could keep a phone number in my MP memory in order to send a relatively cheap SMS message to an acquaintance, even though I would not have called him/her on any occasion.

There is more to the use of an MP, however, than the changing nature of the recorded data on personal networks. According to recent literature, mobile phones may also have an impact on the very nature of our sociability (e.g. Mäenpää 2001, Smoreda and Thomas, 2001, Réseaux 2002).[13] This influence is a two-way street since people may use technological innovations in a way not foreseen by the producers. In the words of a Finnish researcher, "Users have both been completely ignorant of the possibilities offered to them as well as immensely enthusiastic about something which nobody could imagine" (Immonen 2002).[14]

The commercial aspects may also have an important effect both on 'mobile sociability' (and consequently on the nature of MP notebook data on personal networks). The charge on MP calls between different Finnish operators, for example, differs considerably: a MP call to another operator's MP may currently cost more than 200 % of the charge within the same operator. Thus the question "should I call her" may at present imply two additional considerations "should I call her MP or fixed phone?" and "what operator is she on?"[15] There is thus clearly a need for further studies on the relation between the use of MP and the sociability of daily life – and I claim that the data on personal networks collected in MP notebooks may add an important aspect to such studies.

In a recent Finnish study (probably the first network study collecting personal network data from MP notebooks) Elina Kuitto interviewed 30 high school students in the fall of 2001, constructing their

[11] In a network seminar in 2000 I asked eight Finnish students to count the numbers in their mobile phone memory. The average size of their MP networks was 54, with a range from 18 to 112. In a study of the MP networks of Finnish high school students carried out during 2001, the MP network size was 51 for boys (N=10) and 54 for girls (N=20). (Kuitto 2002).

[12] Of the 73 alters on my MP network in 2002, 45 (62%) had a mobile phone. Finnish students in our seminar in 2002 advised me that nowadays it is rare for students to have a fixed phone at all.

[13] In this sense, the study on the MP is analogous to studies of the Internet. It should not be forgotten, however, that paper is also a highly technological innovation with its own impact on human activity.

[14] An example is the unpredicted popularity of SMS messages in Finland.

[15] The special discounts offered for family members (or friendship circles) who are customers of the same operator may have the effect of constraining / enabling interactions within this kind of 'virtual circle'.

personal networks from the name lists retrieved from their MP notebooks. Only two of Kuitto's informants said that their personal 'mobile phone notebook network' did not cover most of their significant social contacts. In general, Kuitto concludes that the mobile phone network is a quite valid and easy way of collecting data on personal networks. (Kuitto 2002).

Conclusions

The increasing availability of mobile phones offers new opportunities for obtaining data on personal networks. Compared to PNN data, the mobile phone notebook networks (MPNN) seem to be more valid data in the sense that they cover more accurately both the weak and strong ties, the interaction network and the network of significant others.[16] In addition, the MP usually offers an indicator of the frequency of interaction between ego and alters, since the standard models enables easy retrieval of the 10-20 last received and/or sent phone calls as well as an archive of SMS messages. Some models also contain a log of phone calls, SMS messages and e-mails sent to an MP: for each kind of contact, the log stores information not only about the alter in question but the direction of contact (incoming /outgoing), the duration of the calls and the date and time of the contact. MP network data (recently also visual data and photographs taken by MP cameras) may also be easily transferred from the MP's memory card to the computer for further analysis.

The MPNN data may open up new perspectives on the ways of communicating and interacting in a 'mobile culture'. As in internet studies, the state of research on mobile phones has been lagging behind the development of the field (Wellman 2001). Recent studies (e.g. Mäenpää 2001) have already suggested that some of the assumptions of the social consequences of MP use, such as diminishing need for face-to-face contacts, may be wrong. Network research based on the MPNN data could investigate the emerging 'mobile sociability' on its own home ground.

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A New Measure of Linkage Between Two Sub-networks[1]

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Network links between groups of people with and without a certain characteristic are important in several substantive areas. For example, models might study people who "link" those with and without HIV infection; or those who are links between two types of organizations, or between two countries. New measures of this linkage are proposed (for individuals and for entire networks) and reasons why they are superior to some existing measures are detailed through examples.

INTRODUCTION

Most of the literature on social networks involves what Wasserman and Faust (1994) term "one-mode" networks, where all the actors are of the same class, and all may interact (at least in theory) with each other. They also discuss two-mode networks, where the actors are of different classes, and where interest focuses on interactions between the classes, but not within one class. The distinction depends on context and interest; for example, if we were modelling use of e-mail in a university department, we might include both students and professors in a one-mode network. On the other hand, if we were interested only in how e-mail facilitates communication between students and faculty, we could analyse similar data as a two-mode network (since we would then not be interested in faculty-faculty or student-student communication).

There is, however, an additional possibility, where we wish to include all interactions, but focus on those between two groups. We may, for example, wish to determine the extent to which the two groups are linked by some behaviour.

For example, we may wish to model HIV-risk among injection drug users (IDUs) and non-IDUs; a two-mode network would look only at connections between IDUs and non-IDUs, while a traditional one-mode analysis would not differentiate between IDUs and non-IDUs, but would instead treat connections equally. However, since IDUs may have very different infection rates from non-IDUs,

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to study HIV spread we may want to look at all connections, but to differentiate those involving both IDUs and non-IDUs from those involving only one group. Here, a two-mode network is inappropriate, because HIV can spread within groups of IDUs and non-IDUs as well as between them, and because the forms of risk linkage can differ between the two groups. Traditional measures (detailed below) do not allow us to focus on the systemic importance of links between groups, but rather treat all links equally.

To better describe such networks, we introduce a new measure of "linkage", used here to describe the concept of a single node being a link between groups in a single connected network. In Figure 1, suppose that A1, A2, and A3 have some trait, while B1, B2, and B3 do not. Then L is a link between the two groups (regardless of whether L has the trait). The idea of linkage is related to that of a bridge between groups, which has been used by other researchers (Elwood, 1995; Morris, Podhista, et al. 1996). Note, however, that Elwood defines a bridge group as one which links a network to people outside the network. In contrast, we define bridge as a link between differentiated groups within a network. Linkage is also related to Everett's concept of "bridge" (cited in Scott, 1991) as a line that connects two cycles, in that linkage involves two different groups (i.e. people with different characteristics), regardless of whether these groups are cyclic. Trotter, Rothenberg and Coyle (1995) identified bridges as one of the key areas for future research in network methods. To the best of our knowledge, however, no currently available measure allows for a numeric estimation of bridgeness or linkage.

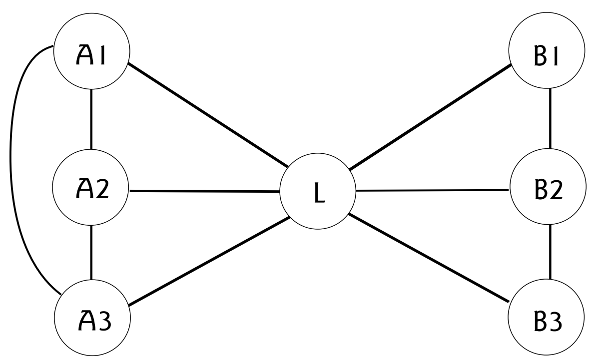

Figure 1

In the next section, we describe existing measures that approximate linkage and propose a new one. Section three examines the performance of existing measures and our new measure in small hypothetical networks. Section four describes extensions of our measure to entire networks (as opposed to single nodes). We close with limitations, suggestions for future research, and conclusions.

EXISTING MEASURES: their inadequacy to the problem, and a proposed solution

The closest existing concept to linkage in this sense is centrality. There are several existing measures of this concept; in this section, we discuss several of these, and discuss why they are not adequate for the task at hand. We then describe our new measure. First, though, we should note that the desired measure is inherently nondirectional; directional measures (which Wasserman and Faust, 1994 refer to as measures of prestige) will not be further considered. Second, the paths considered will be unweighted. Third, we are concerned only with connected networks. The first two of these are possible areas for future work; the last may also be, but the notion of centrality in an unconnected network is somewhat problematic.

Another related concept is segregation. While we are interested in which nodes are key in connecting two groups, segregation is concerned with separation of groups, or limiting interaction between them (Freeman, 1978). There are two key differences between this measure and the one we seek. First it is in the opposite direction – if two groups are totally segregated there is no link between them. In itself, this is a somewhat trivial distinction. It leads, however to a more important one: Segregation, by its nature, applies only to whole networks. While one node might be totally segregated from all others, it does not make sense to speak of the extent to which a node segregates a network, but only of the extent to which it integrates a network.

Centrality

The simplest measure of the centrality of a node, and one proposed by many authors (see Freeman, 1979, for a review) is simply its degree, which is known as the actor degree centrality. Wasserman & Faust (1994) give a standardized form as:

$$C_D(n_i) = \frac{d(n_i)}{g-1} = \frac{\sum_j x_{ij}}{g-1} \tag{1}$$

where n_i is the node in question, $d(n_i)$ is degree, g is the number of nodes, and x_{ij} indicates the presence or absence of a link from node *i* to node *j*

Closeness centrality focuses on how close a node is to all other nodes in the network. Beauchamp (1965) noted that actors who are central in this sense can communicate information to other actors very effectively. Several authors have developed this notion more formally (see Wasserman & Faust, 1994 and Freeman, 1979 for a review). A standardized form (Sabidussi, 1965; Beauchamp, 1965) is given by

$$C_c(n_i) = \frac{g-1}{\sum_{j=1}^{g} d(n_i n_j)} \tag{2}$$

where d(a,b) is the distance between a and b, and other terms are as defined above.

Betweenness centrality

One existing measure that does combine aspects of betweenness and centrality, and may be the closest existing measure to the desired one, is actor betweenness centrality (C_B), which was developed by Freeman (1977). In words, betweenness centrality is the proportion of all geodesics on which a particular node lies, but which do not involve that node. In standardized form (for actor n_i) by Wasserman and Faust (1994, p. 190) as

$$C_B(n_i) = \sum g_{jk}(n_i)/g_{jk}\left[(g-1)(g-2)/2\right] \tag{3}$$

where the sum is over all j < k, with i distinct from j and k, g_{jk} is the number of geodesics connecting j and k, $g_{jk}(n_i)$ is the number of those geodesics which include n_i, and g is the number of nodes. (The term in brackets standardizes the measure to vary from 0 to 1). It should be noted that, while there is a single summation, the sum is over all the geodesics g_{jk} with $j < k$ and i distinct from both j and k. Borgatti (1995) describes this as indexing "the extent to which a node's presence facilitates the flow of that-which-diffuses. If a node that is high on betweenness centrality is removed from the network, then the speed and certainty of transmission from one arbitrary point to another are more damaged than if a node low on betweenness centrality is removed." (p. 114).

Segregation

Freeman (1978) developed a measure of segregation between two groups. Intuitively his measure is the "cross-class edges that are missing in the observed graph, as compared with a graph where edges are generated at random" (p. 416); this is scaled by dividing the expected value by the maximum possible value for a graph of a given size. Since this can only be computed for an entire network, we do not consider it further.

Problems with existing measures

The main problem with all these measures for measuring linkage between two groups is that no distinction is made between nodes in different groups, or between geodesics which remain in one group and those which cross to different groups. They do not account for the fact that the nodes are in different groups, and thus cannot measure which nodes connect the two groups, nor the extent to which they do so.

Proposed solution

We can account for the existence of two groups as follows: Suppose we have a network of n nodes, of which i have the condition and $j = n - i$ do not. First, list all the nodes with the trait as A_1 to A_i, and those without the trait as B_{i+1} to B_n, exclude the node (X) for which we are estimating linkage from whichever list it is on (i.e., A if it has the trait, B if it does not). Then, if x does not have the trait, the linkage for node x is

$$Q(x) = \sum_{a-1}^{i} \sum_{b=i+1}^{n-1} g_{ab}(x) / g_{ab}\, i(j-1) \tag{4}$$

where $g_{ab}(x)$ is, as in formula 3, the number of geodesics connecting a and b and including x, and $i(j\text{-}1)$ standardizes the measure to vary between 0 and 1. If x does have the trait, the summations are from $a = 1$ to $i\text{-}1$, and $b = i$ to $n\text{-}1$, and the standardization term is $(i\text{-}1)j$. In words, Q_x is the proportion of geodesics linking A_i and B_j that contain X, where X is not an endpoint of the geodesic. (see section 5, below for an example of computing Q).

As a simple example, in Figure 1, suppose that L does have the trait, and relabel L as A4. Table 1 lists values for Q(L) and $C_B(L)$. It can be seen that, while L is clearly different from the other nodes in terms of both Q and C_B, the difference is greater for Q than for C_B. Further, $Q = 1$ for node L and 0 for all other nodes. A value of 1 indicates that, if the node is deleted, the network is split into two connected components, one with and one without the condition. This may be stated as a theorem, which is proven in the appendix:

> Theorem 1: Given a network N with n nodes, of which some have a condition and some do not, deletion of a single node X will result in two components, one of which has the condition and one of which does not, if, and only if, $Q(x) = 1$.

Table 1. Q(X) and CB(X) for Figure 1*

X	Q(X)	CB(X)
A1	0.00	0.00
A2	0.00	0.00
A3	0.00	0.00
L	1.00	0.63
B1	0.00	0.00
B2	0.00	0.03
B3	0.00	0.00

* In figure 1, Q1 and Q2 are equivalent; these terms are explained in the text.

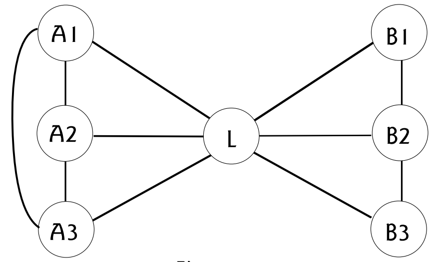

Figure 1

PERFORMANCE OF THE MEASURES IN SMALL, HYPOTHETICAL NETWORKS

Desired characteristics

Here we list some characteristics the measure should have, in order to be able to compare the new measure with others. In Figure 1, we would like the measure to have the following characteristics:

a. Node L1 should be markedly higher on the measure than any other node.
b. All other nodes should be equal.
c. L1 should be 1, or some other distinct value, to indicate that deleting it will split the network into two groups.

Figure 2a is a small network, designed to mimic HIV-risk links (i.e., either sharing needles or having sex) among IDUs and non-IDUs. Group A are IDUs, and group B are not. Here, we would like the measure to have the following characteristics:

a. Node A4 should be markedly higher than any other node.
b. Nodes A3, B4, B5, and B6 should be lowest.
c. Node A4 should be 1, or some other distinctive value.

Figure 2b adds another link between the two groups (the dashed line). Here, we would like:

a. Node A4 to be higher than any other nodes.
b. Nodes A3, B4, B5 and B6 to be lowest.

Comparing Figures 2a and 2b, we would like A4 to decrease and A6 and B3 to increase (although B6 is now more connected to the rest of the network than it was in Figure 2a, removing it from the network would have no effect on the connectedness of the A and B group, as it lies on no geodesics between the two groups).

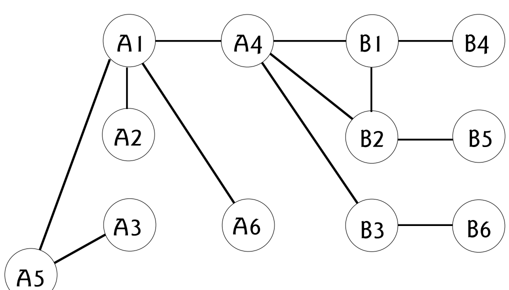

Figure 2a

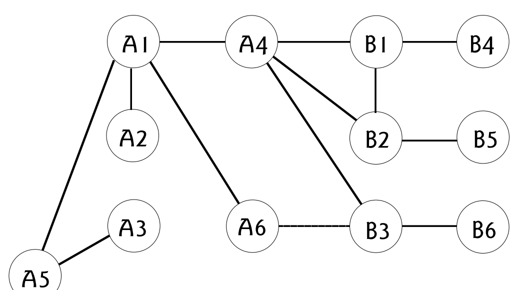

Figure 2b

Table 2. Q(X) and CB(X) for Figures 2a and 2b

	Figure 2a		Figure 2b		
X	Q(X)	CB(X)	Q1(X)	Q2(X)	CB(X)
A1	0.80	0.58	0.72	0.74	0.46
A2	0.00	0.00	0.00	0.00	0.00
A3	0.00	0.00	0.00	0.00	0.00
A4	1.00	0.69	0.79	0.82	0.56
A5	0.20	0.18	0.18	0.16	0.18
A6	0.00	0.00	0.15	0.13	0.09
B1	0.20	0.18	0.19	0.16	0.18
B2	0.20	0.18	0.19	0.16	0.18
B3	0.20	0.18	0.26	0.38	0.23
B4	0.00	0.00	0.00	0.00	0.00
B5	0.00	0.00	0.00	0.00	0.00
B6	0.00	0.00	0.00	0.00	0.00

Multiple crossings

One complication is whether to count as geodesics only those paths which cross exactly once between those with and without the trait, or to count geodesics without regard to how often they cross. For example, in Figure 2b, there are two possible geodesics between B1 and A6: B1-A4-A1-A6 and B1-A4-B3-A6. The former of these crosses once, the latter three times. Below, we calculate Q using each of these definitions of geodesic. Q1 includes only single-cross-geodesics, Q2 includes all geodesics. In some simple networks Q1 and Q2 are identical; where this is so, as in Figure 1 and Figure 2a, we do not show both.

In Figure 1 (see Table 1), it can be seen that Q shows more difference between node L and all other nodes, reflecting the fact that L is the key link between the groups. It can also be seen that the link between A1 and A3 affects C_B, but not Q.

In Figure 2a (see Table 2), Q clearly distinguishes A1 and A4 from the other nodes; while these nodes are also highest in terms of C_B, the differences between A4 and the next highest node are much smaller for C_B than for Q. It is clear from visual inspection that this is “correct” if we are interested in measuring the extent to which a node connects the A group and the B group. Without both A1 and A4, the link would not exist. If we add one link to Figure 2a (the dashed line), both measures change (see Table 2, for Figure 2b). The changes are not very different for the two measures, however. This is the first case in which Q1 is different from Q2, although the differences are small. One fairly important difference is that for B3 all three measures go up (as desired), but C_B goes up more modestly, Q1 goes up slightly more and Q2 goes up substantially. It is difficult to extensively modify such a small network.

EXTENSIONS TO ENTIRE NETWORKS

The measure proposed above is for single nodes in a network with two groups. In this section, we describe extending this measure to entire networks

As Freeman (1977) notes, there are two contrasting views of what centrality for an entire component means: First it could mean the extent to which all points are central; second, it could mean the dominance of a single point. We follow him in using the second definition and use the average difference between the normalized measure of the most central node and that of all other nodes. Thus, Freeman (1977) defined the centrality of a network as

$$CB_{net} = \frac{\sum_{i=1}^{g}\left[C_B\left(n^*\right) - C_B\left(n_i\right)\right]}{g-1} \quad (5)$$

where $C_B\left(n^*\right)_i$ (eq5a) is the largest betweenness centrality value associated with any point in the network (p. 39).

We ca similarly define Q_{net} as

$$Q_{net} = \frac{\sum_{i=1}^{g}\left(Q^* - Q(i)\right)}{g-1} \quad (6)$$

As examples, for Figure 1, CB_{net} = .62 and Q_{net} = 1. For Figure 2a, CB_{net} = .58 and Q_{net} = .85. For Figure 2b, CB_{net} = .44, $Q1_{net}$ = .64 and $Q2_{net}$ = .66. These values seem to indicate that, for whole networks as for nodes, the new measure does a better job of capturing what we want to capture. In Figure 1, the entire connection depends on a single node, and Q_{net} indicates this well. Comparing Figure 2a to Figure 2b,, the addition of the line to Figure 2b makes more of a difference for (either) Q_{net} measure than for CB_{net}, and this makes the importance of that line more obvious.

COMPUTATIONAL CONSIDERATIONS

For this paper, all the numbers were computed by hand by the first author. We have been unable to develop an algorithm for efficiently computing the measure for large groups (i.e. with more than approximately 10 nodes). For small groups, the method used was as follows: First, make a matrix with the columns containing the nodes with the condition, and the rows containing the nodes without it. In each cell, enter the nonterminal nodes in each geodesic between the column and the row. Then, to compute Q for a particular node, count all the geodesics containing that node, and divide by all the geodesics where that node is not a terminal node. If there are two (or more) geodesics between a pair of points, include both. An example may clarify this process; for Figure 2a, we write:

	B1	B2	B3	B4	B5	B6
A1	A4	A4	A4	A4B1	A4B2	A4B3
A2	A1A4	A1A4	A1A4	A1A4B1	A1A4B2	A1A4B3
A3	A5A1A4	A5A1A4	A5A1A5	A5A1A4B1	A5A1A4B2	A5A1A4B3
A4				B1	B2	B3
A5	A1A4	A1A4	A1A4	A1A4B1	A1A4B2	A1A4B3
A6	A1A4	A1A4	A1A4	A1A4B1	A1A4B2	A1A4B3

If we then wish to compute Q for (say) node A1, we count the number of geodesics containing A1, and find there are 24. We divide this by the number of geodesics where A1 <u>might</u> have appeared which is 30, and the result is 0.8.

LIMITATIONS AND FUTURE RESEARCH

One limitation (as noted above) is that the measure deals only with binary data. While a case can be made that this is appropriate in some applications (e.g., people either have sex together, or they do not, and if they do not then there is no risk of sexually transmitting disease), it is also true that, in many applications, people may interact to different degrees. This suggests some measure combining elements of flow-centrality (Freeman, Borgatti, et al. 1991) and the measure proposed in this paper.

A second limitation is that the measure deals with only two groups. The first author is currently working on extending the measure to multiple groups.

DISCUSSION AND CONCLUSIONS

In practice, the differences between Q1 and Q2 may be small. In our example, Q2 seemed preferable. However, preference for one or the other may depend on what the trait and the link are (and their relative computability). For example, if the trait is some disease with multiple strains, each of which protects against the others, then we may wish to consider only links which involve one cross, since a cross depends upon the prior infection (and infectiousness) of the final link in the process. On the other hand, if we are dealing with a disease like hepatitis C with multiple strains with somewhat similar prognoses but in which: (a) infection with one strain does not offer protection against the others; and (b) infection with multiple strains offers different prognoses, we may want to consider all the crossing patterns as possibilities.

The importance of locating a bridge depends largely on context. One example would be that of tracing HIV infection from drug injectors to the general population. Here the link would be having (unprotected) sex, and the two groups would be people who inject and people who don't. If, in a particular sample, it appears that certain characteristics are correlated with linkage, then people with those characteristics might be targeted for interventions, in the hope that these interventions might have particularly great effects.

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APPENDIX: PROOF OF THEOREM

Theorem 1: Given a network with n nodes, of which some have a condition and some do not, deletion of a single node X will result in two components, one of which has the condition and one of which does not, if, and only if, Q(x) = 1.

Preliminary: If there is a path connecting two nodes A and B, then there must be a geodesic between them (i.e., the existence of a path implies a shortest path). If A has the condition, and B does not, then there must be at least one pair of adjacent nodes C and D, one of which has the condition and one of which does not. Since adjacency is the shortest possible path, it is, of necessity, a geodesic. Therefore, every path linking A to B includes a geodesic linking some node with the condition to some node without it.

Sufficiency: Suppose the theorem is false. Then, for some network G, with some node X having Q = 1, there is at least one pair of nodes A_i and B_j where X is not on the geodesic, and where X is distinct from A_i and B_j. But if Q = 1 then node X is on all such geodesics

Necessity: If there is no node X with Q = 1, then there is at least one geodesic between A_i and B_j that does not include X. Therefore, removing X leaves that other geodesic. QED.

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How People See Society:
The Network Structure of Public Opinion Concerning Social Conflicts

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For the last twenty years, on a more-or-less annual basis, the French research organization, Agoramétrie, has surveyed French public opinion on social conflicts. With a unique methodology involving the representative sampling of both the French population and French media discourse concerning social conflicts, a closed questionnaire is constructed and used to collect survey data which is then analysed using principal component analysis, among other methods.

The rather surprising results of twenty years of research on the same topic are that a small set of approximately 30 "trunk" questions appear in each sampling of media coverage of social conflicts, independent of economic crises, national or political crises, or other environing events. These "trunk" questions — such as "are there too many immigrant workers," "are doctors trust-worthy," "should women have the same rights as men," "are politicians corrupt" — appear as basic human interrogations concerning society, and the use of the Agorametrie method in Great Britain, Russia and Costa Rica reinforces this surprising conclusion. The other result that these surveys produced is that "trunk" questions, and the 50 to 70 other questions concerning social conflict which constitute the questionnaire each year, do not have an arbitrary structure which changes from one survey to the next. The "trunk" questions define each year a fundamental network structure that comes back with little modification each year, and in which ties — and oppositions — define an overall structure with two fundamental dimensions: first, an opposition between an overture toward society and its problems (social problems and conflicts can be addressed and dealt with) and closure ("we were better off in the past"); second, an opposition between emotive and non-emotive reactions to social conflict. Each individual, each social group, possesses a network of opinions on social conflicts, opinions that are not arbitrary but tied one to the others to form specific, coherent networks whose ties show a strong resistant to deformation by external events. In short, specific networks of opinions on social conflict can be associated with individuals and social groups, and the network ties show strong resistance to change over time. There is even the possibility of measuring the "resilience" of these network ties.

INTRODUCTION

Public opinion is habitually considered to be a difficult research topic because of the variability of the results obtained from opinion polls, despite statements concerning expected error margins. In a classic study of variability in polls and surveys, Converse and Traugott (1986) noted that direct measurements of public opinion about national affairs were appearing with increasing frequency in the mass media.

Discrepancies were often noted between multiple surveys done at the same time on what seemed to be the same topics. The authors compared products of different survey institutions and reviewed several sources of variability and fixed bias in such surveys, including sampling error, variability in sample composition, interviewer variability, and questionnaire variability. Groves (1989) also published a thorough review of the question. Since then, major progress has been made in most of these domains (De Heer, de Leeuw and van der Zouwen, 1999). The means of arriving at the necessary methodological rigour to significantly reduce that variability do exist, but, as Groves has shown, there is a cost for the reduction of variability.

"REPRESENTATIVE SAMPLING" FOR QUESTIONNAIRE CONSTRUCTION

One of the traditional concerns in surveys is questionnaire construction, and although there has been extensive research concerning question format, response format, question wording, question order or "halo effects" (Schwarz and Sudman, 1996), there seems to have been very little research on setting up a format process by which questionnaire content is determined in such a manner to provide a statistically valid "representation" of the social phenomenon the survey is supposed to study. In short, there is a certain "lopsided" aspect to polls and surveys. On one hand, there are formal procedures for generating a statistically representative sample of a nation, of a specific population, or of many types of social groups. On the other, a "panel of experts" often determines the content of questionnaires for major national surveys in a very empirical or even pragmatic manner, based on the experts' own "personal knowledge" and past experience with similar surveys.

It is in this particular aspect that Agoramétrie's survey methodology differs from traditional surveys and has been able to produce results that are so stable that major French institutions — governmental and non-governmental — have found it possible to make projections several years into the future based on these survey results. From one to several months before a survey on social conflicts, a specialised media research center[1] analyses an extensive representative sample of French printed media for all articles concerning topics of social conflict. For the 1992 survey, the press was analysed between 15 December 1991 to 31 January 1992. The representative media sample included seven nation-wide dailies (Le Monde, Libération, Le Quotidien de Paris, Le Figaro, L'Humanité, La Croix and France-Soir), two regional dailies (Ouest-France and La voix du Nord), nine nation-wide weeklies[2] and two monthlies[3]. For the 1998 survey, the press was analysed from 1 July 1997 to 10 October 1997. This time, the representative media sample included only six dailies — Le Quotidien de Paris and L'Huanité were replaced by Le Parisien — but five regional dailies,[4] ten weeklies[5] and three monthlies.[6]

The individual topics of social conflict are considered a representative sample of the universe of public discours on social conflict in France at that time. The individual entries are reorganized into 27 thematic categories which have proven to be both useful and more or less exhaustive. They are: national politics, international politics, scandals, natural catastrophes, economy, security, justice,

[1] Hedera (70 bis rue de Romainville, 75019 Paris; **hedera@wanadoo.fr**) performed this analysis for the surveys from 1981 to the most recent 1997 survey.

[2] L'Express, Le Nouvel Observateur, Le Point, L'Evénement du Jeudi, Le Figaro Magazine, Elle, La Vie, V.S.D. and Paris Match.

[3] Actuel and Globe.

[4] Ouest-France, La Voix du Nord, Midi Libre, La Montagne and Le Républicain Lorrain.

[5] L'Express, Le Nouvel Observateur, Le Point, L'Evénement du Jeudi, Le Figaro Magazine, Elle, Paris Match, Madame Figaro, Le Canard Enchaîné and Charlie Hebdo.

[6] Notre Temps, Pour La Science (French edition of Scientific American) and Science et Avenir.

family, work and labor, health-medicine, urbanisation-housing, armed forces, energy, education-teaching, religion, agriculture, environment-ecology, transportation, morals-social problems, science, information-media, the elderly, consumers-food, the arts-show business, sports, leisure, fashion-beauty. Within each of the 27 categories, individual entries are regrouped according to content to constitute subthemes, and, sometimes, sub-subthemes, depending on the number and content of the sampled entries.

For example, in 1997, the category, "National Politics," had the following subthemes: legislative elections, cohabitation, new government, major policies, 1998 budget, job policies, working hours, social policy, naturalization and immigration policy, political parties, Corsica. The subtheme, "political parties," was organized with the following sub-subthemes: parliamentary majority (two entries), Socialist Party (one entry), French Communist Party (four entries), Ecologists (one entry), parliamentary opposition (five entries), RPR conservatives (one entry), National Front (seven entries). One can see that the theme of social conflict are focussed around the extreme right (National Front), the opposition and the Communists.

Using this reorganized thematic sampling of media production concerning social conflict, a large panel (often over 20 persons) of expert observers of social problems from many walks of life is brought together and proposes a list of questions that is as representative as possible of the thematic sample. For each survey, the panel has been different with nearly 50 percent new members. The suggested list of questions is used by Agoramétrie to construct the survey questionnaire which varies in length from 70 to 100 closed questions on social conflict. The questions are typically written in the form of a declaration — "God exists" or "There are too many immigrant workers" — that encourage a respondent to "take a position" or "make a stand." The closed five-point scale of response categories is: "Don't agree at all," "Don't agree very much," "Perhaps agree," "Agree somewhat," "Very much in agreement"; English translations of "Pas du tout d'accord," "Pas tellement d'accord," "Peut-être d'accord," "Bien d'accord," "Entièrement d'accord." There is also a "non-response" category.

AGORAMETRIE SURVEY METHODOLOGY AT HOME AND ABROAD

The survey questionnaire constructed in this manner by Agoramétrie is submitted to a representative sample of the French population with usually between 1,000 and 2,000 respondents. The questionnaire is administered by major professional French survey organizations (SECED, 1977-1985; SEDEF,1986; BVA,1987-2004). The data is analysed by a form of eigen decomposition called principal component analysis which, like correspondence analysis, is essentially a factorization of the data matrix to extract eigenvalues and principal axes. The first axes has systematically designated "engagement" or "participation in the survey," meaning the respondent avoided massive use of the "non-response" and "perhaps" categories. In the remainder of this article, we will not take that axis into consideration when talking about the "first," "second" or "third" axis.

Much of what we have related above is not known in Anglophone sociology for the simple reason that this work has been done almost exclusively in French, and published and distributed directly by Agoramétrie to a specialized but rather small audience. In 1987, the Bulletin de Méthodologie Sociologique (BMS) published an article (in French), "Les structures de l'opinion: Enquêtes et méthodologie" (The Structure of Opinion: Surveys and Methodology; Agoramétrie, 1987), based on the two methodology chapters of Les structures de l'opinion en 1985 (Agoramétrie, 1986). A doctoral thesis was defended 1988 on the basis of Agoramétrie research et presented Agoramétrie's survey methodology in detail (Iliakopoulos, 1988). One of the very few publications in English concerning

Agorамétrie research appeared in the International Journal of Public Opinion Research (Durand et al., 1990).

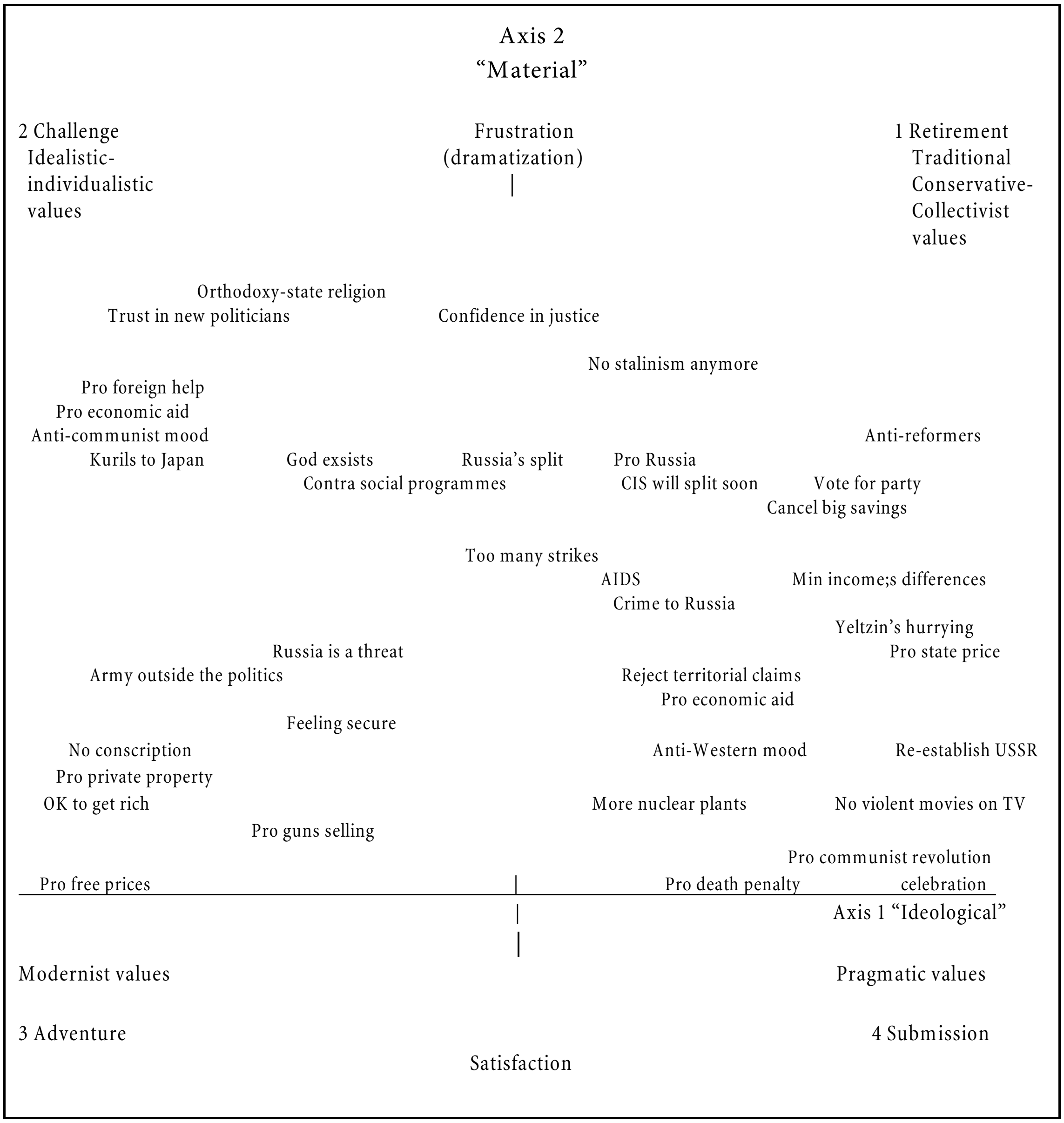

Figure 1. Russian public opinion structure – 1992. A plan of first principal components. Rukavishnikov (1992).

However, this lack of involvement in mainstream North American sociological research has not kept the method from being applied elsewhere. Vladimir O. Rukavishnikov, former deputy director of the Institute of Socio-Political Research of the Russian Academy of Sciences research center on sociology and deputy editor of the journal, Sotziologicheskie Issledovanija, has use the method in opinion surveys in 1991 and 1992 in Russia and presented results in the "Current Developments in Environmental Sociology" symposium in Woudshoth, the Netherlands, in June 1992 (Rukavishnikov, 1992). He explicitly noted that: "VARIMAX analysis shows a remarkable stability of public opinion structures ... The first principal component corresponds to the dimension opposing traditionally-conservative views to modern-radical ... The second principal component — 'material' — seems to characterize the dimension opposing frustration to satisfaction ..." (ibid: p. 7). These are precisely the two first axes that were found in French surveys (see Figure 1).

Rukavishnikov clearly noted: "For us, it was an extraordinary insight that even the labels of axes in French colleagues' study were the same as in our one. But we worked independently." (ibid) The results also "showed a very high degree of similarity" with those of a Radio Free Europe-Radio Liberty study (1990). It should be noted that the Russian survey results were generated by a set of 38 questions that are quite different from those found in our French surveys.

Rukavishnikov's use of Agoramétrie methodology is not unique in Eastern Europe. Rasa Alisauskiene, former director of Baltic Surveys Ltd. in Viniius, Lithuania, has told the author she has also been using the methodology. The 1992 "Questionnaire of a Sociological Study on Public Opinion about Environmental Risks," constructed by the Institute of Sociology of the Bulgarian Academy of Sciences, consisted of 65 questions largely inspired by Agoramétrie research.

In Western Europe, the Agoramétrie approach was used by the Institute Morri s, a British survey firm for its "Living in Briton 1989" study which, like the Russian study, found the same two principal axes in the structure of public opinion on social conflicts (Figure 2). Again, the set of questions, generated by the Agoramétrie method, concerned British media discourse on social conflict and was not a direct copy of French survey questions.

Outside the "First" and "Second" Worlds, the Agoramétrie method has been used in Costa Rica at the School of Sociology of the University of San Jose in opinion research concerning social conflicts and, once again, similar results have been found.

SURVEY RESULTS OVER TWENTY YEARS

What exactly are these results that have been found in France, Russia, Great Britain and Costa Rica? Beginning in 1977 in France, each Agoramétrie survey has produced a typical two-dimensional graphic whose axes are the first two principal factors in the eigen-decomposition of the data matrix (Figure 3). In the upper right-hand corner (first quadrant), one can see "Feeling of insecurity" ("Sentiment d'insécurité"), "Bring back the death penalty" ("Rétablir la paine de mort") and "Too many immigrant workers" ("Trop de travailleur immigrés). We will see below that these three responses not only characterize the upper right-hand area of the graph, but they also form one of the tightest and most stable networks of opinions. The reader can easily imagine what sort of person would hold this network of opinions and what other positive and negative ties with other opinions would likely exist.

In the lower left-hand corner in the third quadrant, one can find "Hashich on sale in public" ("La haschich en ventre libre"), "The right to become French" ("Pouvoir devenir Français) and "For naked women on TV" ("Pour des femmes nues à la télé"). Here, again, these three items characterize an area of the graph, but they are far less tightly and stably tied between themselves in a network of opinions when compared to the three preceding items.

In the upper left-hand corner, in the second quadrant, one can find "Retire younger" ("Retraite plus jeune"), "Equalize revenues" ("Egaliser les revenus") and "[there are] Major industrial risks" ("Risques industriels importants", not in Figure 3) which are also relatively loosely associated between themselves and to the area of the graph.

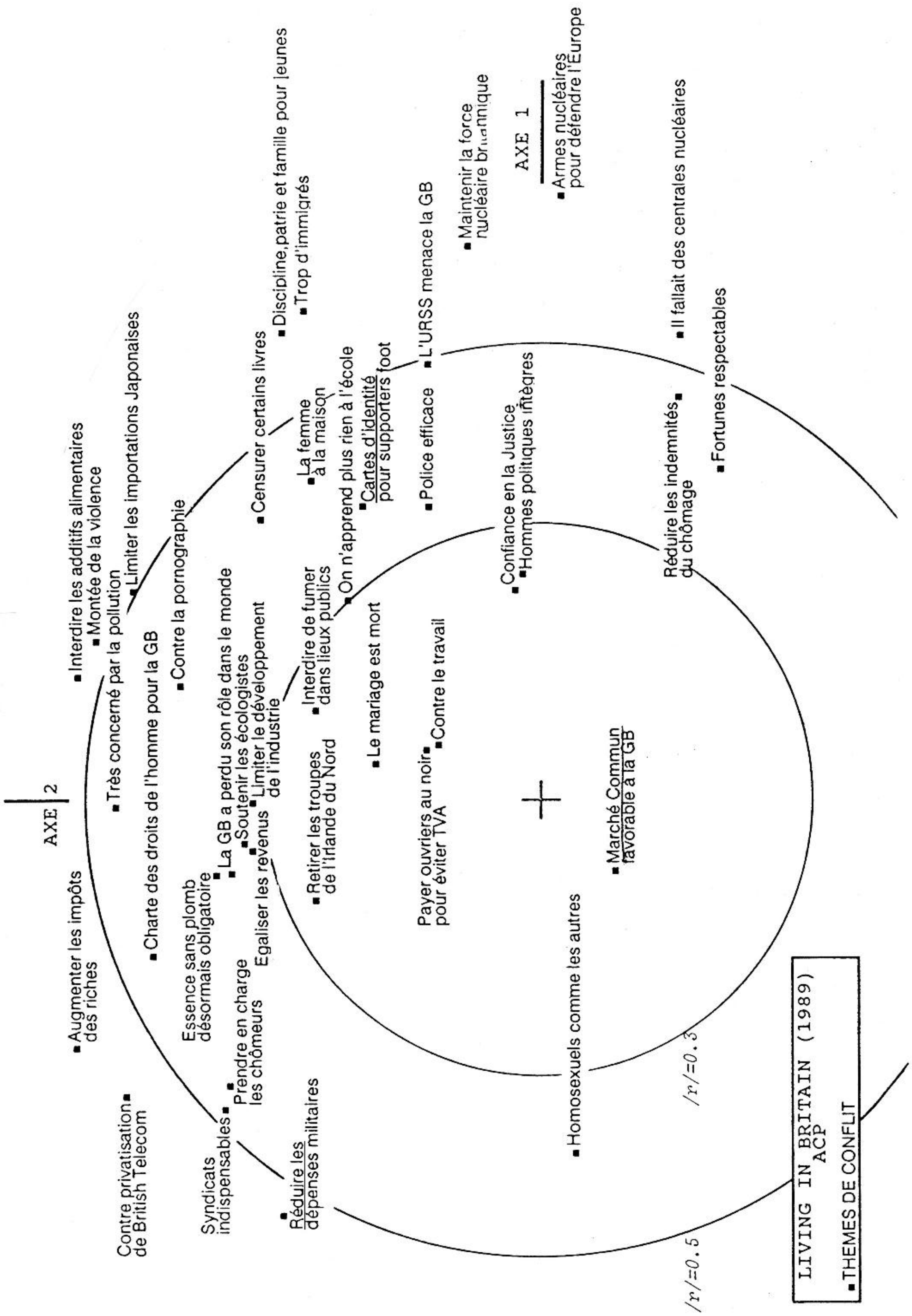

Figure 2. Living in Britain survey – 1989.

In the lower right-hand corner in the fourth quadrant, on can see closely grouped together "Nuclear power plants were necessary" ("Il fallait des centrales nucléaires), "Confidence in the Justice system" ("Confiance en la Justice"), "Politicians are good people" ("Hommes politiques intègres"), "Police does its job" ("La police remplit sa mission"), providing a clear characterization of this area of the graph, but not implying that these items form a tight or stable network of opinions.

On the right-hand limit of the first or horizontal axis, one finds "For my country" ("Pour la patrie"), "God exists" ("Dieu existe") and "For [our] nuclear armament" ("Pour la force de dissuasion"), characterizing a clearly conservative attitude toward society and response to social conflict. On the opposite left-hand limit, one finds "For the 35-hour week" ("Pour les 35 heures"), "Against work" ("Contre le travail") and "Homosexuals like others" ("Homosexuels comme les autres"), characterizing a clear rejection of dominant social attitudes.

On the second or vertical axis, we find, at the top, "Fewer robots" ("Moins de robots"), "Energy crisis is preoccupying" ("Crise de l'énergie préoccupante"), "Europe will never work" ("L'Europe ne marchera jamais"), and, at the bottom, "Long live the Euro" ("Vive l'Euroe"), "Increase taxes on diesel fuel" ("Augmenter le diesel"), "Build Europe with the East" ("Construire l'Europe avec l'East"), both of which lack apparent thematic coherence but do show emotional coherence with "cooperation" or a non-emotive response toward the bottom and with "conflict" or an emotive response toward the top.

These same characterizations of the first and second axes and the thus constructed four quadrants were found in all the more or less annual surveys in France (annual surveys from 1977 to 1999, except for 1979, 1980, 1990) and the other surveys abroad mentioned above. The readers can easily compare the two-dimensional graphs for the Russian, British and French surveys and see the similarly in structure both of the axes and often the items – or types of topics – themselves.

Thus, we can describe a general structure of how society sees social conflict by stating that the first most important factor is an opposition between adherence to dominant conservative attitudes with a certain "closure" toward social conflicts, and different non-conservative attitudes with a certain "overture" toward social conflict. The second most important factor is the opposition between a cooperative non-emotional attitude toward social conflict and a conflictual emotional attitude. The quadrants thus become characterized by conflictual closure (first quadrant), conflictual overture (second), cooperative overture (third) and cooperative closure (fourth).

Let us stress, once again, that this very stable general structure has been found in several rather different countries and over a sufficiently lengthy period of time in France — twenty years — that we can state with a high degree of confidence that these results are independent of the economic context, of the political context, of the social context and even of the international context, short of even more monumental changes than the crumbling of the Communist Bloc, the end of the Cold War and major wars in the Persian Gulf and the Balkans. This clearly raises the question of what are the limits of the application of these results. To which human societies are these results not applicable? At what scale are these results applicable: national populations only, regional populations, cities, social groups, families, or even individuals? These questions will be addressed below after examining the surprisingly stable results of these surveys.

"TRUNK" QUESTIONS OF SOCIAL CONFLICT

From the description above, the reader can easily imagine that media sampling process of social conflicts implies that topics or themes only recur systematically if they actually represent an essential aspect of public debate and not the vested interest of any particular social institution, even that of the media itself. If anything, the great variability of context over the twenty years of Agoramétrie surveys in France lends weighty support to that affirmation.

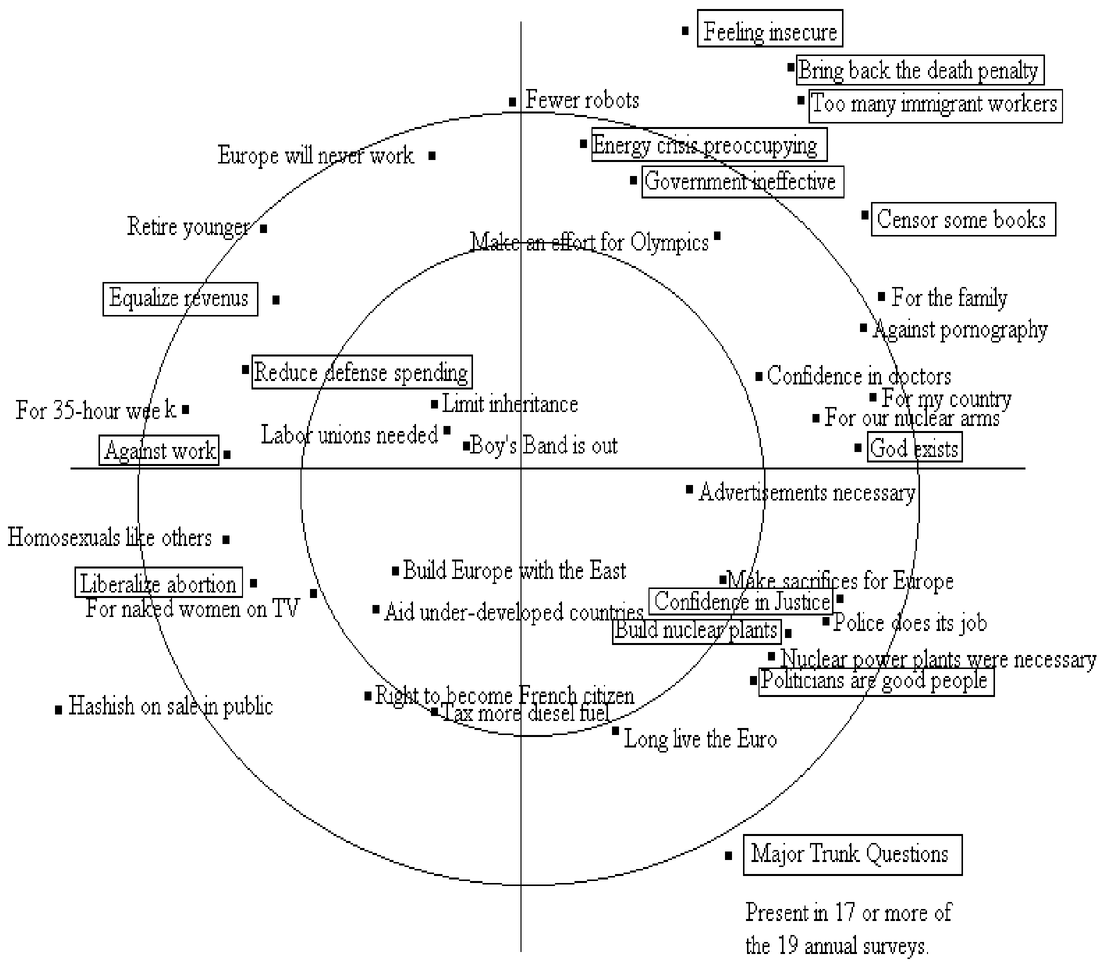

Figure 3. Principal components analysis of social conflict influence.

So what has this sampling process of social conflict turned up over twenty years of generating 70 to 100-item questionnaires? The 1997 survey provides a complete list of the 351 questions which have figured in the 19 Agoramétrie surveys since 1977 (Agoramétrie, 1997; 43-66). There are only a certain number of themes-questions that systematically recur. There are eight questions that were "sampled" even time: liberalize abortion, build nuclear power plants, God exists, equalize revenues, confidence in the legal system (with various formulations), reduce defense spending (and similar questions), government is ineffective (and the formulation "politicians are good people") and feeling of insecurity (and associated variants). Three themes appeared in 18 out of 19 surveys: too many immigrant workers, against working, and energy crisis is preoccupying. There were also six themes which appeared in 17 out of 19 surveys including: abolish/bring back the death penalty, TV considers us all stupid and censor certain books.

Liberaliser **L'AVORTEMENT** (1) --------------- Dans 19 enquetes
Construire des **CENTRALES NUCLEAIRES** (4)
DIEU existe (6)
Egaliser **LES REVENUES** (7)
Confiance en la **JUSTICE** (9)
Reduire les **DEPENSES MILITAIRES** (36)
GOUVERNEMENT inefficace (42)
Sentiment d'**INSECURITE** (46)

Trop de **TRAVAILLEURS IMMIGRES** (15) --------- Dans 18 enquetes
Contre le **TRAVAIL** (31)
CRISE DE L'ENERGIE preoccupante (57)

Supprimer **LA PEINE DE MORT** (12) ------------ Dans 17 enquetes
/Retablir la peine de mort (117)
Pris pour abrutis a **LA TELEVISION** (19)
CENSURER certains livres (41)
Limiter **LES HERITAGES** (16)
Contre **LA PORNOGRAPHIE** (18)
Aider **LES PAYS SOUS-DEVELOPPES** (21)

Pour la **PATRIE** (26) ------------------------ Dans 16 enquetes
Encourager **LA NATALITE** (28)
Maintenir **LA CROISSANCE** (35)
Pour **LES 35 HEURES** (77)
SYNDICATS indispensables (84)

Pour **LA FAMILLE** (30) ----------------------- Dans 15 enquetes
Defense du **CONSOMMATEUR** (33)
Contre **LE MARIAGE** (34)
Respecter **LES CONVENANCES** (43)
Soutenir **LES ECOLOGISTES** (66)
HOMMES POLITIQUES integres (106)

PUBLICITE indispensable (2) ---------------- Dans 14 enquetes
ETUDIANTS parasites (13)
HOMOSEXUELS comme les autres (103)
Trop de **FONCTIONNAIRES** (104)
ORDINATEURS menacent nos libertes (93) ----- Dans 13 enquetes
RETRAITE plus jeune (99)
Il fallait **DES CENTRALES NUCLEAIRE** (168)
Pour **LA FORCE DE FRAPPE** (11) --------------- Dans 12 enquetes
Moins de **ROBOTS** (182)
Confiance aux **MEDECINS** (5) (8 enquetes) ------------- Divers
Liberation de **LA FEMME** (64)
On n'apprend plus rien a **L'ECOLE** (90) (11 enquetes)
Confiance aux **JOURNALISTES** (308) (5 enquetes sur les 5 dernieres)
Le haschisch en vente libre (122) (11 enquetes)
Alcool prie **DES DROGUES** (97) (2 enquetes)
Liberte de se droguer (91) (3 enquetes) [total 13 enquetes]

Table 1. "Trunk" questions of major recurring themes in the French surveys

This list of themes-questions can be reduced or concentrated by regrouping various formulations or similar questions to produce a list of 42 themes (see Table 1), beginning with those mentioned above. How many could be considered strictly "French" themes that would not be "sampled" in a foreign context? Perhaps the "35 hour week," but it is closely tied to other "labor" themes and will in all likelihood become a topic of debate throughout the developed world in the near future. In short, the list of 42 themes is not limited to French social conflicts alone. Is it limited to social conflicts in the developed world alone? Indeed, questions concerning "nuclear arms," "energy crisis," "ecologists" and "computers" or "robots" would seem to limit the field of application to the more developed countries in the world. But each of these more-developed-country questions tends to be tied to similar and more universal themes: nuclear arms with defense spending and feelings of insecurity; ecologists with the destruction of the environment, and computers-robots with fear of new technologies.

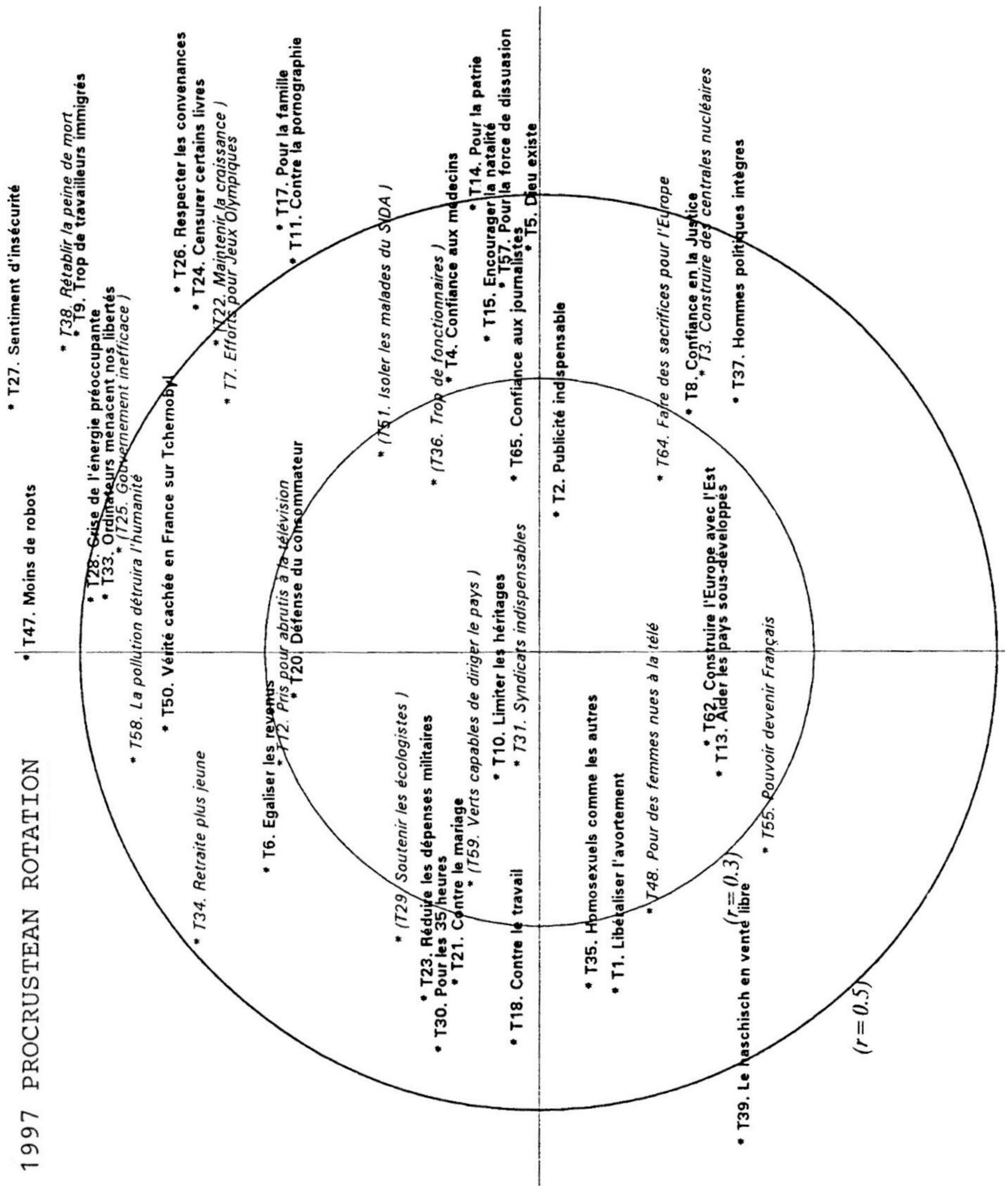

Figure 4. Procrustean rotation of 1997 diagram (active variables in bold face) onto 1992 diagram.

We call this set of 42 recurrent themes the "trunk" questions ("questions souches" in French) of social conflict not only because they have systematically come back over time and in different societies, but also because they in large part determine the general structure described by the two principal axes (see Figure 3). This double determination by trunk questions is brought out by several other statistical results from the analysis of the survey data. The distribution of item non-response values extends from "the Boy's Band is 'out'" (15.3%), "give more power to parliament" (10.6%) and "I like Lady Di" (10.2%) all the way down to "you can trust doctors" (0.5%) and "feeling insecure" (0.4%) (Agorامétrie. 1998: 31). The mean rank (56.83) and the mean non-response value (3.09%) for trunk questions are not particularly significant by themselves, but are so when compared to the mean rank (45.17) and mean non-response value (4.42%) for "non-trunk" questions.

Along with a few current "hot issues" — Lady Di, Algeria, hunting — the trunk questions show the highest correlation with the set of descriptive variables including locality, sex, age, diploma, religion, social-professional category, political tendency, political party (Agorامétrie, 1998: 69-170). In the Procrustean rotation (Mulaik, 1972; Dryden and Mardia, 1998) to graft the 1997 principal component analysis diagram onto the 1992 diagram, the 47 common themes in 1992 and 1997 include all but three trunk questions (students, women and school items). Out of the 47 variables, the 31 most stable ones actually used as active variables for the graft were all trunk questions. The next ten most stable variables were projected onto the resulting graphic (Figure 4) to control for the stability of the Procrustean rotation (Agorامétrie, 1998: 80). Of the ten, all were trunk questions or closely related variants, except for a few "current" issues: "make an effort for the Olympic Games," "Make some sacrifices for Europe."

Of the 31 variables that reconstruct the principal component analysis diagram best, on the basis of multiple correlation coefficient regression analysis (Agorامétrie, 1998: 91), all but two — "in France the truth about Chernobyl has been hidden," "Build Europe with the East" — are trunk questions, although the former of these two can be associated (negatively) with "politicians are good people" and the latter of the two with "Aid under-developed countries." Finally, the trunk questions also figure among the groups of variables most highly correlated with data matrix factors, according to VARIMAX analysis.

In summary, trunk questions provide a topographical background map on to which society projects how it sees social conflict. The major "landmarks" or trunk questions are known and change position or amplitude only very slowly. It's the "current" or immediate terrain which can change far more quickly. But even if this result seems fairly well established, it does not go far toward answering the question of "why" or how widely applicable to human society this result is. We will try to address these questions below.

NETWORK STRUCTURE OF SOCIAL CONFLICT OPINIONS

Let us look at the correlations resulting from the VARIMAX analysis (Dryden and Mardia, 1998). The first factor is correlated, in decreasing order of value, with: too many immigrant workers, against long-term resident foreigners becoming French citizens, against aiding under-developed countries, for intervention in Algeria, for the death penalty, against giving residence papers to illegal immigrants, against building Europe with the East, for more police controls in the streets, feel insecure, Europe will not work, government is not effective, no sacrifices for Europe. This is a coherent and clear description of "closure" toward social conflict and represents the upper right- hand area of our graphic. However, one should note that only about half the items are trunk questions. Although all the variables-themes of the group are correlated with the first factor, it does not necessarily imply they are tied one to another, as we shall see below. Nonetheless, they do form a coherent network of themes associated by their content and attitude toward society and social conflict.

The second factor is correlated with: against pornography, against naked women on TV, for censoring certain books and against hashish on sale publicly. For the third factor: fewer robots, pollution will destroy man, citizens should organize themselves against crime, computers take away our freedom, against nuclear power plants, energy crisis preoccupying and scientific progress is bad. For the fourth factor: our food is not natural, truth on Chernobyl hidden, industries put us at risk, TV takes us for idiots and too much political influence in the legal system. For the fifth factor: the police do their job, politicians are good people, confidence in the legal system and confidence in journalists. We should note that with higher factors, the thematic coherence tends to decrease, but up until now each group included at least one trunk question and often several. This is not always the case further on. For the sixth factor, we have patriotic effort, for seven, pro-business/anti-government, for eight, against working, for nine, for homosexuals and abortion, 10, anti-cars, 11, anti-media, 12, anti-doctors, 13, social activism, 14, ultra-free-marketeering, 15, weight-watchers, 16, for family values, 17, social equalitarians, 18, professional army, 19, well-being and marriage, and 20, God exists and youth job program worthless. As one can see with factor 20, the higher the factor number, the less thematic coherence among the variables. Nonetheless, with the initial factors, the VARIMAX analysis statistically defines the local network in which an opinion is situated.

A more precise description of ties or associations between individual opinions on social conflict is furnished by the complete set of cross-tabulations (Agoramétrie, 1998: 184-282). See Table 2. Returning to the group of themes correlated with the first factor, we find that the strongest pairwise correlations are between too many immigrant workers (trunk question) and bring back the death penalty (trunk question), followed by too many immigrant workers (ibid) and (negative) long-term resident foreigners should obtain citizenship (not a trunk question). Other strong correlations are with don't intervene in Algeria (not trunk), punish young delinquents (not trunk), police controls in the streets (not trunk), ineffective government (trunk) and resident papers for illegal immigrants (not trunk). This is an extremely concentrated xenophobic and repressive attitude which goes much further than the loose network of opinions correlated with the first factor and "fleshes out" the trunk questions present with more "current" concerns (Algeria and illegal immigrants).

In decreasing order, the other most highly pairwise correlated networks of opinions are, successively: against pornography, against naked woman on TV, censor certain books and against hashish on sale publicly (similar to factor two above); help under-developed countries, (negative) too many immigrant workers and (negative) do not intervene in Algeria; government inefficient, feel insecure and too many immigrant workers; with the next seven pairwise correlated networks simply being permutations of the first one above. It's as if the term "closure" were a literal description with "overture" meaning, by contract, open to weaker but much more varied ties between opinions.

Indeed, networks other than in the upper right-hand corner are much weaker and far more varied, and the overall structure is strongly influenced by the negative correlations or oppositions generated by the closed block described above. Figure 5 represents these positive ties with black lines and the negative ties or oppositions with red lines, clearly showing the upper right-hand to lower left-hand diagonal structure that underlies the entire principal component analysis diagram. Here, only the strongest ties or oppositions are indicated. As the threshold is progressive lowered, the graphic quickly becomes cluttered and illegible while the structuring effect changes little.

Correlations les plus importantes (> 0.35) non-redondantes (pp. 184-282)

Trop de travailleurs immigres (p. 192)
0.51 Retablir la peine de mort
-0.48 Pouvoir devenir francais
0.45 Ne pas intervenir en Algerie
0.44 Chatier les jeunes delinquantes
0.43 Sentiment d'insecurite
0.39 Controls d'idnetite indispensables
0.37 Gouvernement inefficace
-0.36 Regulariser les sans-papier

Contre la pornographie (p. 194)
-0.43 Pour les femmes nues a la tele
0.38 Censuer certains livres
-0.38 Le haschisch en vente libre

Aider les pays sous-developpes (p. 196)
-0.36 Trop de travailleurs immigres
-0.35 Ne pas intervenir en Algerie

Gouvernement inefficace (p. 208)
0.37 Sentiment d'insecurite
0.37 Trop de travailleurs immigres

Sentiment d'insecurite (p. 210)
0.43 Trop de travailleurs immigres
0.42 Retablir la peine de mort
0.42 Chatier les jeunes delinquants
0.37 Gouvernement inefficace
0.37 Controles d'identite indispensables

Retablir la peine de mort (p. 221)
0.51 Trop de travailleurs immigres
0.42 Sentiment d'insecurite
0.42 Chatier les jeunes delinquants
0.40 Ne pas intervenir en Algerie
0.39 Controles d'identite inndispensables

Le haschisch en vente libre (p. 222)
-0.38 Chatier les jeunes delinquants
-0.38 Contre la pornographie

Controles d'identite inndispensables (p. 223)
0.40 Chatier les jeunes delinquants
0.39 Trop de travailleurs immigres
0.39 Retablir la peine de mort
0.37 Ne pas intervenir en Algerie

Pouvoir devenir francais (p. 238)
-0.48 Trop de travailleurs immigres
0.39 Regulariser des sans-papiers
-0.34 Retablir les peine de mort

Regulariser les sans-papiers (p. 260)
0.39 Logements aux sans-abri
0.39 Pouvoir devenir francais
-0.36 Trop de travailleurs immigres
0.34 Aider les pays sous-developpes

Chatier les jeunes delinquants (p. 269)
0.44 Trop de travailleurs immigres
0.42 Retablir la peine de mort
0.42 Sentiment d'insecurite
0.40 Controles d'identite inndispensables
0.38 Ne pas intervenir en Algerie
-0.38 Le haschisch en vente libre

Ne pas intervenir en Algerie (p. 275)
0.45 Trop de travailleurs immigres
0.40 Retablir la peine de mort
0.38 Chatier les jeunes delinquants
-0.35 Aider les pays sous-developpes
0.33 Sentiment d'insecurite

Table 2. The strongest correlations between opinions.

At this point, a summary and a bit of clarification would be appropriate. At the level of the general two-dimensional graphic resulting from the principal component analysis, the first two axes are defined by the oppositions closure-overture and cooperation-conflict we have described above. These oppositions, found in survey data in France, Russia, England and Costa Rica, are therefore independent of any specific trunk questions. Each survey of social conflict will generate such a general structure in which appropriate items will appear in the areas we have described. Over time, a series of such surveys will generate the trunk items which, in turn, can be expected to be included in the questionnaire year after year and in particular areas of the graphic. One cannot state a priori that, for example, a series of surveys of social conflict in the United States will result in having “too many immigrant workers” in the upper right-hand corner and being a trunk question.

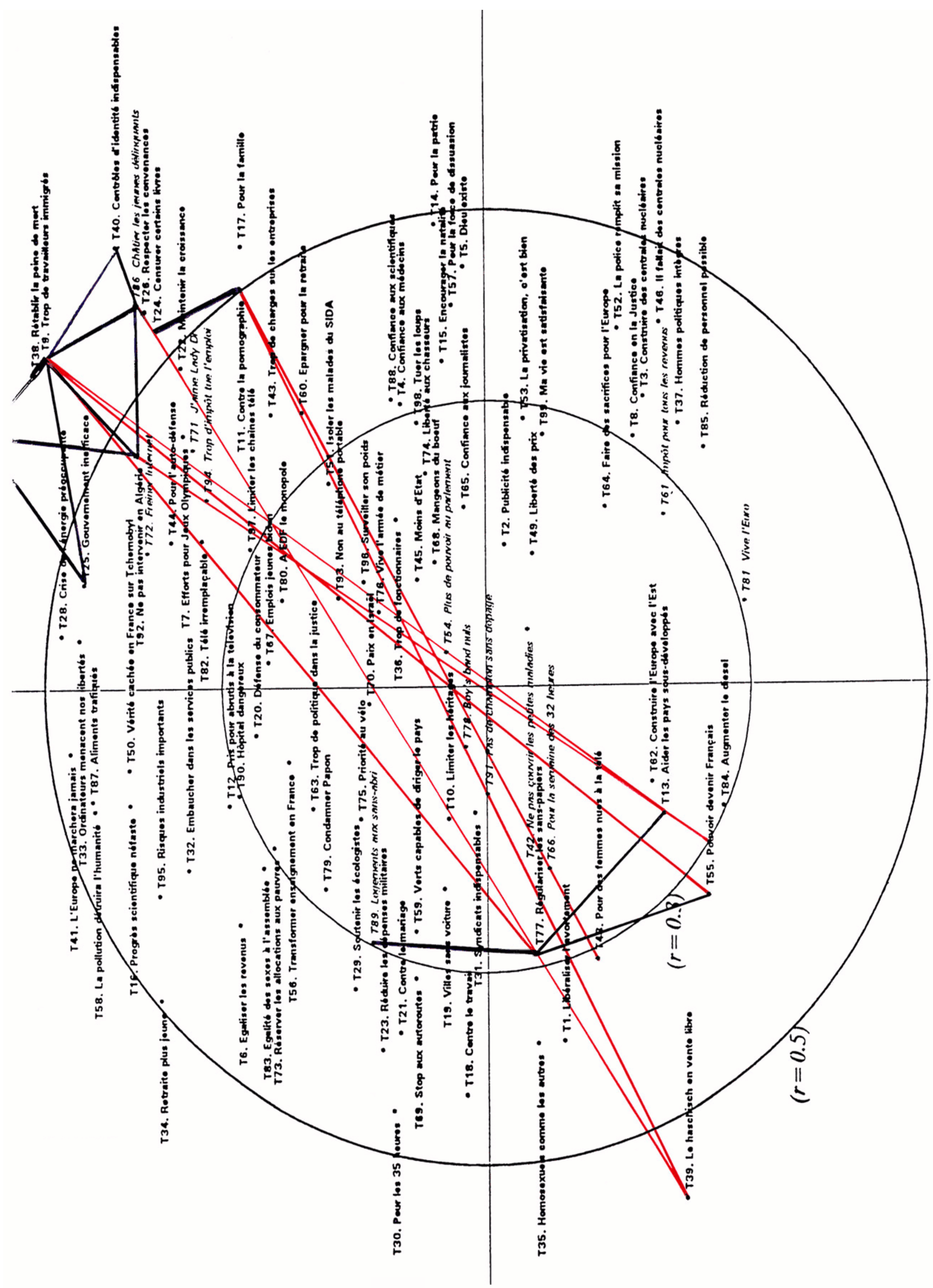

Figure 5. Strongest positive and negative ties (Red [negative - opposition] and Black [positive]Lines)

SOME CONCLUSIONS

Nonetheless, the general structure is constructed by trunk questions which can be found by longitudinal analysis as we have done above, but the specific content and formulation of any set of trunk questions will be influenced by the survey context, meaning the time at which it was carried out and the society which was surveyed. The set of trunk questions will cover the same fundamental themes as the French Agoramétrie trunk questions, and vice versa, but the questions may well not be the same. In the Russian surveys, “feelings of insecurity” were strongly associated with “will Russia break up?” and “will the armed forces take over?” while in France insecurity is tied to “too many immigrant workers” and “bring back the death penalty,” all of which have been trunk questions in France for the last twenty years.

At the “local” level or the level of association between items on the general diagram, we have defined networks of opinions on the basis of statistical correlation, meaning their ties are of a probabilistic nature. One cannot take a declared extreme right-wing voter, who believes there are too many immigrant workers in France, and state that the person will also be in favour of the death penalty. However, there is a high probability that that will be true. These networks of opinions at the “local” level define a socially recognized thematic coherence, and labels, such as “leftist trouble-makers,” “environmental activists,” “religious fundamentalists,” “right-wing racists,” “anti-government business people,” “active patriots” and “technocrats,” can be applied rather easily to many such “local” networks. But these identifiable networks do not consist solely of trunk questions. As stated above, the networks always seem to include at least one, and often several, trunk questions. This, in turn, implies that the other members of these networks are susceptible to change and are dependent on the time and the society studied.

On the general level, the local networks and the trunk questions, imbedded in the local networks, construct the ties and oppositions operating at the more general level, thus defining larger and looser networks and, ultimately, building up the general structure itself.

BASIC HUMAN INTERROGATIONS CONCERNING SOCIETY

Questions of Applicability in Scale

The above summary and clarification of the differences between the general and local levels, and role of networks of opinions and trunk questions, doesn’t answer the questions concerning scale and extent of applicability of these results. In short, where can this type of analysis be applied and these results expected? In terms of scale, there is little doubt that the analysis of national populations will produce the stated results, since we have such survey results from France, Great Britain, Russia and Costa Rica. Does this work at a smaller scale such as social groups? Rock climbers in the forest of Fountainbleau near Paris were surveyed using the Agoramétrie method and the same general structure for the French population was found (Corneloup, 1993). A current thesis project using Agoramétrie’s methodology and studying attitudes toward food and genetically-modified products generated a similar French population general structure for respondents selected arbitrarily from fellow graduate students and students’ family members (Quillet, 1998).

These results imply that the general structure of social conflict we have presented is “scale independent,” would be found in any social group of any size and would only be dependent on size for furnishing a more detailed and complete replica of the general diagram. A corollary of this statement is that the scale of application has no fixed upper or lower bounds. Indeed, neural psychological research at the University of Wisconsin under the direction of Richard Williams (1998) is exploring the apparent laterality of the cerebral frontal cortex activity in relation to reactions to emotive imagery. This research seems to imply that right-handed laterality is associated with reactions of withdrawal or closure when faced with emotional imagery. The left-handed laterality is apparently associated with more open and inquisitive types of reactions. The similarity with the first axis of the general structure of social conflict is evident and implies that human being may carry with them an evolutionarily selected capacity of situating their individually developed reactions to social conflict in a coherent manner somewhere along the first axis we have described. Whether or not this situating is a conscious or unconscious process is a question for further research in neural psychology and social psychology.

An interesting consequence of the potential association between the general structure of social conflict and the laterality of reactions to emotional situations is that every human society, and every social group of any size, will have people distributed along the closure-overture axis due to natural variability. Any decision by a group of persons to forbid, exclude, do away with, repress or eliminate people on any segment of the first axis will be fighting an unending battle against human development. At different periods in its evolution, a society could require the contribution of persons situated in different segments of the first axis. In a war situation, a maximum of closure and a minimum of overture may be the best survival strategy. In a period of calm and plentiful resources, a maximum of overture and a minimum of closure could be the best. Over extended periods of time, a society that has deprived itself of people associated with any segment of the first axis would be at a competitive disadvantage and risk disappearing.

This same argument holds for the second axis of cooperation-conflict but we have not yet found research on its possible scale-independent character or association with individual cerebral activity. Notwithstanding, if these two axes prove to be as fundamental to human social activity, as we believe, then their inclusion in the repertory of human capacities at some point in time must have represented an evolutionary advantage that could be investigated. Although our research method requires the use of language to produce communication, with other methods — such as long-term observation — it would be possible to see if animals, other than human beings, are distributed over a closure-overture axis concerning social conflict or whether other structures, such as rigid hierarchies, handle such problems.

Questions of Applicability in Extent

On the upper extremity of the scale of application, there is indeed no fixed boundary imposed by the scale but rather by our applicability criteria which, concisely stated, are the possibility of constructing a representative sample of public discourse concerning social conflict. Clearly, if there are communication barriers — different languages, geographical separation, social exclusion, separation in time, repressive regimes — then no such sample can be constructed and the methodology and results described above do not apply in the form they have been presented. A sampling of Soviet media in the late 1980's for themes of social conflict would surely not have produced the same results as Rukavishnikov's research a few years later. These criteria of applicability would impose an upper limit on the scale of method application. However, recent protests in Seattle, Washington, against the World Trade Organization show that the process of globalization concerns not only commerce but communication and public discourse on social conflict. Therefore, the upper bound for the scale of applicability of this method is moving higher all the time and can be expected to include the entire human population in the not too distant future.

The method, as we have presented it here, is based on sampling the press for topics of social conflict, but that is, of course, not the only way in which public debate can be sampled in a representative manner. Other public media could be sampled and in most developed countries with high Internet use, sampling public chat room discourse could be used. For historical studies, sampling archive material would be possible, although not necessarily representative. In short, sampling the press, when possible, is an efficient procedure but far from being the only possibility.

Tears in Networks, Resilience and Rupture Strength

Another aspect of the extent of applicability would be conditions under which the method would not work and actually break down. Although this has not happen yet, there is the possibility that catastrophic events, such as a civil war in a developed country or a world war, could cause the ties holding together the general structure of social conflict to break and reform differently. That we have not observed this over twenty years of opinion surveys in France is a clear indication that the ties holding together the general structure resist deformation over time. Nonetheless, the ties are not rigid, since we have observed slow but progressive changes in structure. Therefore, the ties have a certain resistance to deformation or resilience. The last question we shall ask here is whether or not it would be possible to measure the resilience of these ties and possibly their "rupture strength."

It should be possible to construct a measure by comparing the importance of a topic in successive press samples and its subsequent displacement in the general structure. One could use number of articles, their editorial space in square centimetres and over how long a period of time they appeared to constitute a composite measure of these three quantities and compare it with how much the item moves from one survey to the next on the general diagram. This would provide a measure of resilience and, in turn, a descriptive distribution of resilience strength for all items. Although this would not provide an indication of "rupture strength" for any particular tie (unless a break is actually observed), the distribution of resilience strengths would probably describe a Gaussian curve and provide a good indication of lower limits for "rupture strength."

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Abstracts

2003 Sunbelt
International Sunbelt Social Network Conference

Cancún, Quintana Roo, México, February 12-16, 2003

2003 Sunbelt Abstracts

Keynote Lecture

Social Networks, Social Space, Social Structure

Philippa Pattison

In this paper, I discuss the relationship between conceptualisations of social networks, social space and social structure. I argue that social space is an overarching and critical construct for a quantitative social science, and I suggest that there are two key theoretical concerns in specifying the nature of social space. The first is that social space cannot be specified simply in geographical, network or socio-cultural terms; rather, it requires an understanding of the interdependence of these different types of entities. The second is that social space cannot be regarded as fixed: unlike the Euclidean space of Newtonian mechanics, social space is constructed, at least in part, by the social processes that it supports. A general quantitative framework that addresses these two concerns is presented. Social network and other relational ties are constituent elements of social space within this framework, and social structure includes the patterned regularities in relations among these spatial elements. Applications of the approach illustrate its potential for a quantitative social science and also demonstrate connections with a number of theoretical claims about the localised nature of social phenomena. I finish by outlining developments that allow us to develop more precise models of social and psychological processes in both social space and time.

Plenary Lecture

A Two-Way Street: Interdisciplinary Research on Networks

Duncan Watts

Traditionally, social science has been the beneficiary of concepts and techniques derived from the natural sciences, such as mathematics and statistics, physics, and biology, but rarely have they returned the favour. The field of network analysis, however, is showing some promise of becoming an exception to the rule. While many of the early ideas of social network analysis (density, centrality, random-biased networks, blockmodeling), had origins in mathematics and solid state physics, and a number of recent advances in network research (modeling of partly-random networks, non-normal degree distributions, dynamical evolution of networks, and network models of contagion) have come from outside sociology, it is also true that ideas and empirical evidence from sociology, particularly with regard to social networks, have begun to penetrate other disciplines. In this talk, I argue that social network analysis, properly construed, provides us a rare opportunity not only to adopt ideas from the natural sciences to address sociological problems, but to help natural scientists apply sociological ideas to their own problems. As an example, I follow the history of a single problem—The Small World Phenomenon—from its origins as an exclusively sociological question to a veritable cottage industry in statistical physics and other fields. Furthermore, while a few of the general features of the original research are well known, I show that the small-world phenomenon is still yielding insights which shed light on emerging problems such as efficient search algorithms for peer-to-peer networks.

Plenary Lecture

Nagging Issues in the Study of the Role and Meaning of Social Network Influence: Lessons and Potential Directions from a Case Study in Mental Health Care

Bernice Pescosolido

Social network theory and research has received wide acceptance over the last twenty five years across a wide range of discipline and areas of investigation. Yet challenges continue to confront and question the progress made to date. Particularly in the area of health care, the idea that social network influence shapes the recognition of, response to, and even occurrence of illness has taken a central place in research agendas. Yet, much research that mentions social networks takes great liberty in how concepts and measurement are employed. Focussing on the issue of how family networks affect whether and how providers and advisors are activated across healing systems, I raise, discuss and provide some empirical evidence to bear on four critical points relevant to ego-centered investigations. First, can we examine patterns of network activation as solutions to problems? Second, does the role of network influence exist simply as "norms" as depicted in many theories of decision-making or does influence require actual interaction? Third, does the current tendency to focus on single characteristics of network ties underestimate the importance of social networks and, even more critically, ignore the holistic impact of network configurations? Fourth and finally, to what extent does a structural approach to social networks need to take into account social psychological, psychological and even biological factors that facilitate or dampen the impact of social interactions?

Communities

Network Analysis Of Global High-Tech Flows. Does The Internet Change The Picture?

Teodora Erika Uberti

The aim of this work is to analyse two relevant complementary phenomena: globalization and international trade of high-tech goods. This recent globalization wave is characterized by the role of ICT, the rise of R&D intensity in production processes and the development of intra-industry trade. Social network analysis techniques will be used to evaluate these dynamics. Our sample includes about 40 countries, all OECD and their major reporting countries, and trading relations on high-tech goods and traditional manufactured goods, observed in early '70s, '80s, '90s and at the end of '90s. Interesting results emerge by adopting absolute and relative perspectives to evaluate the adjacencies matrices, and including the attributive role of apparent consumption, "reflexive ties", to identify supplier-countries (innovative and imitative) and demand-countries.

Network patterns of social class in Chinese cities: Report of work in progress

Yanjie Bian, Ronald Breiger, Deborah Davis and Joseph Galaskiewicz

China's class structure is changing dramatically in the wake of economic reforms. We used data from household surveys in four Chinese cities to describe the structure of social relationships across 13 occupational categories. Household members described visiting, gift giving, and feasting with family, friends, colleagues, and neighbors around the Chinese New Year. Analyzing frequency counts in an occupation-by-occupation matrix, using Goodman's RC association models and an approach of Breiger's for the aggregation of categories in cross-classification tables, we discovered that government officials formed a class by themselves, fairly isolated from the rest. Industrial workers, service workers, chauffeurs, and nannies clustered in a second- class position, quite distant from the first. Scientists and professionals formed a third cluster, and teachers, managers, administrators, public safety employees, business people, and medical professionals formed a fourth class located in-between the others. Examining relations within and between classes, we discovered that officials, scientists/professionals, and workers were fairly self-contained and avoided interaction with others. In contrast, white-collar workers visited, feasted, and exchanged gifts across occupational classes, exhibiting very little homophily in their interaction patterns. We speculate that white-collar employees may play an integrative role in what is an increasingly and distinctively polarized urban society.

Accounting for social network variability among villages: Kinship and economic ties in Nang Rong, Thailand

Katherine Faust, Barbara Entwisle and Ronald Rindfuss

This paper examines the variability of social networks among 51 villages in Nang Rong, Thailand. Our social network data consist of three relations (sibling ties, help with the rice harvest, and renting, hiring or sharing agricultural equipment) measured between all households in each village. We first document the variability of three general network-level properties: cohesion within villages, permeability of village boundaries to external social ties, and multiplexity of relations. We then explore how variability in these network properties is related to other characteristics of the villages – their size and location, demographic composition and change, agricultural activities, and affluence. Our results are cautionary for social network research that relies on case studies of single settings but leaves unexamined the extent of variability across settings.

Clubbing in Ibiza: Community experiences during vacation

Carlijne Philips

Does community life fade away in modern societies or do we observe a shift to new forms? This paper deals with a possible alternative form of community in modern times. Community is seen as a group of people with multifunctional relationships, shared norms, and a we-feeling. Observing vacation destinations such as the typical Dutch camp-site 'Camping Bakkum', we see people who have such relationships, who share norms, and share a we-feeling for several months, year after year. In short, many features of traditional 'grown' community life appear to be reproduced (Philips & Wielers 2000). But there can also be vacations with shortly staying strangers in which "instant" community might be achieved. Candidates for such vacations are Club Med and Ibiza, particularly the club-scene Ibiza is famous for. This paper presents the results of my community study in Ibiza. Using quantitative and qualitative data from 82 club visitors, I will answer the following two questions: To what extent do the clubs in Ibiza show instant communities? and Which factors determine whether club visitors do or do not participate in these communities? Attention will be paid to characteristics of the clubs (e.g. music, entourage) and its visitors (e.g. shyness, use of XTC)

Analytic Methods

Testing regularity and dispersion at all levels of hierarchical clusterings of social relations in humans and animals

John Boyd and Kai J. Jonas

A large number of social relations are clustered by standard methods that are independent of the regularity of the individual blocks at each level of clustering. These blocks can then be tested for regularity and other properties, such as dispersion (variance over mean). Regularity has a negative correlation with dispersion, but given the empirical failure of regularity in this and other studies, the authors focus on dispersion, which is of importance in biology and other fields. The index of dispersion can be tested because $(N-1)s^2/x$ has approximately a x^2 distribution with $N-1$ degrees of freedom. The statistical models depend upon whether the data matrix is symmetric or anti-symmetric, and whether it is binary or nonnegative integer. Binary matrices suggest beta-binomial, binomial or hypergeometric distributions, as determined by a parameter. On the other hand, matrices with nonnegative integers suggest a negative binomial distribution. The results support the model of high dispersion at all levels of clustering, while rejecting regularity.

Network inference and accuracy estimation with covariates, configurally dependent errors, and non-ignorably missing data

Carter T. Butts

A common problem in social network analysis is that of network inference — that is, inference on an underlying "true" network given a set of incomplete and/or error-prone data. Writ large, this problem encompasses both the general issue of measurement error and informant accuracy, as well as that of network sampling. In prior work, I have demonstrated a family of Bayesian models for network inference with ignorably missing data, under an assumption of edge-wise independent errors (with observer-dependent, uncertain error rates). Here, these models are generalized to encompass non-ignorable missing data (including that arising from non-trivial sampling procedures), covariates, and error processes that are configurally dependent. Computational strategies for posterior simulation and evaluation of these models are demonstrated, along with suggestions regarding reasonable prior specification for various contexts.

Dyad-specific consensus for cognitive social structures

Ju-Sung Lee

I re-examine several of Krackhardt's cognitive social structure data sets using attribute and structural features as predictors of accuracy using a variant of consensus, which focuses on the four components of a dyad as reported by dyad actors. That is, actors i and j's perceived relationship to each other will be equivalent to or a subset of the set of both actor's perceptions of each part of the dyad: {i:i->j, j:i->j, i:j->i, j:j->i} where x:y->z means actor x's perception on y's tie to z. Which of these are positively reported have an impact on general accuracy and accuracy as predicted by social distance. I use a definition of social distance which employs each actor's report in a chain, and not just the originating ego's cognitive map and not necessarily defined by a "Locally Aggregated Structure" rule. I explore predictions on structures such as triads as well as how attributes interact with accuracy. The findings augment those of [Batchelder Kumbasar Boyd 1997], [Bondonio 1998], and [Krackhardt 1999].

Analyzing the life course using interval graphs

Joy E. Pixley and Carter T. Butts

A key precept of the life course approach is the importance of examining the role context in which life transitions occur. Although this encourages a focus on patterns of coterminous roles, techniques used to represent and compare such patterns have so far been limited. Here, we illustrate a new family of techniques for the formal analysis of life course patterns based on an interval graph representation. Under this framework, life histories are represented as networks of relations among spells (e.g., jobs, marriages, children, schooling). The focus is on the changing intersections of roles across time. We introduce two potentially important uses of this approach: to provide parsimonious summary measures of multi-domain life histories, and to enable comparisons of individuals. These methods are demonstrated using retrospective life history data from a sample of 1,532 men and women in upstate New York. Implications of methodological variations are discussed and some potential applications of the methods for life course researchers are suggested.

Settings in social networks: Representation by latent transitive structures

Michael Schweinberger and Tom A.B. Snijders

The range of human interaction is restricted by, e.g., time, money and geographical constraints. As a consequence, large social networks (with more than, say, 50 actors) will frequently contain not one but two or more settings. A setting is defined as a set of ties defined on a set of actors. As was argued by Pattison and Robins (2002) and many others, settings have to be modelled in an adequate way. Recently, two promising classes of settings models were elaborated by Pattison and Robins (2002), and Hoff, Raftery, and Handcock (2002). We suggest another class of settings models, in which the settings are represented by latent transitive structures. The latent transitive structures are expressed by ultrametrics, and statistical inference is made by the Maximum Likelihood method, using a non-greedy algorithm, and a Bayesian approach, using a hybrid Markov chain Monte Carlo algorithm. Applications will be presented

Ethnicity and Personal Networks

An additional probe for inter-ethnic relations

Vincent Kynn Hong Chua

This paper introduces a new approach to measuring inter-ethnic relations, and shows how these relations can be more accurately measured in the context of larger patterns of social integration. Ethnicity is treated as a 'follow-up item' in the mapping out of personal networks. This method is far more accurate than a direct method of eliciting such ties (Smith, 1999). What is innovative in this study is the use of a position generator to probe for further inter-ethnic relations that a person might have. This probe follows from a set of name generators that elicits the social support networks of individuals. Among other concerns, the paper addresses the outcomes of the probe; e.g.: What are the properties that define the inter-ethnic ties thus uncovered? In what domains of social life can such ties be found? What differences are there between ties that are probed and ties that are not? The answers provided are based on data collected in Singapore. Comparisons will be made with official government surveys. Preliminary results are provided.

Ethnicity and friendship choices among Southern California middle school students

Beth R. Hoffman and Thomas W. Valente

This study uses social network analysis to examine the friendship patterns of middle school students by ethnicity. As part of a larger survey, social network data and racial/ethnic identification data were collected from sixth grade students at four middle schools in Southern California. We hypothesized that adolescents will choose friends of their same ethnicity rather than friends of other ethnicities. Linear regression and Criswell statistics were calculated on friendship choices for the entire sample as well as for each school separately. The Criswell statistic is a double ratio used to measure preference for one's group of membership versus another group. Bootstrap methods were used to obtain confidence intervals. Results show that adolescents were more likely to choose friends of their ethnicity rather than friends of other ethnicities. Implications of these results for substance abuse research and prevention are discussed.

A personal network method for measuring race and ethnicity

Amber Wutich and Chris McCarty

Multiple choice questions where respondents self-identify their race and ethnicity have been staples of survey research for over a century. These variables strongly co-vary with socio-economic status. Since the 1960s, attitudes and demography within the US have changed; today, there is more intermarriage between racial and ethnic groups and more mobility between groups. In recognition of this, the most recent Census allowed respondents to self-identify their race and ethnicity using a 'check all that apply box' rather than the previous method 'check the box that most applies'. This approach creates significant problems in the use of race and ethnicity as a variable in analysis. We suggest that the aspects of race and ethnicity that co-vary with structural inequity may be socially defined rather defined by phenotype. In other words, poverty is not a function of skin color, rather skin color is a marker for social interactions that ultimately determine socio-economic status. A series of social network measures of race and ethnicity that use personal network composition (such as percent Black, White and Hispanic), and personal network structure (such as average point centrality scores of Black, White and Hispanic alters) will be a more valid and reliable predictor of socio-economic status.

Information Exchange

Mapping the information relationships of line-managers

Maureen L. Mackenzie

The purpose of this qualitative study is to examine the information relationships of a group of interacting line-managers and to identify the valued information sources. The context was a large business unit within a major US corporation. Social mapping was selected as the appropriate method so as to capture a more intimate view of the information relationships. Content analysis was used to analyze the data and to draw out the themes. The results revealed that relationship, more than knowledge, was the reason an individual was sought as an information source. The insight that relationships on-the-job lead to information access appeared to be less developed with junior (frontline) managers and more evident with senior managers. In addition, the managers considered remote to the central business unit also demonstrated less dependence on relationships since they have less opportunity to develop the relationships in the larger network. The non-hierarchical flow of information among line-managers and the reasons managers seek others as sources further differentiate and document managers as a unique information user- group.

Information exchange patterns in product development projects

Thomas Gulløv and Kent Wickstrøm Jensen

By combining organization theory, organization learning theory and social network analysis, we expect to contribute to the explanation and prediction of behaviour in organizations. Instead of explaining behaviour based on "Organizational Behaviour", this work attempts to describe and design sufficient communication structures based on an analytical approach towards information exchange in organizations. In the paper, we will develop a coherent set of mechanisms including theoretical contradictions and complementarities in the description of interaction patterns. By investigating a software producer, we will identify possible dependent variables in the information exchange and discuss the implications for further investigation of information exchange generally in organizations. The data in this paper comes from a case study of a design team developing an advanced information system. The design team was examined 6 times over a 6-month period through interviews and questionnaires. Over 6 interviews, we further examined the task composition and interdependencies following a FUTS diagram and a matrix decomposition method. We analysed the organization structure including formal superior-subordinate relationships, task responsibilities, skill-requirements associated with each task, skill-possession, skill-level, experience, education-level and age of the participants, task related contacts for each participant, task-status such as delay, committed working hours, and reasons for potential delays.

Trust, informal ties, and genetic screening in the workplace: A computational model to predict screening participation using informal network structure

Tiffany Tummino

Occupational exposure to hazardous materials contributes to many kinds of disease, including cancer, respiratory disease, and allergic reactions. It has been shown that some people's genetic makeup includes mutations that cause higher-than-average risk for occupational disease. People with these mutations can sometimes be identified through genetic screening and offered special protection from hazardous substances. However, occupational genetic screening has encountered strong social resistance, in part because employers may have incentives to discriminate against susceptible workers and to violate the privacy of workers' test results. High levels of trust and strong informal ties between workers and management may facilitate participation in screening. Here I present a computational model that uses intra-organizational network structure to help in predicting participation in a firm-sponsored genetic screening program. A survey-based effort to validate and improve the model is also discussed

Ambiguity and uncertainty: Are friends experts on self?

Pierre Mongeau and Johanne Saint-Charles

In this paper we will present research findings related to two hypothesis, the first one stating that people use friendship networks when situations are ambiguous while they reach for the advice network when there is uncertainty (Krackhardt and Brass, 1994; Weick, 1995), and the second one stating that people use different media through which they communicate depending on the nature of the situation (Sproull and Kiesler, 1988). Ambiguity occurs when actors are confronted with too many interpretations or information, causing a shock of confusion; uncertainty appears when there is a lack of information, causing a shock of ignorance. Questionnaire-based interviews were conducted in a large organisation with a random sample of permanent employees. Respondents were presented with various situations either ambiguous or uncertain about which they were asked to name who they would talk to in order to handle the situations. Aside from the results directly related to the two hypothesis presented above, we will discuss the meaning given by respondents to the notions of 'expertise', 'counsel', 'support' when friendship is involved (Saint-Charles, 2001).

Interdisciplinary research networks: Practices, processes and products

Diana Rhoten and Andrew Parker

This paper presents preliminary results of a one-year NSF-funded pilot study of the structure and dynamics of interdisciplinary research networks in seven environmentally-related research centers (N = between 37 and 483 researchers in each center, with one center having 48 different research groups). Using social network analysis and organizational ethnography, this pilot study (1) produces a series of sociograms that depict the individual attributes and interrelational structures that define the interdisciplinary research networks of these centers; (2) explores the professional, political, personal and interpersonal, etc. dynamics that both shape and are shaped by these structures; and (3) maps the interactional 'hot spots' i sites of interdisciplinary research collaboration i which promise to be significant to understanding how knowledge transfer, conversion, and integration and, ultimately, scientific production and innovation occurs in such centers. By accomplishing these things, this study yields a generalizable set of criteria for classifying interdisciplinary research networks as well as idiographic case studies that provide detailed exposure into how the individual and the organizational, the social and the psychological factors of interdisciplinary research networks are played out in action as well as displayed in pictures. Together, these results provide critical first steps toward the development of currently missing but greatly needed interdisciplinary research methods and metrics.

Inter-regional Networks

A framework for analysing informal knowledge transfers in economic relationships by applying social network analysis

Helen Hennessy and Fergal McGrath

This paper develops a new framework for analysing informal economic relationships by applying social network analysis. Knowledge transfer is a significant challenge for communities and understanding these interactions facilitates the enhancement of social capital. Knowledge is transferred on the basis of groups, relationships and networks all of which are social in nature. SNA is appropriate for knowledge transfer as it helps to make the invisible sets of relations visible. This visibility allows us to support the knowledge transfer potential that exists in informal networks. Economic relationships are often social in nature and previous research has failed to capture this dimension. The research objective is to understand economic relationships by mapping various relationships using an SNA perspective. The research involves examining the ties between two communities. It is hoped that SNA will lead to a better understanding of these relationships. In using SNA software to map the social aspect of the relationship, it may be possible to recognise what ties are prominent in certain types of relationships. The research presents a framework derived from economic exchange, which is theoretical in nature; it proposes a new application of SNA.

Innovation within and across regional networks: The Boston, San Diego, and San Francisco Bay Area biotechnology clusters

Jason Owen-Smith, Kjersten C. Bunker, Walter W. Powell

Two different conceptions of distance dominate our thinking about innovation in high technology industries. Economic geography emphasizes physical propinquity as a key factor in regionally bounded information spillovers. In contrast, sociologists rely upon more structural conceptions of position in a network of formal contractual relationships to explain information and resource flows within high technology industries. Where the former is largely 'structureless,' and the latter independent of physical space, most organizations exist simultaneously in both. Geographic clusters of high-tech firms are interspersed and overlaid by formal networks of strategic alliances. Both regions and networks, however, are complex ecologies home to multiple types of organizations. Drawing on twelve years of data on formal ties involving human therapeutic and diagnostic biotechnology companies we examine the relationship between network position, co-location, and organizational diversity on patenting by these research-intensive firms. We draw upon network visualization and multivariate statistical techniques to compare the ecology, structure, and effects for innovation of networks within and across three biotechnology communities: Boston, San Diego, and the San Francisco Bay Area.

An examination of Canada's inter-provincial networks

George A. Barnett, Eun Jung Sung, Jia Lin, Hsiao-Yun (Iris) Hung and Han Woo Park

This paper reports the results of a network analysis among the Canadian provinces. Available data on migration, trade, air traffic, student-exchange and Internet flow among the 10 provinces and three territories were analyzed to describe the relational structure of Canada. Results show five similar flows among provinces from all five indicators. Ontario is at the center of Canadian life and the territories (Yukon, Northwest Territory & Nunavut) are at the periphery. In between are loosely connected dyads of the Western provinces (British Columbia & Alberta) and the Prairie Provinces (Saskatchewan & Manitoba), and the Maritime provinces (Newfoundland, Nova Scotia, Prince Edward Island and New Brunswick). Quebec is strongly connected to Ontario and somewhat less closely tied to the Maritimes. Research was conducted controlling for population and geography. When controlling for population, Quebec became isolated in the inter-provincial network, which consisted of two groups, one composed of the Maritimes and another of the Western and Prairie Provinces and the Territories; with Ontario acting as the liaison between the two cliques. A gravity model, used to determine the impact of population and geography on the network, was significant for all indicators except for Internet. Finally, changes in the network were examined over time, indicating that network dynamics were a result of economic changes and annual cycles.

Preliminary results of the Cross-Cultural Project on Network Evolution in Isolated Groups

Jeffrey C. Johnson, James Boster and Lawrence Palinkas

This paper reports on the preliminary findings of research on the evolution of network structure over the austral winter in Antarctic research stations in 5 different cultural settings. A series of hypotheses on the relationship between the evolution of network structure and informal social roles and the relationship between structural coherence (i.e., cohesion) and group outcomes (e.g., group morale, individual psychological well-being) are tested at Arktowski Station (Polish), Vostok Station (Russian), Great Wall Station (China), Maitri Station (Indian) and South Pole Station (United States). The preliminary results suggest a relationship between group coherence and the presence or absence of certain informal social roles across all 5 cultural settings. In addition, there is a relationship between global coherence, informal social roles, and group outcomes across all the cultures. These preliminary findings suggest that there may be certain culturally universal group properties that contribute to the proper functioning of groups.

Why is it so difficult to reproduce Silicon Valley: The case of the renewable energy sector in Navarra, Spain

Luis Arturo Rabade

The paper examines the growing need for innovation in small firms in order to increase regional economic development and emphasises the network approach as the way to enhance it. Firstly, the importance of innovation for regional economic prosperity is discussed, as also is the implication of network ties for innovation processes. The relevance of spatial dimension is brought into mind because spatial closeness accelerates the creation of networks as it lowers transaction costs and eases personal interaction. Secondly, the paper shows the way regional networking can be stimulated. Critical success factors that determine the evolution of networks are identified. The paper also examines how far certain decision-making mechanisms in a regional context can foster the creation of networks. A model that helps understanding the process of regional development as well as the dynamics of networking is presented. Finally, the theoretical background is applied to a specific region and to a specific industrial sector: the renewable energy industry in the Spanish region of Navarra. A critical assessment is given of Navarra┤s regional policies and its potential for future promotion of innovation through successful regional networking.

Innovation & Diffusion

Mapping innovation diffusion in UK construction projects: The importance of informal networks

Graeme Larsen

The research focuses upon innovation diffusion within construction projects. To date, attempts at diffusion have focussed on formal organizational and project structures. The aim is to identify if actors have informal communication networks, what role these play in the diffusion of construction innovations, and if they can facilitate diffusion within and between projects. One organization forms the context for the research, with seven projects currently running. Initially, the organizations' informal communication network is mapped. The organization then formally introduces an innovation, but only for two case study projects, the five projects remaining are not formally exposed. Project 1 has its' informal communication mapped longitudinally, thus providing a control sample. Project 2 will, through the initial mapping and understanding of the informal network before innovation introduction, have its' informal communication mapped (longitudinally) and 'stimulated' by particular actors and their roles. This provides a comparison against Project 1, the 'un-stimulated' project. This tests if awareness and encouragement of informal networks affects diffusion between projects by determining from which actor, in which project, the innovation was communicated, thus influencing the adoption decision. Preliminary results show that informal communication networks exist. Actors and the organization's management are unaware of its' shape and their informal roles within it, thus leaving innovation diffusion unmanaged. It is proposed that innovation diffusion is dependent upon exploiting informal strong and weak ties, at project and organization level.

Governing systems of information

David Lazer

As we move to more global networks, we move to more global information systems. While much attention has been given to the impact of network structure on information diffusion, far less attention has been paid to the effects of different network structures on incentives to produce information. This paper uses simulations to demonstrate how networks that are more effective at spreading information can result systems that rapidly converge to 'best practices', resulting in rapid improvement in the short run, but at the cost of long run performance.

Communicate to innovate: Communication patterns and creativity in new product development teams

Roger Th.A.J. Leenders, Jo M.L. van Engelen and Jan Kratzer

Creativity is essential to new product development (NPD) efforts. NPD activity is typically organized through cross-functional teams. Unfortunately, little is known about how NPD team creativity is determined. Based on a sample of 44 NPD teams in eleven companies, this study examines the effects of task-related interaction on team creativity. Both interactional frequency and content multiplexity are found to have an inversely U-shaped relationship to team creativity. Team centralization is found to decrease team creativity. Networks of innovation - Evaluating technology programs with social network analysis.

Report from a user perspective

Wolfgang Neurath and Harald Katzmair

Since the 1990s technological programs have become one of the main tools for the management of public R&D policies. These programs no longer support single research projects or researchers, while at the same time large-scale mission programs (primarily military research) have been phased out. The new research and technology policies address the building and controlling of complex networks of heterogeneous actors to stimulate the creation and the exchange of knowledge. Technology programs focus increasingly on structural aspects of research and innovation processes (structural sustainability of the programs). Evaluating these programs by means of peer review and customer satisfaction (assessment of the future economic impact) is no longer sufficient for monitoring and evaluating research or innovation networks. Evaluation by means of social network analysis enables us to describe and understand how research fields are structured, to find out which actors have a special strategic position and how to connect to networks. The project proceeds from the assumption that the greater the network diversity and the more structural holes there are, the higher the structural potential for radical innovations is. Measures enhancing innovation potential should include the diversity of the actors, the network structure and the balance of the whole system.

Social information processing in diffusion networks: Conceptualizing a model of relative status induction

Mirit Devorah Shoham

Researchers of the diffusion of organizational innovations, such as information systems, have not always acknowledged the influence of the social context, but typically have looked to individual task or organizational characteristics as requisites for particular behavioral or attitudinal propensities. Salancik and Pfeffer (1978) conceptualize a social-information processing framework that describes the environment as providing social

cues which individuals use to construct and interpret events; a referent for attitudes and opinions. This paper proposes a model of relative status induction, whereby relational proximity to significant others is measured along several dimensions of referents: the formal network (structural proximity), the informal communication network (relational proximity), and the perceived influence network (Ibarra & Andrews 1993; Rice & Aydin, 1991). One may discuss status in terms of (1) a formal hierarchical delineation, (2) recognition through popularity/prestige (Wasserman & Faust, 1994), (3) relationships with "important others" Bonacich centrality (Bonacich, 1972, 1987), or (4) access to new (non-redundant) information second level centrality. By measuring status along all 4 conceptual dimensions, this paper aims to deepen our understanding of the diffusion process and social influence. The proposed model of relative status induction will be tested in a longitudinal study, tracking employees' (both functional and conceptual) integration of the e-mailing system to their lives at work.

On-line Communities 1

Preferences and social contacts in an online community

Lada A. Adamic and Eytan Adar

We explore an online community at a private US university with over 2,600 members. A web-based system provides users with e-mail, web diaries (blogs), customized event announcements, chat, matchmaking, and other services. In signing up for the service students fill out various surveys and indicate which other users are friends. Students specify demographic information (year of study, gender, department, and residence), as well as selecting other features (e.g. self descriptions, what they look for in relationships, preferences in literature, music, movies, etc.). Beyond enabling the basic services, the data collected can be used to understand, in considerable detail, various aspects of the student social network. We study the relationships between attributes as well as the likelihood that those users who share a particular attribute are connected. We find, for example, that team sports are more influential in forming friendships than individual sports and users who place an emphasis on socializing preferentially associate with each other. In general, we find a correlation between the number of users sharing an attribute and how likely those users are to be connected. For example the small number of users who like anime (Japanese animation) movies are more connected than the large population that likes comedies.

Identity and action in the on-line classroom: A structural analysis of participation

Brian V. Carolan

This structural analysis of participation on a set of online classrooms aims to achieve two objectives. First, I intend to map the participatory configurations through time to get a sense of how the action is organized. Following this identification, I plan to explain how is it that this structure, once stabilized, endures through various spans of action. The flip-side of this portrayal, of course, is when the structure is disrupted. My sense is that these disruptions, though rare, occur quickly and with finality. This parallels the notion of saltationist evolution in which changes do not occur gradually over time, but rather erupt and resolve relatively quickly. Understanding these consequential turning points will provide insight into how embedded patterns of relations can be purposively re-arranged so that those who have been shut out of the action can become more fully engaged.

Networks of the dead or alive in cybercemeteries

James A. Danowski and David W. Park

Public Intellectuals appear to die a different death in the mass media than on the Internet. There one finds cyber incarnations that project immediacy, life, and sociomorphosis for some of the dead. The current paper looks at the question of whether dead public intellectuals have different social network properties on the Internet than the living. We analyze networks for 700 actors Posner (2001) defined as public intellectuals, people who appear in non-entertainment media, such as news and public affairs venues. Using the number of hits in Lexis-Nexis, Google, and Google Groups as indicators, we assess public intellectuals on several main dimensions: ratios between Web hits and mass media mentions, between Web group hits and Web hits, and between Web group hits and mass media mentions. In addition to the various indexes of numbers of mentions and their log values, we map the social network structures among actors in this discourse. We measure such variables as the degree of threadedness that various public intellectuals foster, the size and shape of the overall network of public intellectuals as represented by co-mention on the Web, along with centrality and distance measures. Dead public intellectuals are compared to the living on these various attributes.

Internet and non-internet sub-networks of intensive Internet users

Katja Lozar Manfreda, Vasja Vehovar and Valentina Hlebec

The impact of Internet on everyday life is studied thoroughly by researchers in various fields. Most discussions are oriented towards effects of Internet on community life and social relationships. Within a national Web survey of Internet users in Slovenia (RIS - Research on Internet in Slovenia, http://www.ris. org, conducted at the Faculty of Social Sciences, University of Ljubljana) ego-centered networks of intensive Internet users were assessed. Randomly split respondents received a name generator for one type of social support: material, informational, emotional support or social companionship. Each respondent received a set of alters interpreters for each alter they named. Data collection was performed from June to September 2001. Data collected in this way allow us to estimate the size and structure of ego- centered networks of intensive Internet users. Analysis shows that composition and structure of sub-networks vary with respect to usage of Internet as means of communication with alters. Respondents communicate to 23% of alters in general. These alters are mostly friends, known less years, younger, and geographically more distant. Differences across different types of social support were not significant.

Governmental Networks

A methodology for using social network analysis to inform spatial allocations of organisational members in a merger/site transfer

Sean Bergin, Paul Rogers, Pip Pattison, Garry Robins and Jodie Woolcock

In this paper we describe an instrument and methodology employed to examine the working relationships in five geographically separated government organisations, in light of a planned collocation onto a single site. The aim of the study was to examine ways in which the members of the organisation might best be physically located in order to maximize the 'synergy' of organisational interactions. A reliance network was elicited though the use of a computer-based questionnaire, and self-report data was collected on the intensity of interaction (importance, frequency), the medium employed, and the perceived effects of distance on relationships. The network data were used to construct a measure of preferred proximity among actors, and we show that the measure has desirable properties at the level of individual ties, dyads and triads for informing possible spatial allocations.

The innovation path and the role of networks inside government

Mark Considine and Jenny Lewis

This study seeks to understand innovation inside government by investigating structures and processes that help and hinder innovation, and examining networks of communication between politicians and senior bureaucrats. The first phase of this research was a questionnaire survey. Elected politicians and senior level bureaucrats from eleven municipal governments in the State of Victoria were surveyed. These people (almost 1 thousand in total) were asked to identify the major characteristics of innovation, particularly in relation to the government context and to both structures and individuals. They were also asked to identify significant innovations in their own Councils and to identify factors that help and hinder such innovation. Network information was collected on ties with people inside and outside each of the eleven municipalities with regard to 'obtaining advice' and getting 'strategic information'. We found substantial differences between Councils, and between politicians and bureaucrats. Results from the first phase of the study will be used to choose four Councils with different structures and networks. These will become detailed case studies in phase two, in which we will seek to identify important innovators, map pathways of key innovations and the networks most likely to support both program and process innovation inside government.

Emerging networks and political stability in Mexico

Jorge Gil-Mendieta and Samuel Schmidt

We have been working under the assumption that Mexico's political stability was secured by a strong network of power. In this paper we explore the recent political transition in the country, where the ruling party lost the presidency after 70 years in power. Political transition has been unexpectedly smooth due, according to our hypothesis, to the network still controlling key positions, to emerging networks both in the left and the right wings; and to the overlap of all political networks.

Knowledge networks in digital government projects

Maria Christina Scharf

In recent years, public sector organizations all over the world have enthusiastically adopted Internet-related technologies. Generally, the introduction of these new information technologies (IT) takes place in the form of a project, often referred to as digital government projects. A few years into this development, many agencies now have a website, offering a range from mere information to sophisticated tools. Governments have invested large sums in IT projects; however, the expectations in terms of more efficient operations are far from being fulfilled. In this paper, I attempt to find potential explanations for this phenomenon from an organizational perspective. In particular, I explore how intra-and inter-organizational knowledge transfer processes facilitate (or undermine) the success of e-government projects. I argue that knowledge transfer processes play a major role in the conception, development, and implementation of IT projects. I compare four different projects in Switzerland and the US with regard to the project team and their decision-making processes. Findings from the case studies give insights on the motivation for the projects, the formation of the team and the choice of the team leader, as well as the use of internal and external knowledge throughout the projects.

Networks and Cognition 1

Reality mining: Quantifying knowledge networks with sensors

Nathan Eagle and Alex (Sandy) Pentland

There are several different types of information inherent in conversations: speech features (speaking rate, interruptions, pitch, volume), location, participants, and the content of the dialogue. Leveraging commercial speech recognition technology and devices that are already common within the workplace (PDAs and cellular phone headsets), this information within face-to-face interactions can be captured. After significant amounts of data are aggregated from people working together in an organization, a variety of applications become possible: (1) Knowledge Management - By spotting topics within these computer transcribed conversations, relevant and real-time knowledge can be inferred and tracked. Clustering techniques can be implemented to identify high-potential collaborations based on similar keywords and phrases. (2) Social Network Analysis -The details of every interaction will be logged by the system and used to continuously map the dynamics of the social networks. (3) Expertise Identification iWe hope to automatically identify questions and responses within recorded conversations. By mapping this information onto the existing network of people, authoritative sources and hubs of information can be identified. (4) Organizational modelling - The face- to - face communication network can be simulated to identify the "global sensitivities" within the organization, the parameters that influence collective behavior, and the ramifications of social disruptions such as relocating a group or merging two divisions.

Concept networks in organizational language: Consensus or creativity?

Eleanor T. Lewis, Kathleen M. Carley and Jana Diesner

Organizations constantly produce and consume organizational language, and these texts and documents are a primary way that organizations interact with their environment. Each text that an organization produces can be represented as a network of linked concepts. The network analysis technique called 'map analysis' allows us to systematically extract and represent the network in a text, and compare networks across texts. When two concepts are linked in a set percentage of the texts in a dataset (i.e. half), those ties are part of that dataset's 'central graph'. When there is high consensus between organizations about what a particular type of text should say and how it should say it, the central graph will be relatively dense, but when there is low consensus, the central graph will be relatively sparse. Using three types of organizational language – annual reports, privacy policies, and mission statements – from two types of organizations – universities and corporations – we compare the concepts networks and central graphs within and across datasets. We argue that there will be denser central graphs in a type of text primarily intended to display responsiveness to the environment, and sparser central graphs when the text is primarily a vehicle for asserting a distinct and creative identity.

Communication networks in geographically distributed teams

Pamela Hinds and Cathleen McGrath

We compare the structure of communication and interaction networks within collocated and distributed teams. We analyze the existence of ties among team members based on similarity, location, and the interaction of similarity and location. We also examine the emergence of subgroups, particularly those that develop within as compared to across geographic location. We explore more deeply how network patterns contribute to team performance for both collocated and distributed teams. Our data is taken from forty research and development teams within a global organization. Nineteen teams were collocated and twenty- one teams were distributed between Europe and the United States. Web-based surveys were distributed to teams asking questions about interaction within teams and about internal team processes and outcomes. The survey was followed up with interviews with one or two members of each team.

A cognitive network analysis of attitudinal accuracy within communication and behavioral visibility networks

Stacy Wolski

An individual's organizational success partially depends on the ability to accurately reconstruct the constellation of social ties that make up an organization (Iberra, 1992). The analysis of cognitive social structures (Krackhardt, 1987) focuses on the accuracy to which individuals can reconstruct their social network. Cognitive accuracy is one measure of interpersonal power (Krackhardt, 1990), and also plays a role in the cognitive mediation model (Carley, 1991). This model extends the focus of cognitive network analysis to include cognitive accuracy of others' attitudes and behaviors. The current paper reports a cognitive social network study of attitudinal accuracy. The main focus is to evaluate whether attitudinal accuracy increases as network in-degree centrality increases. Consistent with prior research, it was expected that deviance scores for attitudinal 'best guesses' would decrease as in-degree centrality increases, supporting the notion that central individuals are more able to accurately reconstruct their networks. Findings suggest that average deviance scores in attitudinal prediction do not decrease as in-degree centrality increases for communication networks. However, the expected association was detected in behavioral visibility networks. These findings are discussed relative to the cognitive mediation model and future research directions are introduced.

Network Constrain and Health Issues

Differences in network structure and behavior associated with an intervention promoting contraceptive use among community group members in Ghana

Marc Boulay

Community groups have long been considered important venues for promoting contraceptive use and other positive health behaviors among women in developing countries. Much of their importance has been attributed to the belief that these groups facilitate discussions among members, that these discussions broaden the composition of women's networks beyond their immediate social circle, and that these broader discussion networks encourage innovative behavior. Although a structural explanation is implicit in this model of community group influence, few studies have considered whether structural characteristics within community groups mediate the effectiveness of these groups in diffusing contraception among their members. The present study will examine the differences in network structure across community groups, the association between structural characteristics and contraceptive use, and the possible effect of facilitated discussions within these groups on the overall structure of the group. Socio-metric data were collected in September 2002 using a census sample of all the members of nine women's groups in three regions of Ghana (N=509), three of which had received the intervention of facilitated discussions. A follow-up study is planned among the same nine groups.

Social group characteristics and their influence on mechanisms of diffusion of contraceptive intentions and use among men and women in rural Malawi

Valerie A. Paz Soldan

Using survey data collected from 210 men and 296 women who reported belonging to social groups in rural Malawi between June 2000 and January 2001, this study examines (1) the association between certain group characteristics (heterogeneity and strength of ties) and two possible diffusion mechanisms of contraceptive ideas within social groups (discussions among group members and perception of group influence on one's reproductive behaviors), and (2) the association between the two diffusion mechanisms (discussion and influence) and contraceptive intentions or use in Malawi. Preliminary results reveal that among women, frequency of group meetings and the group's gender composition influences discussion topics, whereas among men, none of the group characteristics were significantly associated with the outcome of interest. Preliminary results also indicate that among women, only discussions on economic well- being are significantly associated with intention to use contraceptives in the next 6 months. Otherwise, none of the diffusion mechanisms examined is significantly associated with contraceptive intentions or use. Among men, the perceived group influence is positively and significantly associated with intention to use contraceptives and use of modern contraceptives. Discussions on STIs and economic well-being are also associated with contraceptive intentions among men.

Social network influence on family and fertility choices

Laura Bernardi

Our purpose in this paper is to address the importance of the role of social interaction with family and friends in modulating the interpretation and the relative weight of opportunity and constraints of family and fertility choices. Besides providing economic and non-monetary support, social relations with family members and friends shape norms regarding "appropriate" demographic behavior and in providing relevant information about the advantages or disadvantages of certain demographic choices, as for instance, the decision to delay or forego childbearing. In order to investigate the influence of social interactions on fertility and related demographic behavior, we collected 54 in-depth interviews with women aged 30-39 and resident in the northern region of Lombardy (winter 2000-01). Respondents' conversations and observations concerning fertility and family choices are the base for an analysis of the role played by social networks in shaping individual perceptions and about the opportunities and costs of specific childbearing decisions. Social learning and social influence processes depend on tie and structural characteristics of social networks. We find evidence to support the hypothesis that a dense network of peers leads to a synchronization of family related events among its members. Therefore we argue that fertility tempo at the population level might in part depend on the structure of the interaction of kin and peers.

Communication network analysis as a tool for participatory intervention to reduce mercury exposure in Brazilian Amazon

Johanne Saint-Charles, Frédéric Mertens and Donna Mergler

Eight years of participatory research conducted by Brazilian and Canadian scientists jointly with a population of the Tapajós, in the Brazilian Amazon, have led to a deeper understanding of the problems related to mercury contamination. The research also led to the reduction of mercury exposure for the inhabitants of Brasilia Legal (a village on the shore of the Tapajós river) through a change in fish consumption. Since November 2002, a new phase of the research is underway with the main objective to extend the activities from the local to the regional level, therefore including most of the communities of the Lower-Tapajós Basin. An interdisciplinary team is working on the various aspects of the mercury problem. In 2001, network analysis conducted in Brasilia Legal showed, without surprise, the influence of interpersonal communication on individual behaviour changes in fish consumption. In this paper we will discuss these results from the perspective of using SNA in a regional rather than a local perspective and as a way of developing a better understanding of social networks that should facilitate the promotion of healthy change in dietary habits to reduce mercury exposure.

Social Networks, Science & Society

Networks in society

Alden S. Klovdahl

A fundamental proposition in network analysis is that the structure of a network has effects over and above those attributable to characteristics of the nodes and links that constitute it. An example illustrates this proposition. With more interest in networks it is not surprising that speculations about 'small worlds' and 'six degrees of separation' have captured popular imagination. Faced with such conjectures social scientists ask: Where is the empirical evidence? Here, several studies using a random walk design are outlined. A person in an urban population was randomly (Table of Random Numbers) selected, a list of his/her network associates obtained, one of these randomly chosen to be the next person interviewed, and so on, for the number of steps and walks called for in each study design. In each, data obtained about a fairly small number of network nodes yielded information on a single connected region (linking all interviewed and their associates). Some properties of real world social networks are described. An intriguing question is whether some of the concepts, statistical tools, and mathematical models arising out of social network analysis could accelerate understanding of seemingly unrelated phenomena, such as gene networks and protein interaction networks.

Social networks and family: The relationship between family culture and communication about genetic testing in families at risk for HNPCC

Laura M. Koehly

Since the initiation of the Human Genome Project, there has been a steady increase in the availability of predictive DNA tests for hereditary cancers. Despite the potential medical benefits, the identification of carriers of deleterious mutations raises numerous psychological and social challenges for families at risk. Previous approaches to studying the psychosocial implications of genetic testing have focused on a single individual, the proband, or specific dyadic relationships involving the proband (e.g. marital relationships, sisters). Social network methods provide a framework for moving beyond the dyad, allowing us to examine the complexities of the family social system. Social network methodology can provide a detailed map of the social environment within which family members interact and can facilitate an understanding of which aspects of the familial culture influence the discussion and participation in genetic counseling and testing efforts. The family structure and culture may be particularly important to the diffusion and dissemination of health information, provision of support, and persuasion. The relationship between family functioning relationships and discussions concerning genetic testing among five extended families that had been found to carry hereditary non-polyposis colon cancer (HNPCC)-predisposing mutations will be presented. Our findings may have implications for both research and clinical practice in cancer genetics, as family culture may play a significant role in determining who participates in genetic counseling and testing.

Multi-theoretical multi-level models (MTML) for understanding the emergence of knowledge networks

Noshir S. Contractor

Recent advances in digital technologies invite consideration of organizing as a process that is accomplished by global, flexible, adaptive, and ad hoc networks that can be created, maintained, dissolved, and reconstituted with remarkable alacrity. As developments in information and communication technologies continue to reduce or eliminate the potential logistic barriers to our communication and knowledge network relations, it becomes increasingly important to identify the various social factors that enable or constrain the development of these network linkages. Clearly there is a need for a multi-theoretical multilevel approach to study the emergence of communication and knowledge networks. This paper begins by defining the role of multiple human and non-human agents that constitute the network and the relations that exist among these agents. Next, it describes the Multi-theoretical Multi-level (MTML) framework — based on network formulations of social theories - to examine our motivations as individuals to forge network links with other individuals, organizations, as well as non-human agents (such as knowledge repositories). We ask the question: "What are the social motivations that help us understand why we as individuals seek to forge, sustain, or dissolve our knowledge network ties with other human and non-human agents?" We provide empirical results based on applying the MTML framework to understand the factors that explain information retrieval and allocation patterns in organizational knowledge networks.

The small worlds of small social networks

Garry Robins

When a social system is a small world, the individuals in the system tend to cluster together in clique-like structures, yet at the same time paths across the network remain relatively short. The small world phenomenon has been principally studied in large networks such as the internet, but may also be observed in small scale networks including personal networks and friendship groups. Criteria for deciding whether an observed network is small-world may be based on comparison with relevant random graph distributions. We show how the presence of certain local social processes may result in small worlds. Yet the overall strength of these processes is important: if all effects were to become stronger, a small world system of short paths may suddenly transmute into a deterministic structure with longer paths. We present a variety of observed social networks that are small world because they are close to this transition point. The implications relate to the balance between randomness and structure in human networks: it may be that human social systems remain stochastic but are close to deterministic structure.

Studying the mutual influence between relations and behaviour

Tom A.B. Snijders

Individuals attune their behaviour to the behaviour of others to whom they are related; and they relate to other individuals taking into account, inter alia, the behaviour of those individuals. This leads to intricate feedback processes between relations between individuals and their behaviour. Examples are smoking initiation among adolescents — and other substance use and abuse — the formation of attitudes and norms, the dynamics of fads, collaboration in organisations, etc. The empirical study of such processes, and trying to disentangle the influence from relations on behaviour and the influence from behaviour on relations, poses difficulties from the points of study design, theoretical modelling, and statistical analysis. This disentanglement is possible only on the basis of assumptions made about these two influence processes, and the tenability of such assumptions is a crucial question. Recent developments are presented in which theoretical modelling is combined with statistical modelling and expressed in stochastic micro-simulation models, with associated procedures for parameter estimation and the assessment of model fit. These models incorporate the dynamics of a relational network in a set of actors, jointly with the dynamics of individual behaviour of the actors. The statistical procedures are based on Monte Carlo computer simulation. An example is presented which illustrates the two-way influence between relations and behaviour.

On-line Communities 2

Classifying communities through diffusion

Cameron Marlow

As society progresses towards a state of networked individualism, well-defined communities, with explicit membership and easily observable participation, are being replaced by groups emerging from networks of informal ties. Web-logging is a rapidly growing Internet communication medium that exhibits this phenomenon, consisting of frequently updated personal websites representing the interests and opinions of the authors on topics of current events. Web-loggers are connected by an explicitly stated social network of readership, enabling the diffusion of ideas and stories to interested individuals. We maintain a system that tracks the diffusion of website references through this network, collecting over 4 million examples per year. Each reference (e.g. a news story, magazine article, etc.) represents a community of interest around the given topic. This paper presents an approach to finding and labelling communities embedded within informal social networks. Many distinct communities exist within these social ties, but without any central organization -finding these groups or their members is an arduous task. We posit that larger, more inclusive groups are supersets of the individual communities created by the diffusion of a given topic. By automatically clustering these smaller groups, we arrive at more sizeable communities that members can identify with.

Requirements engineering and the social context of work

James B. O'Kane and James Ambrosini

How technologies integrate or fail to integrate with workplace behavior is a critical issue for designers and users of information systems today. The purpose of requirements engineering is to define what a system should do based on requirements, the conditions or capabilities to which a system must conform. More often than not, most requirements efforts yield system designs that are independent of social context. Although people may use technology to do work, people primarily use people to do work. Ignorance of how people informally collaborate is a critical flaw in today's system designs. This presentation suggests that future IT investment will focus on integrated designs that treat social systems and technical systems as one complete system. Social network analysis is an appropriate technique for modeling employee informal networks as a source of requirements. Current client examples of this approach will be discussed.

A longitudinal analysis of hyperlink networks

Han Woo Park

We have recently witnessed surprising growth in hyperlink studies across many disciplines and perspectives. Although the potential of hyperlink analysis lies in investigating the way the configuration of hyperlink network changes in various time-periods, longitudinal hyperlink network research remains relatively untouched. There have been some attempts to automatically index the over-time changes within a Web site or to measure geometric distance between Web sites, but the research does not examine the longitudinal hyperlink association among Web sites by looking at social relations (or networks) among people, groups, or countries represented by Web sites. In response to the lack of research, this paper examines these issues. In summary, the temporal process in which hyperlink networks are organized, maintained, and transformed by Websites' producers (or authors) has become more important but little attention has been paid to this. This warrants the following research question: How have the structures of the hyperlink network changed over time?. This paper attempts to answer this question by investigating the Web sites of South Korean politicians and political parties, over time.

Contagious media: design, diffusion, and development

Jonah Peretti

How do ideas spread in the information age? To answer this question, I have conducted a series of diffusion experiments. For each experiment, I develop a web site, email forward, or phone line. Then I track the number of people accessing the project as it spreads through word of month. The most successful projects (the Nike sweatshop email, the Rejection Line phone number, and the BlackPeopleLoveUs.com website) have reached millions of people. My talk will begin by addressing the qualities that make these projects successful, in particular the use of humor and "dirt style" design. Next I will discuss the dynamics of diffusion with particular attention to existing social technologies. I will describe a media ecology populated by blogs, message boards, personal email, and mass media outlets. I will show how contagious media can increase the connectedness of on-line communities and how on-line communities provide the connections that make contagious media possible. This research initiative includes the development of technology applications. I will conclude by describing Eye beam's social software development projects. By making connections explicit, this software can increase the virtuous circle between contagious media and social connectedness.

Reaching out: The structure of an early internet community

Paul Perry and Cameron Marlow

'Firefly' was an early web community based on a technology that helped people to connect based on shared interests. From its inception in 1995, the site amassed a user base of over three million individuals from more than 200 countries. The community was pre-emptively closed in 1999, but the data collected from its use represents a footprint of one of the largest organically grown communities on the web. Since the service did not supplant other communication technologies (such as e-mail or instant messaging), it can be assumed that the social ties made within the system emerged from its use. Members created web pages that listed their interests, favorite web sites, movies, and music, and friends within the system, and chatted with each other through 'Firefly Whispers', a hosted instant messaging system. New users were able to find their place by searching for others with like-minded interests. This paper presents some preliminary observations on the structure of the 'Firefly' community: a comparison of the interests of users with explicit social ties, the relationship between explicitly stated social ties, and those that emerged from private communication, and an analysis of the network properties of users classified by gender, age, country, and time of adoption.

Sesión en Español 1

Participación social y acceso a biotecnologías modernas en México

Rosa Luz González Aguirre, Alejandro Ruiz León, María Elba González Aguirre y Michelle Chauvet

En países de menos desarrollo, las presiones sociales en torno a las biotecnologías modernas incrementan la complejidad institucional para su regulación e inciden en el acceso que a dichas tecnologías tienen los actores que participan en su desarrollo o utilización. En esta investigaci≤n se aplicó el ARS a dos estudios de caso de acceso a biotecnologías modernas en México. Para delimitar la red se utilizaron redes de afiliación con base en el concepto de sistemas tecnológicos. A partir de éstas se obtuvieron redes de actores que se verificaron mediante investigación documental y de campo, las diadas se establecieron en función de variables de composición. Se consideró a las redes como entidades dinámicas, se hicieron cortes a lo largo del periodo de análisis y se tomó en cuenta la interacción de los actores con el ambiente de la red. Algunas de las propiedades emergentes de las redes sirvieron de base para la identificación de subgrupos cohesivos con capacidad de influir en la dirección de las tecnologías analizadas, así como para identificar estructuras de poder. Los casos revisados muestran el potencial del ARS como herramienta para abordar sistemas tecnológicos, para plantear escenarios y formular políticas y su importancia para la definición de conceptos en el campo de estudios sociales de ciencia y tecnología.

Redes de sentidos en la implementación de polticas sociales de control y prevención de drogas ilícitas; la interfase asociativa-institucional

Paulo Gutiérrez Soto

La implementación de políticas sociales en contextos comunitarios conlleva la interacción de m·ltiples actores, como el Estado, organizaciones de base, instituciones e inclusive el mercado. La interacción entre estos actores genera conflictos, alianzas de conocimientos, lógicas de acción, etc. que, siguiendo a Long (1999), denominamos interfase. La mirada reticular de la implementación de políticas sociales construye las relaciones entre actores como redes de sentidos. A partir de una investigación de las interfases de políticas sociales en Santiago (2002), este paper examina los componentes y relaciones en la implementación de políticas públicas de control y prevención del uso de drogas ilícitas, tomando como principal referente conceptual a la interfase asociativa-institucional que se construye de manera reticular. La capa más baja de esta estructura socio-política puede entenderse como las lógicas de sentidos que construyen los propios actores involucrados. No sólo el comprender las políticas sociales dentro de un marco de eficiencia, puede ayudar en su implementación, sino como la interacción de estas redes de sentidos. La comprensión de estos espacios, de estas 'cajas negras' en las políticas sociales, pueden ayudar a realizar una mejor implementación y replicación de las propias políticas sociales, y poner el énfasis en el rol de los actores involucrados mas que las políticas en sí.

Redes sociales y rendimiento académico en un contexto escolar de pobreza

María Guadalupe Ramírez Ortiz, José Ramiro Caballero Hoyos y María Guadalupe Ramírez López

Se exponen aspectos estructurales de las redes sociales (RS) de escolares de secundaria de estrato socioeconómico marginal para evaluar la asociación entre centralidad de la RS y rendimiento académico (RA). Este es un estudio de caso no experimental de tipo transversal con anßlisis descriptivo y correlacional bajo el enfoque de RS sociométrica, que emplea convergencia para integrar datos cualitativos. Se censaron 523 alumnos(as) de secundaria en Zapopan Jalisco, entre noviembre de 1999 y enero del 2000. El cuestionario incluyó preguntas sobre RS, RA y aspectos sociodemogrßficos. Se calcularon medidas de densidad y centralidad para red escolar y grupo específico, empleßndose UCINET 5 y regresión logística para medir la asociación de centralidad con RA. Se presentaron hallazgos estructurales a informantes clave para contextualizar la RS analizados en ATLAS/ti v4.1. Alumnos(as) con alto RA tuvieron posiciones centrales en RS general y grupal. Posición "Eigenvector" como predictor significativo para la difusión del alto RA. La centralidad dio posiciones periféricas de alumnos(as) con problemas de RA pertenecientes a la RS externa integrada por usuarios de drogas con comportamientos violentos. Programas educativos y de salud pueden considerar la inclusión de alumnos(as) "Eigenvector" como facilitadores del alto RA que favorezcan comportamientos saludables reconociendo la diversidad cultural en las que estßn inmersas las RS escolares.

Dirección estratégica de redes organizacionales

Gustavo Matías Clavero y Mario Arias Oliva

La sociedad de la información y del conocimiento es una realidad emergente, provocando la transformación del entorno tecnológico y económico. Entre otras características del nuevo entorno, las empresas deben de operar en mercados globales, con ciclos de vida de los productos extremadamente cortos, y en condiciones de complejidad y cambio continuo como hasta el momento no habían existido. El desarrollo de actividades en estas condiciones obliga a las empresas a transformar radicalmente sus diseños organizativos, en los que la flexibilidad es una de las claves de diseño fundamentales. La b·squeda de la flexibilidad provoca la aparición de nuevos diseños organizativos que combinen adecuadamente flexibilidad y eficacia, como las redes organizacionales. Los métodos de organización tradicionales deben de ser revisados y adaptados al nuevo "digitalismo". Las organizaciones necesitan nuevas estrategias que deben de implementarse con nuevas formas, transformando estructuras, sistemas, habilidades directivas, cultura, etc. Las tecnologías de la información y la comunicación como Internet, las redes de ordenadores, los sistemas de trabajo en grupo o los servicios de telecomunicaciones móviles van a ser la base de las organizaciones en red. Tanto la estrategia como el diseño de la organización se debe basar en las redes. En este trabajo analizaremos las implicaciones estratégicas que los sistemas sobre los que se soportan las organizaciones en red presenta.

Análisis de redes de políticas en la prevención y atención de la violencia familiar

María del Rosario Campos Beltrán

El trabajo explora las redes constituidas por integrantes de organismos no gubernamentales, instituciones de gobierno, y de la academia para desarrollar políticas de atención y prevención de la violencia familiar en tres estados de la Rep·blica Mexicana: Distrito Federal, Guanajuato y Puebla. Las redes son conjeturadas a partir de generadores de nombres para redes personales aplicados a personas vinculadas con los Institutos Estatales de la Mujer, quienes supuestamente tienen en sus manos la aplicación de programas que buscan contrarrestar la violencia familiar desde un enfoque de equidad de género. Los resultados preliminares muestran que la implementación de dichos programas es posible gracias a contactos informales más que a políticas puramente institucionales.

Networks and Cognition 2

Personality and social network structure

Rosalyn Negrón and Chris McCarty

Previous research by Burt demonstrates a relationship between a personal network structural characteristic, network redundancy, and scores on a personality scale among MBA students. However, the relationship between personality scores and structural characteristics of personal networks among the general population remains untested. Given the extensive application of personal network analysis to studies of social support and mental health, efforts to explain personal network structure by personality types is warranted. A sample of 100 subjects from Gainesville Florida submitted to a study of depression and personal network structure. Each respondent provided extensive information about themselves, including their responses to the IPIP personality index, a 50 item scale accepted in psychology as a measure of five personality components. An attempt is made to predict scores on various components based on a set of network summary measures. These measures, the dependent variables, include global closeness centrality, global betweenness centrality, number of components and a measure of network redundancy. The five components of personality that will be used as independent variables are extraversion, agreeableness, conscientiousness, emotional stability and intellect.

A Cognitive Switchboard between inter-scholarly networks

Joseph Perczel

The Cognitive Switchboard (CS) has been described the first time at the Second International Conference on Work Values (Prague, 1992, Proceedings, pp. 35-42), a radical, innovative approach to the interpretation of experimental data (Dienes). The application of the method turned out to become an able instrument of interdisciplinary transformations, a Gestalt-switchboard using cognitive network operations - so to say. The basic innovation of (CS) is the point that the way of presentation of data already determines their immanent disciplinary character and changes in presentations are operating switches between scholarly networks. Accordingly data have two different meanings: permanent identities (differences) and potential ones (differances), varying according disciplinary lines.

The measurement of social diversity in EGO-Networks: A comparison of some indices

Harald Katzmair and Wolfgang Neurath

Since the introduction of Information Theory in the 1940s (Claude Shannon, Oswald Wiener) researchers in the field of Communication Sciences and Ecology have been developing a vast array of indices to compute the diversity of natural and symbolic systems. This paper presents some of the most commonly used (Shannon-Wiener Function, Simpson Index, Margalef Index etc.). It shows how they can be adopted for computing attribute diversity within EGO-Networks. The paper compares the different sensitivities of indices using the example of the diversity of political preferences, sex, education and age within a sample of 1,033 EGO-Networks drawn from the population of Austria. It discusses the peculiarities of the models with regard to the basic aspects reflected by the measurement of social diversity: the richness and the evenness (equitability) of social attributes within EGOs-Networks. Finally the paper examines the statistical correlation between the attribute oriented diversity measures and some structural indices.

Examining the impact of external network ties upon group effectiveness: evidence from the field

Fabiola Bertolotti, Diego Maria Macri and Maria Rita Tagliaventi

This research aims to deepen the study of the relationship between social network in which groups are embedded and their effectiveness. Data were collected within three groups acting as gatekeepers between three of the major Italian fashion designers and the firm the groups belong to. First we conducted five- month participant observations recording all the interactions thereby deriving the enacted communication network. Then values of groups effectiveness, as measured by managers and organizational clients of the groups and through group members' satisfaction, were collected by means of 56 structured interviews. We also collected information about the communication network declared by organizational actors. Data show different perceptions of performance of the three groups which cannot be explained in terms of the intensity of communication network activated or level of competences of group members or their internal structure. Evidence suggest that the better evaluation received by one group can be traced back to the coordinating role it assumes in the whole fashion development process: in particular it spontaneously activates, through reciprocal interactions, modalities of design for manufacturing not formally required, fostering a co-design which is rewarded by the organizational members with higher evaluations. Implications for fashion firms are discussed.

The role of personality in the formation of social networks

Markus Vodosek

The current study investigates the relationship of personality as described by the Five-Factor model of personality to the formation of friendship, acquaintance, and negative network ties. A sample of 228 undergraduate business students in four classes completed a personality inventory at the beginning of the semester and socio-metric questionnaires at the beginning (T1) and in the middle (T2) of the semester. Regression results showed that Extraversion was positively related to in-degree centrality in both the friendship and the acquaintance networks at T1 and T2. Conscientiousness was negatively related to in-degree centrality in the network of negative ties at T1 and T2, and Openness to Experience was positively related to in-degree centrality in the network of negative ties at T1 and T2. Controlling for in-degree centrality at T1, Extraversion turned out to be the only Big Five factor related to tie formation between T1 and T2 in the friendship network. No Big Five factor related to tie formation between T1 and T2 in either the acquaintance or negative networks. In contrast to my hypotheses, Agreeableness and Neuroticism were unrelated to the existence or formation of ties in any of the three networks.

Networks and Public Health

Can general practice integration research, policy and practices benefit from social network analysis within the Australian context?

Lucio Naccarella, Jane Sims and Rae Walker

The emphasis on general practice integration within the primary health care sector has not encouraged research that recognises the interdependent nature of existing general practitioner (GP) relationships. Given that GP relationships with other primary health care providers are the building blocks for an integrated primary health care system, understanding these relationships is essential. General practice integration research would benefit from Social Network Analysis given its focus on 'patterns of relations' among interacting units. A study based on social network analysis aimed at developing a measurement approach to understand patterns of interaction between GPs and other primary health care providers is presented. Semi-structured interviews were conducted with two GPs. They were asked to name whom they were in professional contact with. Subsequently, four Clinic staff and ten primary health care providers nominated by GPs were interviewed. Individual attributes, relational and contextual data were collected. Network generator questions produced relational data, and acted as a catalyst for interviewees to reflect on how they practiced and why. Preliminary analyses reveal a core group of task-specific GP network members: individuals and organizations. Qualitative analyses of the type of relation, its functionality, impacts for practices and patient outcomes, plus network analyses will be presented.

Hierarchical distinctions between medical professions and a 'disruptive' physician

Betsy White Williams, Michael V. Williams and William Norcross

A study by West and colleagues (2002) demonstrates that various medical professions have different social network structures. Recently the role of communications and team functioning has been identified as a critical [JACHO]. Hospital teams include members from a number of professions, with clear hierarchical distinctions. A team member that is identified as disruptive can cause considerable degradation of the performance of the team. This paper reports on the use of social network analysis to improve the functioning of a team of hospital professionals associated with the critical care (CCU) and intensive care (ICU) units of a suburban hospital in California. The investigators consulted on a 'disruptive' physician; the concern was how to influence the process of procedural change. Measures of social contact and cohesion were given to 42 professionals from the CCU and ICU. These measures were used to determine the communication paths most impaired and the concordance between communication frequency and ease of communications. Key alters were assessed for each of the respondents. Nurses, physicians, and medical executives were demonstrated to have different patterns of social cohesion along with different critical alters. These data demonstrate the need for adjusting intervention strategies for each target professional group.

Individual and building networks: Integrating network measures into a mixed-methodological study of urban adults and depression

William B. Disch, Jean J. Schensul, Kim E. Radda, Julie T. Robison and Sonia Gaztambide

In a study of depression in older adult senior housing residents, multiple research methodologies are being employed with the goal of optimizing the research design and maximizing potential for the collection of data related to the identification of depression, access to resources, and cultural definitions of depression. We used survey data to analyze behaviors and situational factors related to depression, social network analysis to understand relational characteristics among building residents, and qualitative data to verify or expand upon descriptions of behavior related to depression. Our findings illustrate the integration of these research methodologies. Results from 292 participants in six buildings indicate that buildings with the lowest rates of depression (CIDI-D, CES-D) consist of social networks that are higher in density, centrality, and degree of core-periphery structure. The opposite was found in the networks from buildings with higher levels of depression. Results from qualitative data indicate that buildings with the lower depression scores have more organization and less political and inter-resident conflict than the high depression buildings. Understanding the social network dynamics, both quantitatively and qualitatively, within the context of identification and intervention related to depression, greatly enhances understanding of how depression can be optimally addressed in these buildings

Social support networks of elderly using the 'Life-Line' telephone

Valentina Hlebec, Mateja Nagode, Katarina Bitenc and Nina Licer

Ageing of population is a phenomenon widely present in developed countries. Consequently, the need to extend autonomous living for elderly in everyday environment is increasing. One of the possibilities is the use of telecommunication technology or so called 'Life-Line' telephone system or telephone with red button. This system has been available in Slovenia since 1992 and has been supported by Centre for home care established at Home for elderly in Ljubljana, Tabor-Poljane. In two surveys, which were carried out in 1995 and 2001, we found out, that the population that was using the special telephone with red button was becoming older, weaker and more dependent on others. This telephone gives them safety, freedom from 24-hour care, security and information support. On the other hand, the 'Life-Line' telephone is helping close relatives of elderly to take care of them. The most important informal provider of social support for elderly is a daughter. For elderly that need help for everyday tasks, formal support is as important as informal support.

Professional isolation of a 'disruptive' physician in a hospital setting

Michael V. Williams, Betsy White Williams and William Norcross

A 1999 Institute of Medicine report identified medical errors as a leading cause of morbidity and mortality. Communications and team functioning have also been identified as a critical in the functioning of hospitals [JACHO]. Hospital teams include members from a number of professions, with clear hierarchical distinctions. A team member that is identified as 'disruptive' can cause degradation of the performance of the team with potentially disastrous effects for medical quality and patient safety. This paper reports on the use of social network analysis to diagnose the functioning of a team associated with the critical care (CCU) and intensive care (ICU) units of a suburban hospital in California. The investigators were approached to consult on an issue involving a 'disruptive' physician. A concern was whether the physician posed a threat to medical quality. To assess the flow of information, measures of social contact and cohesion were given to 42 professionals from the CCU and ICU. These measures were used to determine the isolation of the index physician. Measures of communications importance were given to determine the concordance between communication frequency and criticality. The results provide evidence of both the isolation of the index physician, and, the degradation of information flow.

Social Capital: Effects on Social Economics

Civic participation and social capital: A social network analysis in two American counties

Marc Magee

The objective of this study is to build upon the social network foundation of the concept of social capital to determine 1) the relationship between social network characteristics and economic outcomes, and 2) the relationship between specific forms of civic participation and these social network characteristics. Original survey data collected in Allegheny County, Pennsylvania and Miami-Dade County, Florida on forms of civic participation and social network characteristics, as measured through a position generator instrument, is utilized. The results provide support for the conception of social capital as an investment in a loose, diverse network of social ties. The results also suggest that in general civic participation is positively connected with a diverse social network, that the greater the range of civic participation the greater the diversity of an individual's social network, and that apart from a consistently and strongly positive connection with participation in religious institutions, the forms of civic participation that are positively connected with a diverse social network are highly variable.

Are the Black urban poor really socially isolated?

Sandra S. Smith

Although previous research has shed much light on the role that social capital, or the lack thereof, plays in perpetuating joblessness among the urban poor, major gaps in our understanding remain. These gaps stem from two measurement problems. First, studies investigating the effects of social networks on employment outcomes have employed name generators that are content bound, elicit information about strong ties, and are specific to individuals, and not positions, within the social structure. Second, these instruments typically do not allow respondents to report more than three ties. As a result, these instruments are inadequate for addressing the extent to which the black urban poor are socially isolated from labor market contacts. To more accurately assess the black urban poor's connection to mainstream ties, data were gathered using surveys and in-depth interviews of 105 low-income African Americans from an economically depressed urban community in Southeast Michigan. By using name generators that do not unduly limit the number of contacts respondents can report, and by employing social position generators that elicit from respondents information about ties who hold various occupational statuses, I find that most of the members of their networks have a high school diploma or more and work steadily. And, even though respondents largely find employment in the less-skilled jobs of the service sector, more than half of their ties are engaged in middle-class pursuits, including semi-professional / skilled and professional positions. My findings challenge conventional wisdom that the urban poor lack social capital because they are socially isolated. Implications are discussed for the use of social capital theoretical framework within the urban poverty context.

Social capital and status attainment among different racial and ethnic groups in the United States

Jennifer L. Moren-Cross and Nan Lin

Using a representative sample of 900 adults from the 25 largest metropolitan statistical areas in the United States, we employ

a position generator methodology (see Lin and Dumin 1986) to test whether access to and mobilization of social capital is stratified by white, African American, and Latino racial and ethnic groups. In addition, we investigate the relationship between social capital utilized and status attainment outcomes among these groups. Preliminary findings indicate that whites have the most access to social capital. In addition, as expected, each group identifies (i.e., has access to) ties predominantly of their same respective race/ethnicity. Each group also mobilizes a tie of their same respective race/ethnicity. Whites utilize the most educated ties, followed, in order, by African Americans and Latinos. Interestingly, while whites accrue the most income, they report the most number of supervisors above them and the least number of employees they supervise. African Americans report the highest number of employees they supervise, but their earnings and number of supervisors reported are similar to that of the Latinos. Further analyses are in order with demographic and human capital control variables to further understand these relationships.

Social capital and occupational mobility in the Southern Cone

Vicente Espinoza

A difficult upward occupational mobility during the last decades in the South-American Cone has moderated the overarching influence of educational attainment and brought into focus the role of personal contacts and social capital. Based on September 2000 occupational and network data collected in Montevideo, Buenos Aires and Santiago (N=1367), my paper examines the contribution of social capital in gaining access to high-status occupations, side by side with other factors. Network data comprises a position generator for influential bureaucrats and institutional brokers. Individual dispositions and demographic characteristics keep their explanatory power, but social ties have also a strong influence. As one might expect, contacts with higher status people and influential bureaucrats are crucial to upward mobility. However, frequent contact, trust and availability have all a positive effect in the access to higher status positions. Tie strength seems to help ego to take advantage of their access to distant social circles. A strong tie in this context is not necessarily a friend that helps to prevent downward mobility. An institutional contact, linked by strong ties, that favors ego access to keenly demanded positions goes against the widespread hypothesis of the strength of weak ties, but highlights the quality and location of ego's contacts.

Social capital of personnel managers: The function of positional networks and civil engagement

Ray-May Hsung and Yi-Jr Lin

In order to design the items of positional networks for personnel managers we face two problems: The kind of positions that should be included and the type of the function of the network in question. We chose six positions (lawyer, owner of large factory/firm, division head, reporter, housemaid, cleaning worker) that could be accessed by the fewest percentage of population in Taiwan. We interviewed 124 personnel managers about the institutions of personnel policy and individual social networks and mobility in 124 firms of Export Processing Zone and Science Park in Taiwan. This study specified social capital as resources embedded in networks with greater accessibility to more social circles, such as more occupational positions accessed or more associations of civil engagement. Education did not significantly affect accessed positions as found by previous studies. Male personnel managers accessed more occupational positions than female personnel managers after controlling all other variables. Further, the study examines the function of positional networks on accessed associations, specialized human capital, occupational prestige, and log of income. We found that the accessed positions strongly affected the accessed associations for personnel managers. Then the accessed associations strongly affected specialized human capital, occupational prestige, and log of income of current jobs.

The Dynamics of Personal Networks 1

Where do social relations come from? A survey of personal networks in Toulouse's region (France)

Michel Grossetti

The survey replies in Toulouse (2001) Fischer's study on personal networks conducted in San Francisco (1982). The interviews include 399 urban and rural respondents who cited 10, 932 persons whom they are related to. A sub-sample of the cited persons (1624), provided information about the first context of meeting which is cross examined with the information given at the time of the first survey. The duration of relations is also analyzed. As in previous cases, this survey show that social ties begin mostly within collective contexts as family, school, firms, etc. These collective entities cannot be reduced to a network. Social actors can refer to them in their interactions, they can feel (and declare) themselves as members of them, and can have a notion of their boundaries. Collective entities contribute to frame interactions. Social ties are embedded in these collective contexts, until they decouple from it. Embedding and decoupling are considered as interactive processes between the level of collective entities and the level of individuals. If collective contexts are the main context for the building of relations, the results of the study show two other kinds of contexts: The first one is the growth of the network by itself (people meet through existing personal relations) and the second one is the connection by common stakes (like in the relations with neighbors).

The navigability of strong ties: Small worlds, complex dynamics and network topologies

Doug White and Michael Houseman

We examine data on and models of small world properties and parameters of social networks. Our focus, on tie-strength, multilevel networks and searchability in strong-tie social networks, allows us to extend some of the questions and findings of recent research and the fit of small world models to sociological and anthropological data on human communities. We offer a 'navigability of strong ties' hypothesis about network topologies tested with data from kinship systems, also applicable to corporate cultures and business networks. For in kinship networks we show evidence of complex dynamic processes at the level of strong-tie interactions between individuals and multilevel groupings are shown to generate emergent forms of social organization that are self-organizing, that have fractal properties, power-law distributions of strategic behaviors, and network topologies that have clustering, small average distances, and distance-decay navigability parameters that match theoretical models. Parallel kinds of structures are shown to exist in the inter-firm networks of the biotech industry studied by Walter Powell et al. Implications are examined for self-organizing systems in social and business organization.

Personal networks and cultural practice: The case of French young amateurs

Dominique Cardon and Fabien Granjon

The aim of our work is to extend the well-known categories of the social network analysis in exploring the specific place and role of the cultural construction of sociability. This dimension is central for the youth culture, but we suspect that it plays an important role in organising and structuring adults' social life as well. We assume that a personal network approach offers a useful and heuristic tool to construct a unified representation of the individual actor intertwined in his/her social and cultural environment. For this end, we combine data on social networks, cultural practice and uses of communication tools in order to reconstruct social and cultural networks for every individual and take into account the different modes of communication used during the observation period. The sample consists of ten French young adults (20-25 years old) strongly engaged in one or more cultural activity (TV, musician, hacker, fashion designer, gamer, etc.).The study was conducted using the ego-centred networks methodology developed by Maurizio Gribaudi, and his colleagues (Espaces, temporalités, stratifications. Exercices sur les réseaux sociaux, EHESS, Paris, 1998). The interviewees also recorded all of their cultural practices during two weeks (TV, radio, cinema, computer use, newspaper, etc.) in individual diaries. The approach delivers an innovative answer to methodological problems raised in sociological studies of culture, social networks and communication.

Impact of ego-centred networks on appropriation of information and communication technologies

Serge Proulx and Johanne Saint-Charles

Many researchers have addressed the impact of information and communication technology on social networks (Katz, Rice et Aspden, 2001; Korsching, Hipple et Abbott, 2000; Muncer et al. 2000; Muller, 1999; Wellman et al. 2001; Wellman, 1999). In our research, we propose a complementary perspective by exploring the impact of personal networks in the individual's appropriation of ICT. Through a qualitative longitudinal approach we explore individual's trajectories through constellations of communicational objects. A series of interviews are conducted with newbies, regular users and experts of ICT as well as with users of open source software. Believing that networks play a capital role in the 'computerisation' of our society and in explaining individual differences in ICT appropriation, such a research strategy should allow for an in-depth analysis of the impact of ego-centred networks on individual trajectories.

Mathematical Models

Use of Hermitian matrices in the analysis of newsgroups

Bettina Hoser and Andreas Geyer-Schulz

Classical network analysis uses adjacency matrices as one of the basic analysis tools. These non-symmetric, quadratic matrices A = aij ? R contain in their standard version only binary (aij = 0 no linkage, aij = 1 linkage) and thus very basic information about the relationships within a group. This representation does not contain, for instance, the information on the strength of Internet communication (number of exchanged messages). The implication is that the result is a mixture of 'signal' and 'noise' (random communication) that is difficult to interpret. Especially, identification of the relevant substructures (informal groups of newsgroup members) in the newsgroup becomes problematic. In this paper we present an enhanced way of describing a network, namely a small newsgroups (90 <= N <= 150), by a Hermitian matrix. The approach is based on the assumption, that in a newsgroup not only the fact, but also the traffic size with which members contact each other is essential when analysing the behaviour within the group. We propose a way to incorporate this directed two-way information into a complex adjacency matrix (with aij = x + iy, aji = y + ix = i ? a*ij, aii = 0 with aij ? C). After rotation the originally non-symmetric complex adjacency matrix becomes Hermitian. The resulting Eigen-system offers on the one hand real Eigenvalue ranking based on the strength (amount of traffic) within a substructure that is centred around a very busy centre-person and on the other hand more information about its members.

A new measure of clustering in networks

John Keisling

A widely-used measure in the analysis of empirical networks, from social networks to the Internet, is the notion of clustering. As used here, the term refers to the effect of a common neighbor on the connection between two nodes. One of two definitions is commonly given for the clustering coefficient, either involving a count of triangles and connected triples over the entire graph (the "fraction of transitive triples") or as the average over all nodes of a node-specific clustering coefficient. In this paper, we propose a new definition, distinct from the other two: the conditional probability that two randomly selected nodes are connected given that they have at least one neighbor in common. We give examples to show that the three measures are not equivalent and investigate the new measure for several well-known empirical networks.

Some useful theorems for solving structural models that include measures of well-known structural concepts

Geoffrey Tootell, Michael J. Lovaglia, Paul T. Munroe and Alison J. Bianchi

When network theorists or researchers introduce well-known matrix measures, such as of centrality or influence, into models using a system of linear equations, they will face a set of potentially daunting problems. These include series that diverge and preclude getting a satisfactorily specific solution, matrices with zero determinants and no inverses, and negative numbers in solutions where they were unexpected make little sense and where none had been fed into the problem solving machinery. A variety of helpful theorems are found in works of Perron (1907), Frobenius (1912), Hawkins and Simon (1949), Debreu and Herstein (1953), McKenzie (1960), Seneta (1973), Plemmons and Cline (1972), Murata (1977), Berman and Plemmons (1979), and Horn and Johnson (1985). Sociologists, social psychologists, network theorists and others who are innocent of these results may blunder into such problems and be left wondering what they face, as were the economists who first worked with Leontief's input-output systems (1941). With these theorems as guidelines, theorists and researchers can structure their expectations and build models that will minimize the impacts of these problems on the work they address.

Multidimensional matrix networks: A new approach to modelling social networks

Armenak S. Gasparyan

In this paper we propose a new approach to social network analysis through the representation of social networks by matrix networks. The matrix network we define is the network constructed from multidimensional matrices of two kinds: "actor matrices" and "tie matrices". The actor matrices represent sources and targets of network resources and express the properties and activities of individual actors. The tie matrices model the existing gaps and relations between actors. By means of appropriate matrix multiplication we connect the matrices of both types into a resulting 'matrix network'. This is a most realistic way for researching not only social and industrial networks, but also several other types of network structures such as computer networks and general neural networks. Firstly, the matrix network is itself a matrix with some numbers of source and target indices, and therefore it can serve as one single actor matrix in a new matrix network, when we try to model the network on higher organizational level. This allows to reflect in one model both -network and hierarchical phenomena (hierarchical networks). Secondly, within the framework of multidimensional-matrix network modelling, it becomes possible to reflect essentially the multi-arity of ties if they cannot to be expressed through only simple binary ties. Finally, these matrices can reflect, in the resulting network model, individual properties of ties with an excellent degree of detail and specification.

Employment Networks

Social networks in determining employment and wages: Patterns, dynamics, and inequality

Matthew O. Jackson and Antoni Calvó-Armengol

We develop a model where agents obtain information about job opportunities through an explicitly modelled network of social contacts. We show that an improvement in the employment status of either an agent's direct or indirect contacts leads to an increase in the agent's employment probability and expected wages. A similar effect results from an increase in the network contacts of an agent. In terms of dynamics and patterns, we show that employment is positively correlated across time and agents, and the same is true for wages. Moreover, unemployment exhibits persistence in the sense of duration dependence: the probability of obtaining a job decreases in the length of time that an agent has been unemployed. Finally, we examine inequality between two groups. If staying in the labor market is costly (in opportunity costs, education costs, or skills maintenance) and one group starts with a worse employment status or a smaller network, then that group's drop-out rate will be higher and their employment prospects and wages will be persistently below that of the other group.

Social capital as a 'bridge set' in the transition from school to job

Marc Lecoutre

This work is based on Granovetter's perspective on the labor market. In the domain of vocational and professional training, teachers have the opportunity to develop-or not-ties with people working in companies. These contacts can be managers, engineers, or technicians, who teach more or less often in their own specific training programs or as hosts for students on internships. In such cases, social relations developed by teachers and the school's actors generate social capital usable by students. First, we can identify this form of social capital from a tri-level point of view: individual, institutional and organizational. Second, its role is to articulate an 'art of the training' system with work organizations, thereby facilitating school to job transition for students when these are looking for their first job. We work on results from an empirical study we conducted in 1995, based on five specific training programs specializing in management of cultural activities and organizations, similar to MBA's. Our analysis utilizes interviews with the managers of these specific training programs as well as results of a longitudinal survey on the entry career of 265 students just after leaving these programs.

Young adults' work goals and related social capital during transition to working life: A longitudinal study

Markku Jokisaari and Jari-Erik Nurmi

We investigate young adults' work goal-relevant social capital during transition to working life. Our first aim is to examine what kind of work goal-related social networks do young adults have, and to what extent networks change during the transition. Secondly, we investigate to what extent goal-relevant social capital contributes to employment and adjustment to work. The sample includes over three hundred young adults, who were graduating from Polytechnic schools in Finland. They were examined twice: when they were still at school and half-a- year after graduation. The results indicate, first, stability in young adults' strong ties and change in their weak ties during transition to working life. Second, contacts with specific socio-economic status and weak ties in social networks seem to contribute to getting a long-term job commensurate with education. Moreover, the results indicate that goal-relevant social capital contributes to young adults' adjustment to work. Network-based support for young adults' work goals predicted their self-appraised mobility prospects in the workplace, and supervision in the network contributed to job satisfaction. Instead, network-related goal hindrance was found to be detrimental to job satisfaction even after workplace social support was controlled for.

Emergence in networks: The impact of structural forces on the entry of new actors

Maryjane Osa and John Skvoretz

The paper applies exponential random-graph models to an inter-organizational affiliation set that includes the Polish trade union 'Solidarity', to test whether the structure of affiliation exhibited by the union, when it joined the network, can be predicted by the models. The aims of this paper are both theoretical and practical. The theoretical question addresses the issue of where new actors will emerge in an on-going network, given the existent structure. We also suggest how predictive models can be combined with inductive data gathering to solve the inevitable problem of missing data in the reconstruction of historical networks.

Peer Influence in Behaviour Pattern

Pupil's petty crime and networks at high schools

Chris Baerveldt, Ronan van Rossem, Marjolijn Vermande and Frank Weerman

In criminology two viewpoints on delinquents compete. According to the inability model, delinquents lack social skills, and therefore are not able to engage adequately in personal relationships. According to the ability model delinquents are people in wrong circumstances, but with normal social capabilities. According to the first model, delinquent have poor personal networks, according to the second, not. From both models it can be predicted that the levels of delinquency of related people is correlated. From most criminological theory it could also be predicted that those correlations are stronger in networks defined by strong ties than in weak tie-networks. The Dutch Social Behaviour Study was conducted in 1995. A network survey was carried out on 1,317 pupils 15-17 years old, in 20 Dutch high schools. Pupils completed a questionnaire about petty crime and characterized their fellow pupils according to ten different types of relationships. The network structure of delinquents and non-delinquents did not differ over any positive relationship. Delinquents seemed to avoid others a little more than non-delinquents, but where not avoided more. Delinquency was correlated over positive relationships, but this was caused substantively by sex segregation. Effects in weak tie-networks were not weaker than in strong tie-networks.

The relationship between changing network position and changing pattern of teenage smoking behavior: an exploratory study.

Duan-Rung Chen, Lan Lee and Hsieh-Hua Yang

Literature review indicates peer group influence is an important role in initiating and maintaining teenage smoking. This study focuses on the changing structure of peer social network, and its impact on changing pattern of smoking behavior among teenagers. A self-developed questionnaire was used to collect baseline data at the second semester of the 9th graders and posttest data at the first semester of the 10th graders at one high school. Using NEGOPY and KrackPlot software, changing patterns of network structure for each class is examined. Two network variables are constructed: group membership change at two points in time (baseline and posttest), and betweenness at posttest. Using polytomous regression analyses a significant relationship was found between network variables and changing pattern of smoking behavior. Teenagers who leave their groups at posttest are 4.46 time more likely to become smokers, as compared to teenagers who are still in the groups at posttest will do so. Male students who have high scores on between-ness index, are 2.3 times more likely to become smokers at posttest, as compared to female students will do so. The results indicate that network position has important relevance for exploring changing pattern teenage smoking behavior. Further study on the quality of social relationship among teenagers can be examined.

The association of changes in the personal networks of injection drug users with subsequent changes in risk behavior

Elizabeth Costenbader and Chyvette Williams

The social support literature provides numerous examples of how enduring social relationships have positive effects on health. On the other hand, the literature on substance abuse indicates that breaking ties with substance-using friends is important for reducing personal risk. To date, relatively little is known about how and how much the personal networks of injection drug users change, or stay the same, over time and the consequences of stability, or lack thereof, on health risk behaviors. In this study, we looked at changes in the composition of the personal networks of a population of street-recruited injection drug users in Baltimore, MD. We found the personal networks of the study participants to change considerably between the baseline interviews conducted starting in 1997 and the follow-up interviews conducted approximately two and four years later. Stability, as measured by the stability index, was very low, ranging from .03 to .75, with an average value of 0.18. We then sought to determine whether these changes were associated with changes in a number of subsequent health risk behaviors.

School bullying: Unique patterns of risk for bullies, victims, and aggressive victims

Michele Mouttapa

The presence of bullying in schools is well documented and is recognized as a growing problem worldwide. Previous studies have identified sociometric variables, peer behavior variables, and classroom-level variables that predict bullying and victimization. However, few studies have examined the unique contribution of such variables to the prediction of bullying, victimization, and aggressive victimization. The purpose of this study was to determine whether (1) centrality, (2) frequency of peers' self-reported bullying and victimization, (3) interactions of centrality with classroom levels of bullying and victimization, and (4) interactions of individual and school levels of bullying and victimization predict self-reported (1) bullying, (2) victimization, and (3) aggressive victimization (those who are both bullies and victims). An ethnically diverse sample of 1368 6th grade adolescents completed a self-administered questionnaire that included questions about bullying, victimization, and spaces to nominate five best friends in the classroom. Logistic regression analyses were conducted on each gender separately to determine whether the independent variables predicted bullying, victimization, and aggressive victimization. Results suggested that victims received fewer friendship nominations relative to all other students. Bullies and aggressive victims had a higher proportion of friends who bullied other students. These findings varied by gender. Implications and future directions are discussed.

Multiple Meanings of Social Capital

Position generator and personal networks in everyday life: an evaluation with diary logs

Yang-chih Fu

Contrary to the name generator, the position generator methodology intends to reveal the segments of personal networks that are relatively peripheral, diverse, weakly tied to Ego, and where structural holes are more likely to occur. While empirical studies that adopt the position generator have demonstrated its utility in correlating or predicting a host of outcomes, there has been a lack of actual and complete information about personal networks as a base for comparison. Based on two diary logs that contain information about contacts in everyday life (N=1962, 1553 contacts, respectively), this study intends to examine samples taken from a position generator against a comprehensive base of personal networks. The specific goals in this paper are threefold. First, I explore how well the data from the position generator reflects actual networks encountered in daily life. Second, I demonstrate how such data from the position generator might help predict other kind of behavior significant in actual life. Third, I shall propose additional items useful in the position generator.

Position generator measures and their relation to other social capital indicators

Martin van der Gaag and Tom A.B. Snijders

During the last twenty years, several different methods of measuring social capital for individuals have been proposed. One of the more consistently constructed and also more popular methods to do this has been the Position Generator (Lin and Dumin, 1986): a method that models access to social capital by asking for access to a set of occupations, that spans the social status ladder across a population. The Position Generator is characterised by a very thorough underlying theoretical framework, a straightforward derivation of measures, a standardised idea of how to adjust its design to various research populations, and is relatively quick and efficient in use in interview situations. Whereas it can be a very valuable method to study 'big social capital issues' in sociology (such as status attainment), one of its disadvantages is that its actual representation of social resources remains at a very abstract prestige level. In the 1999-2000 Social Survey on Networks of the Dutch, many questions were included that offer opportunities to compare Position Generator data with other social capital measurement methods: the name generator / interpreter (McCallister & Fischer, 1978), and the Resource Generator (Snijders, 1999). In this presentation we will observe how more relationship-based and more concrete resource-based social capital measures relate to position generator data.

Social capital: Social resources, civic engagement or trust? An integration

Nan Lin

In the case of expressive functions (cooperation and maintenance of resources), dense or closed social networks are postulated to evoke civic engagement and trust, which in turn, bring about solidarity and sense of security to the group and its members. For instrumental functions (competition and search for additional resources), open and expansive social networks are seen as more likely to access better social resources (diversity and quality of resources embedded in the networks) which, in turn, bring about profits or gains to the individuals. The hypothesized relations among network density and extensity, social capital (as indicated by social resources, civic engagement and trust), and instrumental actions (attainment of socio-economic statuses, and propensity to participate in collective actions) and expressive actions (psychological well-being and quality of life) were put to test with data from an island-wide survey conducted in Taiwan. Results strongly confirm: (1) the linkage between density of networks to trust and participation in localized organizations, (2) the linkage between openness and extensity of networks to diverse social resources and participation in cosmopolitan organizations, (3) the effects of trust and participation in localized organizations on psychological well-being and life satisfaction, and (4) the effects of diverse social resources and participation in cosmopolitan organizations on attained socio- economic statuses. Implications for future theoretical development and empirical research are discussed

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An investigation of the relationship between social networks, interpersonal activities and community resilience in British Columbia's coastal communities

Ralph Matthews and Sandra R. Enns

This paper presents preliminary findings from a study (the Resilient Communities Project) examining the relationship between social capital and resilience in the coastal communities of British Columbia. Many of these communities have traditionally relied on the resource industries of fishing, forestry and mining for their economic stability, and as these industries have experienced dramatic changes, so have these communities. The project examines how these communities are responding to the economic downturn, and whether existing social structures are able to provide a buffer to the current economic crisis. An important contributor to social capital within a community is the structure and function of personal networks. In order to investigate this, we included a revised version of the position generator in the mail out survey we are sending to some 4,000 people in 23 coastal communities. This paper includes the data we received from six communities and some 750 respondents. We included a further measure of whether the activities took place inside the community, in another community or in both communities. Combined with the position generator data, this allows us to compare the social life within and between our communities, as well as investigate whether differences in such network structure and social activities may contribute to a greater resilience in the face of economic instability.

Does social capital affect access to information resources? A study of information seeking in Mongolia

Catherine Johnson

This paper reports how social networks affect access to information resources in Ulaanbaatar, Mongolia. A network questionnaire was administered to 313 people. Names of social network members were elicited through a combination of the name generator and position generator methods. Findings indicate that while factors such as income and education are positively associated with access to social capital, there is no significant gender difference. The role of weak and strong ties in providing access to resources is discussed as well as the relationship between social capital and success in information seeking. Findings from this study are compared with findings from similar studies conducted in other transitional economies.

The Dynamics of Personal Networks 2

Building a typology of ego-networks in a dynamic perspective

Alain Degenne and Marie-Odile Lebeaux

The network of a person changes with time. Some bonds cease to be activated, while others are tied up. Some main statistical tendencies are known: extended and outer-oriented for young people, the personal networks become more elective and centered on the couple in adult life and tend to be limited to the close relations for old people. Beyond this simplified model, it is interesting to seek to identify the processes, the moments when the changes intervene. Looking for the means of building a typology of the evolutions of the personal networks is also an interesting methodological question. We carry out an experiment starting with the data of a panel of young people at the time of their transition to adulthood in France. Three waves of the panel are currently available, which represent a six-year follow-up. At that stage of their existence in which young people settle in adult life, the network shows many changes. The selected method initially consists in characterizing the bonds by the quality of the alters (kin, friends, etc.), the context in which the relation was born and what people do together. The analysis of the evolution of these relations allows for a definition of a typology. From these types of relations, we try to constitute types of networks in a dynamic perspective.

Are social networks technologically embedded? How networks are changing today with changes in communication technology

Christian Licoppe and Zbigniew Smoreda

Communication mediated by various technologies (from ordinary mail to the telephone or e-mail) provides important evidence for the study of social networks: given that networks determine who communicates with whom, data on usage can provide important information of individual, private sociability. However, it is also true that networks not only shape but are also shaped by technological means for communication, since these entail the re-constituting of social ties and the re-drawing of social boundaries. We will develop three ideas coming out of various empirical studies undertaken in the last three years: 1. How ties are managed over a distance once someone has moved out of town, 2. The way personal ties are re-organised at the time of the birth of a first child, and 3. The ways social ties become more bound up with technological instruments (fixed and mobile telephones, answer-phones, SMS, etc.), meaning that people are "always on-line". These three examples show in different ways how technological means of communication allow people to re-negotiate the constraints of individual time rhythms, and of who one communicates with. Tools of communication provide new resources to negotiate individual timetables and social exchanges, making it possible to adjust roles, hierarchies and forms of power in relational economies: from established roles to mutual reachability.

The dynamics of personal networks of teenage mothers

Johanne Charbonneau

Personal networks bear the imprint of biographical trajectories. They are also involved in the logics of individual action, structured by attitudes, changes of direction and plans. When adult life begins with an event like a teen pregnancy, which is far from the social norm for this stage in the life cycle, it becomes interesting to trace the relationship of those young mothers. In fact, over time, those mothers will need to mobilize all the resources available in their social network just to meet the day-to-day needs of their family. This paper draws on data gathered in a research project on adolescent pregnancy and social support systems, based on retrospective interviews conducted in 1996- 1997 with adolescent women, living in the Montérégie region (just south of the City of Montréal, Québec, Canada) and now in their twenties and thirties. Through the analysis of the sequence of events in the life history of each of the mothers, the history of relations between adolescent mothers and their social network will give us the opportunity to draw up a typology of the various ways that their relationships may evolve and to isolate the key determining factors.

The development of personal networks and life events

Claire Bidart, Daniel Lavenu and Anne Pellissier

Networks of personal relations evolve over time. The number of people involved in them and their composition change, as does the quality of the links that constitute them. What life events might influence these changes, or possibly even explain them? Drawing on a qualitative survey of a panel of 67 young people living originally in Normandie (France), who were questioned every three years, we attempt here to find a relation between the evolution of their personal networks and the events marking their entry into adult life. Do their networks expand or contract, do they move regularly or in stages? What are the links that appear, disappear or change, become stronger or looser? What events are most likely to influence changes in these links and in the networks as a whole? We begin by examining the changes in young people's networks during the survey's three waves. We then identify the life events that took place in the intervals, focusing in particular on entry into the labour market, geographical mobility, setting up house with a partner and the birth of children in the household. This enables us to advance some hypotheses about the impact of these events on the evolution of networks and to illustrate our argument with a few significant examples.

Social Structure

Finding social groups: A meta-analysis of the southern women data

Lin Freeman

This is a meta-analysis of the Davis, Gardner and Gardner's (1941) data on southern women. Their data have been used in 21 attempts to specify groups and 11 attempts to assign women to core and peripheral positions. Here, I use various techniques, including consensus analysis, (Batchelder and Romney, 1986, 1988, 1989), canonical analysis of asymmetry (Gower, 1977) and dynamic paired-comparison scaling (Batchelder and Bershad, 1979; Batchelder, Bershad and Simpson, 1992), analyze these various analyses. My aim is to answer two questions: (1) do the several earlier analyses reveal anything about the structural form of the data? And, (2) can a meta-analysis reveal anything about the strengths and weaknesses of the various methods?

Blockmodeling two-mode network data

Patrick Doreian, Vladimir Batagelj and Anuska Ferligoj

We extend the direct approach for block-modelling to the analysis of two-mode data. With such data, the rows and columns are partitioned simultaneously but in different ways. All of the block types for generalized block modelling can be used and other block types can be defined. These methods are applied to the classic Deep South data and the set of opinions from Justices of the U.S. Supreme Court. The partitions are easy to interpret and are substantively meaningful. These methods are applied also to voting in both the Senate and House of Representatives for voting patterns for a set of bills concerning the environment. Finally, we consider applying these new methods to one-mode data where the rows and columns are partitioned in distinct ways. We use some journal to journal networks as examples where sending and receiving citations are used and the partitions of journals are interpreted in terms of knowledge producers and knowledge consumers.

Methods for the MR-QAP: A comparison

David J. Dekker and David Krackhardt

In network data observations are typically not independent. Krackhardt (1988) suggests the quadratic assignment procedure (QAP) to deal with this problem in a multiple regression framework. Since, different methods such as Y-permutation (as implemented in UCINET), X-permutation, Partialing and Semi-Partialing have been developed to apply the QAP to network data regressions. Although many contain that these different methods provide similar results we show some important differences. In this paper we present a comprehensive overview of advantages and disadvantages of those methods. Especially, we check to what extend different methods are robust against multi- collinearity. Using extensive simulations we show that the partialing method proposed by Krackhardt (1988) indeed holds under the standard assumptions. However, the results show that semi-partialing is more robust under conditions of multi- collinearity. Furthermore, individual parameter test are more robust under semi-partialing.

Social gravity: Studying homophily as a variable

James M. Cook and J. Miller McPherson

Current models of homophily either do not account for the socio-demographic structure of the population in which homophily is expressed, are unable to accommodate additional individual and structural variables in their analysis, or require a level of methodological sophistication high enough to render results inaccessible to a broad audience. Conceptualizing homophily in a manner analogous to Newtonian gravity not only exploits the advantage of a familiar explanatory image, but also allows the problems mentioned above to be addressed. We use a simple yet flexible method of logistic regression to describe the impact of socio-demographic distance on the probability that two individuals know each other, to predict the heterogeneity of an individual's social circle, to test theories regarding the variability of homophily, and to assess theories regarding the impact of homophily on other sociological outcomes. We conclude with discussion of applications for future research.

Networks Through Time

Following the path or navigating a network: Naval officers' careers

Rick Grannis

Current U.S. Department of Defense sponsored research on Naval careers assumes that (1) Naval officers' careers follow one of several independent paths; (2) each billet (or particular job) is associated with a particular path; (3) these billets form a logical progression as officers acquire the training and experience required for subsequent billets; and, (4) while not all officers follow the ideal path, those that don't branch out to a limited number of secondary paths, each associated with a main path, and usually leading to an early departure from the Navy. Using data on the billets actually occupied by all Naval officers from 1976 to 2000, I reconstruct the actual flow of officers' careers and show that the dominant pattern is for Naval officers to navigate a complex network of billets rather than follow a single career path.

Instability at the core: Content differentiation in developmental networks

Monica Higgins and Jonathon Cummings

We present a dynamic model of core developmental networks — interpersonal ties who take an active interest in and concerted action to advance one's career — and show that these networks are not as stable as previously described in the literature. In particular, a stable inner core comprised of psychosocial ties provides friendship, caring, and non-work counsel, while an unstable outer core comprised of career ties provides professional opportunities, visibility, and open doors. By linking tie content to network structure for 77 MBA graduates over three time periods (N=1,012 ties), we shed light on mechanisms underlying the receipt of support, help, and advice early in one's career. We conclude with a discussion about the impact of changing careers on the stability of core developmental networks.

Is tie-strength decisive in politics?

Silvia Casasola Vargas and Narda Alcántara Valverde

Given an expected career pattern from school through minor governmental positions toward cabinet appointments and beyond, the careers of 444 Mexican politicians are explored along 16 presidential cabinets and 80 years (1920-2000). The aim is to identify the paths followed by certain actors, linked to prominent leaders in the political, entrepreneurial and/or intellectual milieus of Mexico, in order to test the suitability of the strong/ weak tie conjecture in a political milieu. Preliminary results are shown.

Drugs and Spread of Disease

Fragmentation in inner-city drug user risk networks

Stephen Muth, Carl A. Latkin and Joanne Jenkins

An extended network comprising nearly 25,000 nodes was constructed by matching data (name, date of birth, age, ethnicity, address, social security and phone numbers) from 1,645 drug-using respondents and their 26,379 citations of social, sexual, drug-using, and needle partners. Quality of matches was assessed from most to least conservative as: "certain", "probable", "possible", and "tenuous". Networks visualized using Pajek and NetDraw include the largest component (N=24, 702; largest component, 3966), and the largest components within the much smaller risk networks of drug use (N=7780, largest: 83) and needle equipment sharing (N=2768, largest: 44). Ethnographic observations corroborate the picture revealed by network visualization; the larger social network reveals enhanced cyclicity with many 3-cores suggesting a robust environment for interaction among network members, yet networks of palpable risk (sharing behaviors) remain highly fragmented. Risk networks are shown not to differ appreciably across the three intuitive standards of matching personal data (certain, probable, possible). Network component size and complexity result when tenuous matches (many of which are likely to be false matches) are included, raising a cautionary note for researchers matching incomplete personal data.

The growth and dynamics of a needle exchange network

Andrew J. Seary, Thomas W. Valente, David Vlahov and Steffanie Strathdee

We describe the growth and dynamics of a needle exchange network in Baltimore MD which provided sterile syringes in one-to-one exchange for contaminated ones from August 1994 to February 1997. Needles were bar-coded, laser scanned, time-stamped when distributed and returned (k=199,519), and linked to the person acquiring and returning each one (N=4, 296) . The time-stamping was used to follow growth and dynamics of the resulting network. The network goes through an almost linear growth period, then, it settles into a roughly constant number of exchanges. A strong component is established within a month, then, grows steadily in size. Out-degrees begin to follow a power law within two months and follow this law thereafter. The number of needles exchanged shows scale-free behaviour over time, volume and location, largely due to high-degree "hubs". The circulation time between acquiring and returning needles also follows a power law. The network shows early clustering based on exchange sites that becomes stronger in time, and begins to show formation of new clusters after the introduction of new exchange sites. We will discus how these preliminary results relate to current theories of network formation and diffusion, and to optimising program effectiveness by reducing circulation time of needles.

The relationship between personal network characteristics and drug overdoses

Carl A. Latkin, Karin Tobin, Wei Hua and Amy Knowlton

Heroin users have high rates of drug overdoses, which is a leading cause of death among drug users. The present study examines the relationship between history of drug overdoses and social network characteristics among cocaine and opiate users. Data for this study were from cross-sectional surveys administered from March 2001 through October 2002 as part of follow-up of the SHIELD study, an experimental network oriented HIV prevention intervention. A total of 730 participants with histories of cocaine and opiate use completed the survey. Several network variables were found to be significantly associated with drug overdose in the prior two years, including number of network members who were drug users, number of network members who smoked crack, number of network members who injected drugs, number of network members with whom client shared drug paraphernalia, and the number of conflictive ties in the network. Even after controlling for age, frequency of drug use, and health status, network variables continued to have a strong association with history of recent drug overdose. These data suggest that large injection and drug paraphernalia networks should be targeted for drug overdose prevention interventions.

African American women's serostatus and risk network characteristics

Maureen Miller, Alan Neaigus and Ted Fernandez

This paper aims to explore the relationship between egocentric risk network characteristics and women's serostatus. One hundred and thirty one index women who had used heroin, crack or cocaine in the past 30 days were street recruited (5/02- 11/02) in New York City. Women completed a network survey and were serotested for HIV and hepatitis C virus (HCV). Women were predominantly Black (95%) and 38 years old (sd 7.6); 86% used crack, 49% used heroin and 34% used another form of cocaine; 44 (34%) had ever injected drugs, and 22 (17%) were current injectors. 20% of women were HIV seropositive and 18% HCV seropositive. Women who had ever injected were more likely than women who had never injected to be HCV infected (39% v 8%, $p<.001$), but not HIV infected (24% v 18%, $p=.47$). Women reported known infection status in their risk networks: 37 (28%) HIV infection and 14 (11%) HCV infection. Having HIV network infection was associated with the index woman being HIV seropositive (RR= 1.7; 95% CI=0.8, 3.5) and having HCV network infection was associated with being HCV seropositive (RR= 2.7; 95% CI=1.2, 6.1). Mixing patterns between index women and network members were assortative by serostatus and linked to injecting status.

Context of Social Capital

Characterizing and explaining social capital of Chinese urbanites: A position generator

Yanjie Bian

Based on a 1995 city survey data (N=4600), I develop an event-based position generator of social capital of Chinese urbanites. The position generator characterizes the political, professional, and work-structural components of social capital in urban China. Individuals have different kinds of social capital because they connect to different kinds of people who possess different kinds of positional resources. Thus, the idea to capture the kinds of social capital goes beyond the usual network measures of social capital (e.g., size, density, status ceiling, diversity, etc.), giving us a way of integrating relational and positional approaches to social capital and social structure. The Chinese survey dataset allows for developing and testing an explaining model in which variations in social capital measures are accounted for by variations of individuals' class position in society and of their job activities in the occupational structure. This is an ongoing project.

Marriage and social capital

Gina Lai

Both academic research and practical life experience have informed us that marriage is more than the union of two persons. Marriage often involves integration of two previously independent or minimally related personal networks. Because of marriage, couples obtain access to some or all of the social ties that were previously accessible via the partner. Further, common ties are established to help maintain their marital identity and meet new life demands. Social network analysts have long argued that social ties are important conduits via which extra-individual resources can be accumulated and channelled for instrumental and expressive actions. However, few studies have been done to investigate the implication of marriage for social capital, as a result of merging two personal networks. Adopting the position generator approach, the present paper examines the impact of marriage on individual access to social capital. It focuses on two related issues. First, how do individuals' and spouses' personal resources influence the degree of marital network integration? Second, how do personal resources of both partners and marital network integration relate to the extent of social capital directly and indirectly accessible to individuals? Data are collected from a telephone survey of 454 married men and women in Hong Kong.

Persuasion versus perception: Two different roles for social capital in forming political views on gendered issues

Bonnie H. Erickson

This paper fills two important gaps, one methodological and one theoretical, in the study of network influences on politics. Earlier research has studied only tiny parts of networks, such as the three people with whom one most often discusses politics, yet people receive trickles of political inputs from many of their contacts. I fill this methodological gap in a way especially useful for the study of gendered issues, by using a gendered position generator. Respondents reported whether they knew any men, and whether they knew any women, in each of 15 occupations chosen to vary in both occupational prestige and gender composition. This measure was included in the survey study of the November 2000 federal election in Canada.(N = 1517). Theoretically, earlier research only considers networks as sources of social influence: extensive contact with the kind of people who support a political view should influence one in the direction of that view. Thus, people who know a wide variety of women should favour views strongly favoured by women. Results show that network influence occurs, but in addition, networks act as a source of biased information about social life, which leads to opposite effects. The more that people know women in every sort of occupation, the more they live in a misleadingly un-gendered world, and the less likely they are to think that gender inequity exists or to support action against it. Thus knowing a wide range of women actually pulls respondents away from the views prevailing among women for equity-related issues.

Social capital and internet use in Japan

Kakuko Miyata

This paper reports on the first position generator study conducted in Japan. Research questions include both the causes and the consequences of social capital. Concerning causes, I investigate whether social capital is related to frequency of Internet use as well as to the usual predictors (age, gender, education, and having a child). Concerning consequences, I investigate the possible impact of social capital on self-esteem and sense of control, two important correlates of individual well-being. My position generator asks respondents "Among your relatives, friends, or acquaintances, are there people who have the following jobs?" The respondent is asked to indicate whether he or she knows any men, or women, or both men and women in each of fifteen occupations chosen to vary in occupational prestige and gender composition. Results are based on a random sample of 1320 adults as of November 2002, in Yamanashi prefecture. Yamanashi prefecture includes areas ranging form urban to rural, and it is similar to Japan overall in its distribution of Internet use, civic engagement, and political activity.

Comparing network-diversity in four Boston neighborhoods: The E-neighbors study of community and technology

Keith N. Hampton

The E-Neighbors project examines the relationship between new information and communication technologies and people's personal and neighborhood networks. Through an empirical analysis of four case studies this research project explores i) the current relationship between Internet use and the size and composition of people's social networks, and ii) the potential for new information and communication technologies to expand social networks at the local level. The cases were selected to represent samples of similar socio-economic status, at different stages in the life cycle and with different predispositions toward local community involvement. The study 'Neighborhoods' consist of two suburban single family communities, one inner city apartment building, and a gated condominium development. Variability in neighborhood type allows for the testing of hypotheses related to how place-based relations may be impacted by differences in neighborhood level characteristics for which residents self-select. Results from the position generator portion of the first of three annual surveys of adult residents are presented. It is hypothesized that neighborhood type is a strong predictor of the extensivity, range, and upper reachability of both personal and neighborhood networks. It is also hypothesized that the use of computer-mediated communication (CMC) encourages the formation of diverse social networks, while other Internet based activities, focused not on interpersonal communication but on information searching (web surfing), are predicted to have the opposite effect.

Social structure, identities, and values: A network approach to understanding relationships to the forest

David B.Tindall, Howard Harshaw, Gabriela Pechlaner

Past researchers have examined how network range is related to social capital (Lin 1999, 2001), cultural capital (Erickson 1996), and identification with a social movement (Tindall 2002). The present study examines how network range is related to diversity of identities and to support of non-material values. The data are based on a province wide quota sample of respondents who were surveyed about their values, attitudes, and opinions regarding forestry issues in British Columbia. Tindall (2001) has argued that one's forest values are related to his/her "relationship to the forest" (e.g., through occupation, voluntary organization membership, recreation, etc.). This is important because the main emphasis of forest planning has historically been narrowly focussed upon economic values. This study examines the hypotheses that people with more diverse personal networks (as indicated by range of ties to people with diverse relationships to the forest) will: 1) have more diverse identities, 2) be more supportive of non-material forest values. Results from this study have potential implications both for understanding the relationship between social structure and cognitions, and also for forest management planning.

Networks, Collective Action & Social Movements

Weak ties, strong ties, and social movement activism over time

David B.Tindall

This study examines the personal networks of environmental movement participants over time. In particular, it examines the relative importance of different patterns of personal network ties for explaining activism (or level of individual participation in the movement) over time. This analysis makes several contributions: 1) it examines longitudinal data - a rarity in this field, 2) it provides evidence that network ties have a causal effect on activism. The second point is important because there has been some debate as to whether network ties are merely an epiphenomenon of activism, an issue that is muddled by the fact that most studies use cross-sectional data. Results show that in time-1, weak ties are a significant predictor of activism (and the strongest predictor of activism over all) but strong ties are not significant. Also both range of organization ties and membership significantly predict activism in time-1. In time-2, however, both weak ties and strong ties significantly predict activism with strong ties being the strongest predictor, while neither of the range measures are significant. Further, in time-2, these effects are net of the effect of activism time-1. It is argued that these findings can partly be explained by the 'cycle of protest' and the biographical availability of participants.

The Mobile-ized society: In theory and in practice

Barry Wellman

Although technology does not transform societies, it does create social affordances: constraints and opportunities. This is happening now with the two-fold technological shift to wireless and personalized computer mediated communication. We hypothesize that this will foster a turn towards societies organized more on 'person-to-person' relationships where before they had been organized more on the basis of solidary groups and 'place-to-place' relationships where immediate physical contexts and relationships still mattered. To test these ideas, we analyze data from the worldwide Survey 2001, plus more focused sub-studies. Rather than analyzing wireless communication in transcendant isolation, we look at how it fits into people's entire panopolies of interaction using a variety of media. To look for social changes, we compare findings from Survey 2001 with those from the earlier worldwide Survey 2000.

Adaptation and performance of local volunteer groups

Chris Baerveldt

The Dutch refugee aid movement is considerably institutionalised and dominated by a federation of 336 local groups. However, the organization's self-appointed tasks and the performance of the local groups differ substantially. Because national and local conditions are changing rapidly, it is studied how adaptation to these changes affects the organization and performance of the groups. In this paper an analytic tool is proposed, the coordination network TMR. TMR is a three-mode network of tasks, members, and resources, and the relations between them. These include the one-mode ties among members, among tasks, among resources, and the two-mode ties between members and tasks, between members and resources, and between tasks and resources. It is illustrated that coordination problems always show as inconsistencies in the TMR network. Also, it is demonstrated that the effects of external conditions emerge as a series of 'holes' and 'isolates' in the TMR network. Adaptation includes repairing such anomalies by changing sets of ties. When the group's adaptation is poor, holes and isolates persist, which will hamper the performance, as is the general hypothesis of the study.

Social movement network formation through coalition repertoires

Doowon Suh

Network approaches to understanding the recruitment of social movement adherents and their involvement in collective action have proven highly useful, especially when established personal and organizational networks are considered important. Yet how networks evolve — which greatly affects whether they significantly influence social movements — has been understudied. This article uses comparative, empirical research to analyse organizational network formation (here, networks connecting unions, not interpersonal networks) by the attempts of Korean white-collar unions to intensify inter-union solidarity. Networks are created by organizers' tactical efforts — based on participants' endorsement – to elevate the collective power of their movements. My analysis reveals that successful networks feature moderate organizational leadership centralization and intervention in the activities of discrete unions. Such leadership best promotes a democratic network structure and directs coalition efforts – two, mutually conflicting, requirements for effective networks. Excessive leadership centralization and decentralization equally attenuate network cohesion and effectiveness. The former impedes internal organizational democracy, whereas the latter hinders inter-organizational coalition.

The heterogeneity in collective action and social networks

Yen-Sheng Chiang

Based on the insight of heterogeneity on the research of collective action (Oliver, Marwell and Teixeria, 1985), the paper deals with 'interest' and 'resources' as two dimensions that measure the variation of attributes individuals' possess. Four different types of individuals categorized according to whether they are interested in a social event to a certain level and whether they have resources (to contribute) to a certain degree, are set to play a collection-action contribution game with each other. The equilibrium outcome in the dyadic game determines individual's willingness to participate in collective action or not, depending on which type of people they play games with. Social networks are the setting to determine how and whom individuals play games with. In this paper, I use simulation to explore how features of social networks, collaborating with the setting of game, influence the level of contribution to collective action and the structure of protesting groups.

Methods

Social networks and categorical attribute data: Extending E-I

Martin G. Everett and Stephen B. Borgatti

It is common to have a network together with a partition of the actors into groups based upon some categorical attribute. For example, an organization that is arranged into departments or a set of friends partitioned into male and female. David Krackhardt and Robert Stern proposed an index that compared internal to external links in such a network, they called their measure the E-I index. In this paper we extend the index and briefly review how other methods can be adapted to deal with this type of data.

Social networks and categorical attribute data: Extending Gould & Fernandez

Stephen B. Borgatti and Martin G. Everett

In a companion paper we build on the Krackhardt and Stern E-I index to develop centrality measures that distinguish between ties to insiders versus outsiders. In this paper we do the same thing with the Gould & Fernandez brokerage measures, effectively partitioning centrality into components that correspond to different kinds of structural roles played by actors with respect to members of their own and other groups.

Social capital and the evolution of social structures

Volker G. Täube

The reformulation of the typology of brokerage roles from Gould and Fernandez within the framework of Hummell and Sodeur's census of triadic role positions was part of an earlier work that yielded at the formulation of an empirical measurement procedure for social capital. Since the connectivity of a social network and hence, the available social capital depends on the nodes that set actors or subsets of actors into contact, the focus of the analysis is on brokers that deal within groups as well as on brokers who are positioned between groups. The earlier part of the research consisted mainly in the formulation of definitions for measurement concepts of support and leverage capital associated with Locals and Cosmopolitans respectively. It restricted itself with regard to its empirical application to Newcomb's student fraternity. This rather small data set covers the development of a friendship network of 17 students over 15 weeks. In the end of the first part of this analysis one of the remaining problems was whether the measurement procedure could equally be applied to larger networks. In order to clarify this question the measurement instrument was used in a second part of the analysis to depict the social capital of a network consisting of about 200 freshmen at a German university over the first 10 weeks. Based on the appearance in certain triadic positions as well as on aspects of actor centrality, actors will be assigned to different categories of brokerage roles.

Comparing personal network size and content in Mexico and the U.S.

H. Russell Bernard, Chris McCarty, Peter D. Killworth, Gene A. Shelley and Eugene C. Johnsen

We discuss the two methods we have developed for estimating the size of personal networks - the scale-up method and the summation method. We compare data from two studies based on the summation method - a national telephone survey in the U.S. and a face-to-face survey in Mexico City. Consistent with findings from our earlier work in Mexico City and the U.S., total network size in the U.S. is larger than in Mexico City. However, Mexican respondents report more family members (both consanguineal and affinal) in their personal networks, while respondents in the U.S. report more co-workers in their networks. We use personal network size to estimate the size of several hard-to-count populations (the homeless, women who have been raped, and people living with AIDS) and compare the estimates for Mexico City and the U.S.

Bayesian and likelihood based inference for longitudinal social network data

Johan Koskinen and Tom A.B. Snijders

A natural approach for modelling stochastic processes on social networks is by using continuous-time Markov chains, examples of which have been given by Wasserman (1977, 1979, 1980) and Leenders (1995a, 1995b). Snijders (1996) proposed a class of models that allow for greater flexibility in defining the evolutionary components, relaxing the restrictions on the type of dependence structures that could be modelled (for applications see e.g Van de Bunt et. al., 1999, Snijders and Baerveldt, 2001). Previously, estimation of the parameters in such models has been based on a Markov chain Monte Carlo (MCMC) implementation of the method of moments. In this paper we propose an MCMC algorithm that explicitly models the changes in-between observations as latent variables. This procedure can be used to obtain standard Bayesian as well as Maximum likelihood estimates. The methods employed, to some extent, parallels and generalises the work on other models for binary longitudinal data recently developed in epidemiology (Auranen, Arjas, Leino and Takala, 2000). We also point to the possibility of model inference within this general framework.

Sesión en Español 2

Las relaciones sociales: una forma de conservar la agro-diversidad

Jorge Mendoza González

En una investigación etnográfica realizada con diez familias de una comunidad maya-yucateca los resultados preliminares muestran que existen diferentes tipos de relaciones sociales que se establecen cuando se da seguimiento a los flujos de semillas. De igual forma hay elementos para afirmar que esas relaciones influyen en la conservación de las principales plantas cultivadas de la milpa: maíz, frijol, calabaza y chile; la "red social del flujo de semillas" que se forma act·a de diferente manera en la conservación de las plantas cultivadas. Se han identificado cinco elementos presentes en tal conservación: (1) la agro-diversidad, (2) los actores, (3) el tipo de transacción de semillas, (4) las normas sociales y (5) el tiempo. Los resultados obtenidos muestran tres tipos de redes sociales: (I) las abundantes, (II) las intermedias y (III) las reducidas, diferenciadas por el n·mero de personas o actores que proporcionaron semillas, el n·mero de variedades sembradas y la cantidad de años que las semillas fueron mantenidas por las familias campesinas.

Redes de participación social. Diseño de políticas y estrategias para el desarrollo sustentable en la Selva Lacandona, Chiapas, México

María Elba González Aguirre y Rafael Calderón Arózqueta

La investigación pone en relieve la importancia de la participación de actores locales para el éxito de políticas p·blicas de desarrollo sustentable. Se analiza la conectividad de las redes construidas en el proceso de elaboración de los planes microregionales para los Centros Estratégicos del Programa de Desarrollo Sustentable de la Selva Lacandona 2002, y se la relaciona con el alcance y la eficiencia de los proyectos desde su creación hasta su puesta en marcha. Las redes se construyeron a partir de información sobre las interacciones de los diversos actores involucrados, y se graficaron con Ucinet 5 y Pajek.

Integración Benchmarking - ARS en estudios de innovación: las prácticas de interacción como elemento de diagnóstico para la vinculación investigación û industria

Silvia Almanza, Rosa Luz González Aguirre, Hilda Hernández

El proceso de innovación comprende una compleja red de mecanismos de comunicación y cooperación entre muy diversos actores. Las interacciones entre ellos, sin embargo, no son meras transacciones de corto plazo, sino que representan una forma de aprendizaje que contribuye a la construcción y enriquecimiento de un reservorio de conocimiento, económica y socialmente relevante, fundamental para el funcionamiento del sistema. La configuración peculiar y el desempeño de los sistemas de innovación a nivel macro, y la contribución de sus instituciones a dicho sistema a través de sus prácticas, a nivel micro, resulta de la intensidad y efectividad de las interacciones, a través de las cuales se establecen los canales por los que fluirá el conocimiento entre ellos. En este trabajo se propone la integración de algunas herramientas y conceptos de benchmarking con el análisis de redes sociales, para la generación de diagnósticos y escenarios. La idea es medir el desempeño institucional para efectuar sus interacciones de manera sistemática, y detectar propiedades de la red que emerge de tales relaciones, y que puede ser ·til para formular políticas. El modelo se ilustra con el estudio de caso de un centro universitario de investigación de México, en relación con el problema de la vinculación con el sector productivo, considerado como problema grave en el país.

Una red socio-ambiental en tensión: El caso de la gestión ambiental de los humedales de Bogotá

Dolly Cristina Palacio T.

Los humedales bogotanos se han convertido en el centro de un debate entre la ciudadanía organizada y las entidades p·blicas locales responsables de su gestión ambiental. Existe una tensión entre estos dos actores al no encontrar un acuerdo sobre los criterios y las prioridades frente al tipo de uso que deben tener estos sitios; la disyuntiva se encuentra en el manejo que se debe hacer de estos sitios como ecosistemas estratégicos y como parques de uso p·blico para la recreación. Esta ponencia tiene dos objetivos principales que apuntan a develar algunos aspectos relacionales constitutivos de esta tensión. El primero busca mostrar los puntos de vista de los distintos actores involucrados en la gestión ambiental de los humedales bogotanos, mediante una estrategia narrativa. El segundo, explora los aspectos estructurales de las interacciones socio-ambientales de la Red de Humedales de la Sabana de Bogotá û La Red -, compuesta por grupos organizados de ciudadanos con los humedales, en el contexto de la expansión de la ciudad de Bogotá entre 1997 y 2002, mediante la aplicación del análisis de redes sociales.

Factores que determinan la ayuda internacional en situaciones de catástrofe natural

Juan Pablo Zuluaga

Se aborda la estructura reticular de los flujos de ayuda internacional en catástrofes naturales, desde 1992 hasta el 2001. Mediante modelos de regresión QAP, se estudia el efecto de algunas características individuales y diádicas que han sido mencionadas a menudo en las descripciones periodísticas, en cuanto a la frecuencia, cantidad y tipo de ayuda enviada. Los resultados muestran que la riqueza y la cultura de beneficencia institucional en el seno de los países donantes, pesa más que las características de los países que reciben la ayuda, o que la mayoría de características de las relaciones entre donante y receptor. Se discute la relevancia de estos hallazgos en términos de los modelos teóricos en relaciones internacionales.

Inter-group Networks

Local action, network evolution and effective alliance strategies in the telecommunications industry

Jonghoon Bae and Martin Gargiulo

This paper takes an evolutionary approach to explore the strategic implications of structural hole and network closure theories for building efficient alliance networks. To this end, we focus on the performance effects of new direct (ego-alter) and indirect (alter-alter) inter-organizational ties, which are the building blocks of emerging network structures. A longitudinal study of the effects of new alliance formation on firm revenue and profitability growth in the US telecommunication industry reveals a pattern bridging between structural hole and closure theory. Confirming the predictions of structural hole theory, new non-redundant direct ties that increase the number of separate cliques in the ego-network have a positive effect on ego's performance. In addition, new indirect ties that bridge across previously separate cliques in ego's network have a consistent negative effect on ego's performance. Yet new indirect ties that only contribute to increase the cohesiveness within existing cliques -rather than bridging across such cliques- also have a positive effect on performance, which offer partial support to closure theory. While the formation of indirect ties around ego initially may have a negative impact on performance, further addition of such ties within an already formed cluster could actually enhance ego's performance.

Institutional transition and the evolution of inter-organizational networks

Federico Ballardini, Maurizio Sobrero and Steve White

We investigate the role of institutional changes as drivers of inter-organizational networks evolution. We use longitudinal data on new product development projects in the pharmaceutical industry in China between 1986 and 1994 to study the impact of several reforms on the size, scope and structural patterns of interactions among research focused organizations and manufacturing focused organizations. Our data show that the progressive move from a centrally planned industrial structure to a new regime of higher individual firm level responsibility is associated with an increasing level of inter-organizational interaction. Controlling for the effects of changes in the overall network size overtime, we show that the network evolves overtime both in terms of scale of exchanges and scope of relationships. Moreover, while collaborations increase, the number of collaborations managed by each research institute/ manufacturer remains constant. Despite this stability, each individual relational set becomes more complex and articulated, as the partners involved are themselves involved in other partnerships. These patterns are consistent overtime and are interpreted using economic and organizational models of spatial competition and industrial evolution to analyze some counter-intuitive tendencies and to offer some insight from a social science perspective to the debate of institutional reforms in emerging economies.

Reasons for minority cross-holdings

Marko Pahor

According to the classical theory of the firm (Coase, 1937), a company invests into productive assets of its own specialization area. This means that if a company is not a financial institution, it is not supposed to make financial investments. It is however well known that non-financial companies around the world hold extensive financial assets, mainly in form of equity holdings in other companies. There is a strong economic rationale for holding controlling stakes, covered in the theories of mergers and acquisitions. On the other hand, little is known about the reasons for minority cross-holdings. Two sets of reasons are explored in this paper: Financial reasons, that may use some underlying information about the targets, and the use of cross holdings themselves as information exchange network. The reasons for minority cross-holdings are tested on a sample of the largest Slovenian joint-stock companies in years 1998--2002. The case of Slovenia is interesting as the cross-holdings network emerged from a practically empty network before the transition (similarly as in other transitional economies) to a rather dense and active network. The reasons will be tested using the methodology for statistical evaluation of social network dynamics (Snijders 1996, 2001).

Peer capitalism: Learning, motivation and friendship in industry peer networks

Stoyan V. Sgourev and Ezra W. Zuckerman

In this paper we analyse an understudied inter-organizational social structure: the industry peer network. These networks are sets of firms that are industry peers but not market competitors, gathering on a regular basis to share information on relative performance and business practices. While little research has been conducted on industry peer networks, they appear to be common in many U.S. industries with regionalized market structures. We argue that these networks are theoretically significant because they provide an opportunity for examining the conditions under which "embedded social structures" may supplement the market by facilitating learning and providing additional motivation to improve. The study incorporates a survey of a peer network in remodelling ("Business Networks") as well as longitudinal performance data from the same source. We distinguish the effects of social structural position from that of market position, since relationships between non-competing firms cannot be understood as efforts to facilitate market exchange or collusion. Exploring within and between-group variation in the level of social integration, based on three types of relations (help or advice; motivation or inspiration; and friendship and egocentric ties), the analysis demonstrates that higher level of network embeddedness is associated with greater commitment to the network as well as enhanced capacity for learning and motivation to improve.

Technological alliances in genomics: network effects in the consolidation phase

Peter Groenewegen, Gerhard G. van de Bunt and Tom Elfring

In the late 1990s private interests from diverse parties such as the pharmaceutical industry, university spin offs and biotechnology companies emerged. The entrepreneurial ideas in genomics are clearly related to a new search and uncertainty reduction pattern leading to cross-disciplinary innovations, based on the life sciences and information technology. The potential for new business has been heralded in much the same manner as in e-commerce. However, large uncertainties remain. Establishing ties from business to business and between business and public sector research is one way to reduce the uncertainty. The formation of networks between the existing pharmaceutical industry (broadly defined) and new genomics and bio-informatics companies is analyzed. Ties between relevant actors based on different sources (news-sources and webpages) are presented. Subsequently new tie formation network over a two year period will be related to the estimate of the propensity to collaborate based on reputation, resources and network characteristics. Elements of reputation include patent activity, alliances with large companies, positions in the scientific community, regional position and entrepreneurial experience. Network dynamics (using SIENA) based on the use of the same dimensions of reputation and network position will be used to test the relative contributions of network effects and reputation.

Visualization

Generalized blockmodeling with Pajek

Anuska Ferligoj, Vladimir Batagelj, Patrick Doreian and Andrej Mrvar

The MODEL 2 (Batagelj, 1993) program for generalized blockmodeling was included in Pajek. On some typical examples we present different ways of use of this new Pajek's option.

Network analysis for visualizing WWW navigation behavior

Anna L. Langhorne

The continued diffusion of the World Wide Web makes evident the complexity involved in successful and meaningful analysis of this network of 605.60 million worldwide users (NUA Survey 2002). The majority of approaches to Internet measurement have focused on counting the number of hits, visits, page views, and bytes of data exchanged. Methods, such as site log analysis, may yield click stream usage data; however, the relational information is lacking. The method employed in this paper provides a visualization of Web navigation by individual and aggregated users. CATPAC, a computer content analysis program developed by Joseph Woelfel, is used to identify and graphically illustrate the Web navigation structures of employees at two small to mid-sized, private organizations. From the results, WWW navigation may be better facilitated by organization schemes, which are based on behavioral similarity rather than content.

Methods for visualizing social capital networks in the Vancouver multimedia industry

Michelle R. Petrusevich

Now that businesses are starting to see the limitations of traditional approaches to maximizing financial profitability and shareholder value, the concept of social capital is being looked at more closely due to its ability to improve the innovative climate and knowledge sharing inside and outside a given business. This paper addresses these issues by investigating the Vancouver Multimedia industry and then visualizing the results. Building on the visualization literature, our goal is to explore how different representations techniques help enhance the understanding of social capital. Using the Vancouver Multimedia industry as a case study, this paper analyzes the role of social capital within this industry and develops effective techniques for representing social capital. This project is a part of the five-year research study, the Innovation Systems Research Network that studies how regional clusters in Canada contribute to fostering innovative capability and economic development nationally. The findings from this paper will be used as recommendations for visualizing social capital in the studied networks and used as suggestions for designing the ISRN Graph Generator. The identified social patterns will then be used to influence the policymaking and distribution of resources in a manner that maximizes the desired benefits.

Analysis and visualization of network data

Vladimir Batagelj, Jeffrey C. Johnson, Lothar Krempel, Andrej Mrvar, Ulrik Brandes and Gerhard Wührer

At the Sunbelt XXII 'Viszards session', we presented different analyses and visualizations of the media coverage of the September 11 terrorist attacks. This year session attempts to establish a tradition. Rather than a series of contributions on related subjects, this session features a single, joint presentation by all contributors. Our aim is to demonstrate the richness and power of network analysis, in particular when supported by visualization. We therefore present a multi-perspective analysis of a single data set, utilizing a broad range of visualization methods.

Politics and Network Structures

The effects of negative relations on country centrality in an international political network

Paulette Lloyd and Phil Bonacich

Eigenvector centrality is a valid measure when centrality (or status) is transmitted between interacting individuals. For example, being connected to a knowledgeable individual adds to one's own pool of knowledge in a communications network. Being friends with a popular individual adds to one's own popularity. Being associated with an individual with much status adds to one's own status. The logic of the eigenvector measure of centrality could easily be extended to mixtures of positive and negative relationships. It may equally be true that a negative or disassociate connection to a popular individual or a positive connection to an unpopular or disvalued individual reduces one's own status. Similarly, a negative relation to a disvalued individual may increase one's status. Balance theory would seem to apply here, and in fact there is a close connection between eigenvector centrality extended to mixed positive/negative sociometric structures and balance theory. This paper will use United Nations General Assembly (UNGA) voting data to develop the concept of negative centrality. To date, negative relationships have been under-theorized in sociology. Using 20 years of UNGA voting, we will explore the effects of being negatively connected to powerful others. We hope to begin a dialogue of discussing the effects of negative relationships, and to theorize about negative centrality and to develop a method to test for it.

Networks through time and space: Tracing political-institutional transformations in telecommunications

Volker Schneider

The paper focuses on the political-institutional development in the telecommunications sector from the late 19th century to the year 2000. The study concentrates on the development of political governance in this sector within the US, Japan, Germany, UK, France and Italy. The various institutional topologies and development patterns - from the dominating state monopoly in the early 20th century to liberalization, privatization and deregulation will be analysed with concepts and methods based on network analysis and facet theory. Besides the description of individual development pathways and their structural similarity, it is the goal to explain the various institutional transformations by an interaction between general structural determinants (technical and economical), and political factors based on country specific political institutions and regional integration patterns (e.g. role of the EU).

Network structures of domestic business associations facing the international environment

Jürgen Grote

On a worldwide scale, both the growth rates of trade associations and their involvement in public policies continue to increase. At the same time, in Europe at least, academic interest in studying these collectivities has declined over the past years. If at all, it is not the virtue of these groups to contribute to governance arrangements of democratic societies but rather the vices of egoism, rent-seeking, veto power and reform aversion which most of the time attract the interest of the public. This paper seeks to rectify this image. Based on relational data from a study of some sixty sectoral business associations (chemicals and information and communication technologies) in Germany and the UK, the effects of globalisation and Europeanisation on interest groups are made the subject of inquiry. The paper adopts an organizational ecology perspective and shows that it is the structure of organizational populations - i.e. of focal associational networks - which determines the structure of the wider organizationalcommunity and not vice versa. The opportunities offered by an increase in the number of actors and of potential targets within the European and global organizational communities have less effect on the structure of established interest populations in the domestic realm. Where such effects are discernible, they result from the organizations' membership (firms and enterprises) rather than from a potential loss or increase of power in the organizations' influence domain.

Persistence of power differences: Metapower in dynamic exchange

Robb Willer and Arnout van de Rijt

There exists remarkable stability of stratification systems throughout history. We assert that one reason is that power differences, by creating significant wealth differences, grant the powerful the resources necessary to perpetuate their structural advantage. In modelling this process we introduce the concept "metapower," individuals' structurally determined potential for affecting beneficial changes to power structures. We model the process by which power sows the seeds of its own perpetuation by extending Network Exchange Theory (NET) to predict network changes. The scope of NET has previously been largely restricted to the analysis of static network configurations. However, this scope stands in contrast to the ubiquity of attempts to change exchange structures in natural settings. We demonstrate theoretically that unequal power networks are more stable than equal power ones.

Structures of survival? Social networks in resilient communities

Brian Elliott, Ralph Matthews and Gerry Veenstra

This paper reports the preliminary findings from a large sociological study examining the relationship between social capital and 'resilience' in the coastal communities of British Columbia, Canada. These communities, long accustomed to the booms and busts of the resource industries on which they traditionally depended, are today facing crises that flow not just from resource depletion, but from the workings of a global economy. Many appear to be in serious decline, but some communities show remarkable adaptability and resilience. Our curiosity is "what explains that?" Can we find the roots of resilience in the structure and content of social networks? Using data from a questionnaire survey distributed to contrasting communities, we address that question.

Networks and Organizations

Optimising the spatial allocation of members of an organisation embedded in a work interaction network

Jodie Woolcock, Pip Pattison, Garry Robins,
Sean Bergin and Paul Rogers

We discuss the problem of allocating individuals to work spaces in the event of an organizational merger and co-location. We argue that the problem can be construed as one of finding optimal allocations of organizational members within an ultra-metric space that is constrained by features of the physical environment. We describe an algorithm that uses an organisational reliance network to optimise the placement of organisation members within a virtual physical environment encompassing buildings and floors. Specifically the algorithm is designed to populate an architectural floor plan, and optimise the allocation of members to workspaces within a multi-building site according to their reliance network ties. Optimisation is sought across multiple levels of grouping. Variations in optimisation criteria are also encompassed, including weighting on other variable such as importance and frequency. We present an empirical application of the approach, and show how it can assist in proposing and comparing the suitability of various floor-plans and placements.

The effect of alliance block membership on innovative performance

Charmianne Lemmens, Geert Duysters and John Hagedoorn

This paper explores the possible relationship between alliance block membership and innovative performance in inter-organizational technology-based networks from a longitudinal perspective. Alliance block membership or cohesive subgroup membership can be seen as one of the strongest forms of social embeddedness. We expect that a firm's innovative performance is contingent on both its position in various network settings (block-membership or non-block membership) and is shaped by the nature of technological change (cumulative vs. disruptive). After discussing this complex interrelationship, we will derive some basic hypotheses on the effect of block membership on innovative performance under changing technological conditions. Empirical testing is performed on the microelectronics industry from 1980-2000.

A multidimensional and multilevel analysis of structural embeddedness and small firm growth: A longitudinal study

Simone Ferriani and Raffaele Corrado

This study draws on the structural embeddedness perspective to address the following question: What is the relation between the growth of a small firm and its structural position within a network of multidimensional ties? The strategic approaches that have adhered to the structural embeddedness perspective build on the assumption that the firm is embedded in multiple inter-firm networks, shaping the set of information, opportunities and external resources accessible by the firm. Despite this theoretical premise that places the firm into a multidimensional space comprised of several overlapping networks, empirical research has tended to focus on a single dimension. Typically, a certain organizational outcome is related to a set of relational variable derived from a single network. In this study, we developed a multidimensional research design of how structural attributes of the firm, as well as the firm's absorptive capacity influence the likelihood of firm growth. Asymmetries in growth potential arise because firms engage in multiple network relations that imply diverse access to information and opportunities as well as differential ability to control such flows. Hypotheses based on these ideas were tested on a stratified random sample of 80 small firms located in Northern Italy. Three-year longitudinal multi relational data were gathered based on direct interviews. Results from pooled time series analysis support the multidimensional embeddedness hypothesis suggesting a number of insights for strategic network research and the link between firm's networks and its growth.

One relationship is not enough: Toward a theory of multiplex embeddedness

Fabio Fonti

Network studies have become very popular for scholars trying to understand differences between organizations. Many of such studies have focused on the association between the organization and its embeddedness for one of the critical relationships within its network (such as communication or knowledge transfer). While these works help in exploring the effects of network structure on organizations, they do not capture the inherently multivariate nature of organizational networks. The fact that within the same organizational network each actor is simultaneously involved in many types of relationships, which affect its choice of action. This work attempts to bring this multiplexity into the picture. Through a 12-month field study of a whole industry, I investigate the effects of multiplex embeddedness (defined as the degree of an organization's involvement in different types of relationships) on organizational performance. I also look at the role of space in moderating the relationship between multiplex embeddedness and organizational performance. I do so by investigating the influence on such relationship of both physical space (where the locale is determined by the firm's geographic location within its industry, for example inside an industrial district) and institutionally created one (where the locale is socially constructed by an institution, such as in common membership in the industry association).

Data Collection

Ethics of social network data collection and analysis

Charles Kadushin

Recent controversies over the role of social network analysis in counteracting terror have spurred an interest in the ethics of social network data collection and analysis. Unlike most social science observation, social network data in principle require tracking individual respondents or organizations (units) and their interrelationships. The main issue is under what circumstances can individual unit identities be revealed and when ought they not to be revealed. Some data are public data to begin with, but even here there is an issue over the adequacy of social network analyses to pinpoint the network location of individual units with sufficient accuracy to take actions that have repercussions for those units. Moreno, who invented sociometry, insisted that it was not valid unless subjects knew that their answers would have consequences. Since Moreno, the general tendency has been not to reveal individual identities. The famous "Bank Wiring Room" omitted details that would have revealed the identity of the subjects. A practical issue is the reaction of literate "natives" to the revelation of the details of their interrelations. Data and studies from different studies of "ordinary folk," elites, and organizations will be reviewed in an effort to derive principles and open up discussion.

Adding quality to quantity: The role of relationship content in the network effect

Fabiola Bertolotti, Maria Rita Tagliaventi and Fabio Fonti

What is the role of the quality of a given relationship within a network, above and beyond its mere quantity? When studying organizational networks, researchers often focus on the quantity of the flow, rather than on the actual content of the relationship at hand. The reasons for this behavior are both practical and theoretical. It is a major task to map a network not only in terms of the existing relationships, but also of their actual content. Additionally, in certain cases limiting attention to the presence or absence of a relationship, or to its level, can be theoretically justifiable and/or suffice for the influence that the network structure has on its members to emerge. However, if possible, using additional, qualitative information on the nature of such flows can be extremely revealing and help to disentangle seemingly contrasting network effects, or even to bring to the fore influences that the network has on its members, but that get canceled out once all the different types of interaction are collapsed to form a unique number. We investigate this issue using a dataset on an Italian fashion company that includes communication networks collected both via survey (quantitative aspect) and via ethnographic study (qualitative aspect). In addition to highlighting the importance of the quality of the flow, this study has also implications on the link between quantitative and qualitative approach to social network analysis.

Sampling in social networks

Steve Thompson

Studies of socially networked populations, and in particular of hidden populations such as those at high risk for HIV/AIDS, involve obtaining a sample of individuals from the population to study in order to estimate characteristics of the wider population of interest. Often it is necessary or desirable to use link-tracing methods in obtaining the sample, or a targeted spatial design supplemented by tracing of social links. In this talk I will discuss some methods for making these estimates with samples of these types from social networks.

Attempting to quantify transmission and barrier errors in scale-up methods

Peter D. Killworth, Eugene C. Johnsen, Chris McCarty, H. Russell Bernard and Gene A. Shelley

This paper examines two linked problems in respondents' articulation of how many people they know in various subpopulations. First, can the effects of transmission error (when respondents are unaware that someone in their network is in a subpopulation) and barrier error (when something has happened to stop a respondent ever knowing someone in a subpopulation) be quantified? Second, if these errors can be taken into account, is it possible to estimate how the probability density function (pdf) of the number of people known to a random individual varies? We argue that respondents may be giving accurate responses based on incorrect knowledge, and that it is possible to estimate the relative effective sizes of subpopulations so as to produce an internally consistent theory. Given these effective sizes, it is possible to invert the problem and obtain the shape of the pdf, which, remarkably, agrees qualitatively with our earlier estimates using scale-up methods, despite involving completely different analysis methods. This progress, however, has moved the actual size of a subpopulation (of direct interest to policymakers) towards an effective size, and more theory will be needed to predict how the two are connected.

Personal Support Networks

Whom do you call a friend?

Fruzsina Albert and Beata David

Several surveys operate with the question "how many friends have you got?" despite the fact that from the literature it is well known that the interpretation of this term is very varied, and often systematically so. When analysing the data, one's doubts about what we measure with this question are strengthened. Especially in Hungary no research has been done so far to study the exact content of this term. We collected data for a 2-generation survey in a small town in Hungary. We interviewed young people, 15-20 years of age and in most cases both of their parents (a total sample of app. 750 people). The general aim of the research was to get a picture of their social networks (by also using Fisher's name generator), whom they consider friends, etc. We intend to use this data to relate it to their mental and physical health. Respondents are asked to define what they mean by a friend, and also the differentiation they make when this term refers to a male or a female. Networks are mapped from name generators, including the content of the relationship (e.g. discussing important things: which is considered to be such?). They are also asked who their friends are so that the 'function' of people termed to be friends could be identified. Some inter- and intragenerational differences in the usage of the term are also analysed.

Transformation of family structure and partnership solidarity in Hungary (1986 - 2001)

Agnes Utasi

This paper provides an overview of the changes in family and partner relationship structure and that of socio-economic conditions occurred in the past 15 years in Hungary. It demonstrates how these changes affected everyday solidarity within the family. The author confirms that informal strong relationships, especially family solidarity gained importance as a result of increased economic difficulties in the market economy characterized by limited resources, unemployment and doubled inequity between the upper and bottom income levels. At the same time, the decreasing number of stable partner relationships has necessarily led to a restructured pattern as far as support and help relationships of everyday life are concerned. The data for these findings come from a representative Hungarian sample of the ISSP/ Social Network empirical research from 1986 (N=1000) and 2001 (N=1500).

Social Capital and Differential Effects on Social Support: The Case of Germany

Afte Unification, Jan Marbach

The paper will propose two analytical concepts of social capital relying on ideas connected with the names of M. Granovetter and J. Coleman. The concepts, then, are applied to ego-centered networks of adult Germans using repeated survey and panel data. At the beginning of the sampling period respondents lived in the former Geriman Democratic Republic and Federal Republic of Germany. As sampling came to its second and third sweep unification had taken place bringing "transformation stress" mainly to bear on East Germans. This is the socioihistorical background of some questions to be answered in the paper: How did social change in the wake of uniification impact personal networks of both East and West Germans? Did "transformation stress" spill over into attenuated networks of

East Germans or did networks provide social capital capable to compensate for the loss of former securities? Have there been significant differences between the two concepts of social capital regardiing their impacts on East and West Germans?

Enacting relationships: The difference media make

Jonathon Cummings and Robert Kraut

Relationships within one's social network are enacted - they grow or decline through communication and the exchange of social resources. Media (e.g., telephone, e-mail, and instant messaging) are increasingly being used to enact relationships, though it is unclear what impact this has on both the content of the exchanges and the quality of the ties. This paper reports the results of a study aimed at understanding the role of media in the relationship enactment process. A sample of students admitted to college (N=350) completed three surveys about family and friends in their social network (N=1,870 ties): (1) at the end of their senior year in high school, (2) at the end of their first semester in college, and (3)at the end of their second semester in college. Using hierarchical linear modelling, we examine the maintenance of old relationships from high school to college, and the initiation of new relationships from the first to second semester of college, and find that media shape both the kinds of topics students talk about and the levels of emotional closeness and social support they report in their relationships.

Simulation

Efficiency versus vulnerability: A test of scale free networks

Elisa Jayne Bienenstock

This paper compares scale free and small world networks using standard tools from social network analysis to better understand how they differ and how they are similar. Scale free networks, which are characterized by hubs, have high degree centrality. High betweenness centrality, for these networks is a function of high degree. In small world networks betweenness can be distinct from degree. While positional degree and betweenness are highly correlated in all networks, networks where the two are not synonymous are fundamentally different than networks where one is a direct function of the other. Simulations that test the vulnerability, measured as loss in efficiency, of networks when positions are removed demonstrate why these differences are important. Results from simulation indicate that in fact network efficiency is compromised more in high centrality networks, like scale free networks than in other, e.g., low centrality, networks following the removal of network positions.

Formal and informal structure within innovating companies: Using organizational simulation to understand innovative performance

Cathleen McGrath, Jim Blythe and Deone Zell

We develop a computer simulation to investigate alternative approaches to centralized and decentralized coordination of innovative activity across divisions within a company. Within the simulation we define the core features of the production development and then test the influence of different coordination mechanisms. The core components of the model consist of the following: The company headquarters; a number of divisions; a number of innovators within each division; and products. Products are defined by a number of characteristics that may align with the characteristics of products from other divisions. Next we define different conditions and structures through which the company organizes. We consider both the degree of centralization and informal connections among divisions. The computer model allows us to abstract the most significant components of the tension between alignment and innovation and examine how organization structure and innovation systems might influence the innovation performance of organizations. Under a range of conditions, centralized coordination may lead to a fast solution but with a significant probability fails to converge. Decentralized coordination is typically more robust. We identify network structures for innovators under which decentralized coordination also often converges quickly. We will test insights from our simulations through interviews with managers in innovating companies.

HIVSIM: A discrete-event simulation of HIV transmission networks with complex transmission network dynamics

Daniel C. Barth-Jones

Discrete-event stochastic simulation methods are capable of simulating complex infectious disease transmission networks and can be invaluable tools for increasing the scientific understanding of such networks. Accordingly, epidemiologists have increasingly adopted simulation technologies for evaluating transmission network effects, epidemiologic study designs and statistical estimation methods. This paper reports on HIVSIM, a simulation developed to simulate data for the evaluation of a novel HIV vaccine trial design that measures vaccine effects on both susceptibility and infectiousness. HIVSIM explicitly models HIV transmission networks with: 1) variable-length partnerships, 2) differential sex-act contact rates within partnerships, 3) selective sexual partner mixing patterns, 4) concurrent sexual partnerships, and 5) HIV transmission probabilities dependent on sex-act type, sex-act role and stage of HIV infection. Simulation of the HIV transmission network permitted investigations into the common, but unwarranted, statistical independence assumptions routinely used in the estimation of vaccine effects. The importance of the stochastically evolving dynamic transmission network structure for HIV transmission dynamics is also demonstrated through the use of network visualization methods and social network analyses. Analyses indicate that the vaccine trial design is able to produce vaccine effect estimates with acceptably small bias, high precision and excellent statistical power under plausible HIV vaccine trial conditions.

A simulation of convergent-divergent public opinion formation on social networks

Moses A. Boudourides

We re-examine Axelrod's 'adaptive culture model,' i.e., a simulation of the dissemination of culture through social interaction proceeding by local convergence and resulting emergence of global polarization at a limited degree. In fact, Axelrod was dealing with the dissemination of culture over a rectangular grid (regular lattice) the nodes (or cells) of which were supposed to be the interacting agents. Each agent possessed a list of numerical attributes, interpreted as the agents' cultural characteristics. Axelrod's simulation assumed processes of local convergent interactions that were globally homogenizing the culture: almost all individuals were adopting the same culture, or only a very small number of cultures were surviving throughout the model. Our simulation intends to further overcome the restrictions of the produced homogenization in the original Axelrod's model and to manifest that significant diversity and heterogeneity can be sustained over general networks of agents. For this purpose, we are interpreting agents' features as opinions, issue stances, political allegiances or any other judgments the agents may have on the political sphere which would orient their voting choices or their political participation in one way or another. We are using in our simulation an arbitrary graph. In order to derive a higher degree of diversity and heterogeneity in the emergent patterns, we consider two types of agents and define different rules of interaction for each of them. We add a small amount of divergent interactions that turn out to dramatically increase the level of diversity.

Reciprocal exchange networks: Model and experiment

Phil Bonacich

Research on how power develops within exchange networks is a lively and exciting topic within sociological social psychology. Almost all the work has involved the power imbalances that develop when actors are in unequal bargaining positions within networks of bargaining opportunities. Models (one of which is mine) have been developed to predict exactly which positions will have power. Only one researcher, Linda Molm, has experimented with networks in which actors do not negotiate over the distribution of rewards from transactions but instead have opportunities to distribute rewards to each other. As yet no one has developed a general theory predicting the location of powerful positions in any network. Computer simulations and a mathematical model suggest that the distribution of power among positions will be different in negotiated (cooperative) and non-negotiated (non-cooperative) networks. In these models actors are governed only by the principle of reciprocity, not by utility maximization. The simulations also suggest that whether or not the actors have complete information about the network and the pattern of giving should also affect the distribution of power. Knowledgeable actors can learn that they are better off giving less frequently to actors who are dependent on them for rewards and more frequently to actors who are less dependent. Preliminary experimental data using three networks support a number of predictions of the model.

Sesión en Español 3

Las redes personales como programa de investigación: muestreo, variación cultural y estructuras meso

José Luis Molina y Chris McCarty

Hasta el momento los estudios sobre redes personales se han centrado en tres grandes líneas de trabajo: Muestreo de la estructura o del tamaño de las redes, redes personales y comunidad, y la influencia de las características de las redes personales en los resultados profesionales, el consumo de drogas, la ayuda mutua, el bienestar psicológico, etc. En esta contribución se realizan un conjunto de propuestas destinadas a avanzar de forma coordinada en cuatro campos con la ayuda del programa Egonet: (i) el muestreo de las redes personales, (ii) la variación cultural de clase y género, (iii) la integración de las redes personales en las estructuras locales e intermedias, y (iv) evidencias empíricas para el problema del mundo pequeño.

La dinámica de las redes de amistad. La elección de amigos en el programa Erasmus

Ainhoa de Federico de la Rúa

A partir de hipótesis teóricas tomadas de la psicología social y la sociología a propósito de la amistad, examinamos la emergencia y evolución de una red total de amistad de estudiantes europeos de intercambio en una situación en que, prácticamente, nadie conocía a los demás. Se estudian factores potencialmente interesantes para el desarrollo de la red como similitud (p.e. nacionalidad, sexo), oportunidades de interacción (p.e. proximidad de lugar de residencia, estudios), costes de la relación (p.e. nivel hablado de los distintos idiomas), así como efectos estructurales como reciprocidad,transitividad, niveles de actividad sociable y popularidad. Ya que los datos fueron recogidos a partir de redes personales, es posible también considerar las alternativas fuera de la propia red. Se emplean modelos de actor orientado implementados en SIENA para modelar la evolución de la red.

Representación del chiste político en gráficas no planas

Samuel Schmidt

El humor político es considerado como una forma de participación política, sobre todo entre los miembros de las elites. Hay tres aspectos interesantes a considerar respecto del chiste político: (1) El proceso de creación de los chistes, que es una combinación de conexiones, recolección de información (que incluye secretos y chismes familiares), (2) el intercambio internacional de chistes, que incluye la transformación de anécdotas humorísticas de carácter diverso en chistes políticos y, (3) el proceso mismo de la difusión de los chistes a través de los medios masivos de comunicación. Se propone un modelo de gráficas no planas que representan el momento de creación de un chiste político y el proceso de su circulación entre actores.

Aplicación del análisis de redes sociales para la intervención en fármaco-dependencias

Juan Machín, Magdalena Solano,
Bernardo Tarango y Manuel Velasco

El fenómeno de las fármaco-dependencias es complejo y requiere de diferentes abordajes complementarios. Una de las aproximaciones más fructíferas ha sido la del Análisis de Redes Sociales por, entre otras razones, hacer resonancia con las propuestas de trabajo de red: terapia, intervención y articulación en redes. En el presente texto se exponen algunas de las aplicaciones del análisis de redes sociales que hemos empleado en el modelo ECO2 (Epistemología de la complejidad, ética y comunitaria), desarrollado en México para la prevención, la reducción del daño y el tratamiento de las fármaco-dependencias y otras situaciones críticas asociadas, así como para la formación de agentes que realizan estas tareas. El análisis de redes sociales es perfectamente coherente con el marco teórico y metodológico para la intervención en comunidades locales y terapéuticas.

Networks and Performance 1

An ecology of employment ties: Firm growth in the Nashville legal industry, 1933-1978

Jonathan Jaffee, Bill McEvily and Marco Tortoriello

This paper investigates the influence of social networks on the 'life chances' of organizations. We examine whether (1) networks affect performance and (2) if there is an ecological component to the performance effect. We analyze the network structure of past and present employment ties among partners in Nashville law firms over a 45 year period. We argue that centrally located partners (i.e., partners whose prior law firm affiliations create linkages between otherwise disconnected firms) will be better positioned to discover, access, and exploit lucrative opportunities for their firm. Our core proposition is that the betweenness of a law firm's partners will increase the firm's growth rate (in terms of the number of associates at the firm), controlling for a host of firm-level and population-level factors. Preliminary analyses support the prediction that firm growth is enhanced by partner centrality. We also examine whether the value of law firm partner centrality (for firm growth) varies with industry evolution (e.g., more beneficial in early stages) and depreciates with time. This paper offers a novel contribution to existing research by integrating work in social networks with organizational ecology in examining the role of employment ties on firm growth.

Relationships and interpersonal citizenship behavior: A social network perspective on organizational citizenship behavior.

Matthew Wm. Bowler and Daniel J. Brass

This study examines the effects of social network ties on the performance and receipt of interpersonal citizenship behavior in an organization. Interpersonal citizenship behavior (ICB) is defined as any assistance provided by one employee to another beyond what is prescribed in one's job description. ICB is one of the most valuable forms of organizational citizenship behavior (OCB) to firms. Research in the past has related ICB to individual attributes such as satisfaction with, and commitment to the organization. Previous research has failed to look at interpersonal relationships as a cause of ICB. A field study involving 175 employees of a manufacturing firm provided evidence that social network ties are related to the performance and receipt of ICB. Results support hypothesized relationships based on social exchange theory that suggest friendship, group size, and group density are related to performance and receipt of ICBs. Support was also found for impression management based hypotheses suggesting that asymmetrical friendships and asymmetrical influence, third party influence, centrality, and prestige are related to the performance and receipt of ICBs. Employees with strong friendships and in weaker power positions are likely to perform ICBs, while those in powerful network positions are likely to receive ICBs. Implications for future research and suggestions for management practitioners are discussed.

Network centrality and proximity: How social interaction patterns shape the psychological contract in employment

Guillermo E. Dabos

Although psychological contract research recognizes the role of informational and social influences in the contracting process between employee and employer, empirical examinations of the propositions derived from this research are rare. The present study investigates how social interaction patterns shape employees' interpretations of organization-wide promises the employer has made. Following Ibarra and Andrews (1993) two alternative mechanisms for social interaction are simultaneously examined: (1) localized social influences that produce perceptual convergence based on either relational proximity (cohesion) or positional proximity (structural equivalence), and (2) systemic power influences that produce differential access to benefits and opportunities within the organization, and thus differential perceptions of the exchange, based on network centrality. Data collected from 96 faculty members in a university's department were analyzed using quadratic assignment procedure (QAP) and spatial regression analysis with maximum likelihood for handling network autocorrelation. Results suggest that network mechanisms shape the psychological contract of employees, though their effects are contingent on the nature of the specific promise and the type of network relationship. When promises relate to resources of competitive nature, instrumental network centrality evidences significant effects. Conversely, when promises relate to non-competitive resources, mechanisms based on network proximity tend to prevail.

Co-evolutionary Principles for 21st Century Organizational Networks

Coevolution of multidimensional networks in bio-surveillance

Kathleen M. Carley, Alex Yahja and Doug Fridsma

At the multiple levels of coevolutionary theory, one can study the different kinds of links between individuals, knowledge, tasks, and groups. The perspective presented here assumes that each individual actor has a different perception about network relational ties. One area of particular relevance for a multidimensional coevolutionary perspective is public health measures for Bio-Surveillance. The paper describes how large scale community-level integrated databases, data-mining techniques, simulation, and machine learning can be used to detect, prevent, and provide guidance in the event of bio-terrorist attacks at various levels: from community to first response medical personnel. Networks at all levels are coevolving even as new technological and organizational solutions are being proposed and legislation is passed that impacts information provision networks (such as through the CDC), response and reporting networks (such as insurance), and contagion networks (through inoculation programs). This paper presents a theoretical framework and study plan for coevolutionary networks in bio-surveillance.

Coevolutionary principles for 21st Century organizational networks

Peter Monge and Noshir S. Contractor

This overview presents a community coevolutionary theory view of social dynamic relations within, between, and among "functionally integrated systems of interacting populations" (Astley, 1985, p.232). Two tenets are: (1) a community network's increasing interdependence allows it to become relatively self-sufficient, depending less on the resources provided by the external environment and exhibiting more robustness in the face of major environmental changes. Second, the accompanying increase in internal network complexity can reduce the community's functional effectiveness, and the system may collapse. Subsumed within this community coevolutionary framework are lower-levels of organizing. The population level includes similar organizations that compete with each other for resources. In general, until a carrying capacity is reached, organizations act mutually to establish legitimacy for the population; but once the carrying capacity is reached, populations begin competing. At the organizational level, evolution can be viewed through the lens of Campbell's (1990) variation-selection-and retention model. Finally, a key cross-level tenet of coevolutionary theory is that lower- level parts of the ecology, such as populations and organizations evolve faster than higher-level parts, thus leading to conflict between the more agile parts and the more stable whole. The remaining papers apply these principles to specific domains.

Coevolution of multidimensional networks in film production

Francesca Gardini and Janet Fulk

Coevoutionary theory can be deployed using a multidimensional representation of coevolving networks to examine the dynamics of financial relations in Hollywood film production. Recent years have seen a dramatic change in the size of film budgets and an associated jump in the use of partnerships at national and global levels. These partnerships are designed to spread the risks associated with production of expensive cultural products whose market appeal is difficult to predict. One result of these transformations is the embeddedness of the Hollywood majors in a network of global relations. Individuals put together ad-hoc teams to produce a film. Individual relations thus wax and wane within the industry depending on team composition for feature films produced at any time period. At the organizational level, studios partner with other studios, distributors, and production companies. At the population level, studios compete with other forms of entertainment, such as TV, video games. Yet, these companies may also be partners in the aftermarket for films (e.g., cable, TV, videogame tie-ins). Digitization also affects the patterns of relationships, the power balance, industry dynamics and community relations. This paper describes these relations and presents a series of propositions based in coevolutionary theory and risk management theory.

Networks and Globalization

Internalisation of public utilities: A study of ownership concentration

Vladimir K. Popov

This research shows how Social Network Analysis can provide insights into the process of globalisation. Although globalisation is the main issue on the agenda of businessmen, politicians and scholars, there is no clear understanding of its content and consequences. It is possible to distinguish two main viewpoints on the meaning of globalisation -optimistic and pessimistic. The proponents of the first approach highlight the positive impact of globalisation due to integration of global markets and states. Pessimists point out the increase in global inequality. Who is right in this dispute? It is not easy to answer this question not least because of paucity of solid empirical data. Our research is an attempt to address this dilemma. We assume that the concentration of ownership is a key parameter to be taken into account. We analyse the structure of ownership concentration in public utilities globally -about 5000 companies in 150 countries (data are provided by the Public Service International Research Unit of the University of Greenwich). We explore the structure of stocks of multinational corporations in various countries and sectors. We use clique analysis, centrality measures and a number of other SNA techniques in order to find out the general pattern of this structure and whether it supports either of the above-mentioned positions.

Germany Inc (die Deutschland AG): changes in capital ties among the hundred largest German firms, 1996-2002

Lothar Krempel

Germany is characterized by a complex web of cross-shareholdings among the country's largest banks, insurers and industrial groups. Europeanisation and internationalization as well as changes in national tax laws are expected to change this. We give a detailed account of changes in shareholderships for the period between 1996 and 2002 and trace mergers and acquisitions.

Software for Networks

The SocioMetrica SBIR Project

Allen Y. Tien

Phase I of this Small Business Innovation Research (SBIR) project funded by the National Institute on Drug Abuse (NIDA) focused on the problem of linking members of network samples in large or unbounded populations. A software program ("SocioMetrica LinkAlyzer") was created that matches and merges records from egocentric data to construct sociometric data. LinkAlyzer uses node attributes to determine if different records represent the same actual person (for analysis and for intervention) or the same type of person (for making population inferences). Phase II will create a SocioMetrica package of applications. Assessment interfaces will be added to assist in gathering network data. LinkAlyzer functions will be extended and refined, and additional network estimation functions will be implemented under the General Public Licence (GPL). A Common Data Model and platform will be created to help network researchers work with different programs and to implement and share their own estimation and visualization algorithms. Due to the computational demands of estimating certain network measures with large datasets, an Internet architecture is planned to provide users with centralized low-cost processing power. This Web services architecture will facilitate multi-site project operations and management.

Network applications of flock theory: Emergent self-organization in online interaction

Devan Rosen and Dean Krikorian

This paper introduces network measures of Flock Theory (Rosen, 2002). Flock Theory draws from a theoretical basis of emergence and self-organizing systems (Contractor, 1994; Hodgson, 2000; Monge & Contractor, 2001; Monge & Eisenberg, 1987), jamming (Eisenberg, 1990), and the Emergence of Creativity (Sawyer, 1999) to create a theory of emergent self-organization in human interaction. Catalyzed by a computer graphic simulation of a flock of birds by Craig Reynolds (Reynolds, 1987), and conceived to model jazz improvisation, this theory focuses on the optimization of group members' distance, the maintenance of leadership, and matching of direction of other individuals. Methods and applications of Flock Theory extend across disciplines, from task groups to online interaction. However, this paper discusses Internetwork measures (Krikorian, in press) in online newsgroups allowing for the direct measurement and prediction of networked interaction over time. To capture these measures GroupscopeTM (Krikorian & Ludwig, 2002) over-time network software is used. Other applications and methodological outlets for Flock

Theory, such as agent-based simulation, are offered along with implications and future directions.

The Sociometer: A wearable device for understanding human networks

Tanzeem Choudhury and Alex (Sandy) Pentland

This program uses RSA BSAFE« Crypto-C by RSA Security Inc. We describe the use of the sociometer, a wearable sensor package, for measuring face-to-face interactions and learning the social networks that arise within a community of people. The sociometer has on-board storage and power supply, an infrared (IR) transceiver, and an extension board for specialized data acquisition (accelerometer, light sensors, microphone). It is packaged into an aesthetic shoulder mount and can be worn all day without any discomfort. We develop methods for learning the structure and dynamics of human interaction networks. Knowledge of how people communicate is important in many disciplines, e.g. organizational behavior, social network analysis and knowledge management applications such as expert finding. At present researchers mainly have to rely on questionnaires, surveys or diaries in order to obtain data on physical interactions between people. We show how noisy sensor measurements from the sociometer can be used to build computational models of group interactions. We present preliminary results on how we can learn the structure of face-to-face interactions within a group, detect when members are in face-to-face proximity and also when they are having a conversation. We also measure the duration and frequency of interactions between people and the participation level of each individual in a conversation.

Advances in network analysis: Over-time visualization, dual-mode relations, and clique detection methods

Dean Krikorian and Greg Ludwig

Recent analytical discoveries in over-time and bipartite affiliation networks are presented using Groupscope software developed by the authors. Three main findings are illustrated: (1) the over-time visualization (2D and 3D) of network data via (a) the role of transition matrices in discrete longitudinal networks and (b) the modelling of continuous time-stamped data; (2) the mathematical relationship between events and actors in bipartite affiliation networks, extending the work of Breiger (1974) and Borgatti and Everett (1997); and (3) a unique method for uncovering dual-mode clique structures in sparse and covert networks. Examples are provided using online data mining techniques (see Krikorian & Ludwig, 2002) and extant longitudinal networks on 9/11 terrorist networks (continuous) and banking affiliations (discrete). Results indicate the application of these techniques particularly useful in corporations (e.g., email networks), virtual online community management (e.g., newsgroups), and government agencies (e.g., homeland security). Future directions explore the integration of these techniques as part of a commercially available software suite.

Egocentric network research tool

Chris McCarty and José Luis Molina

This paper describes a free tool for researchers who collect data on egocentric (personal) networks. The software is designed to make it easier for researchers to create standardized studies and output data to a file with one record per respondent. This record includes demographics about the respondent, as well as summary measures of network composition and structure. It also outputs adjacency matrices for individual respondents as Excel files that can be loaded into UCINET and other packages. This Java-based program comes in two executable files. EgoNetW. exe creates the study, and EgoNetClientW.exe runs the study for a respondent. Respondent files are stored separately in the directory where the client executable is stored. Creating a study with EgoNetW.exe consists of four modules: creating questions to ask respondents about themselves, creating questions to elicit network alters, creating questions to ask respondents about each alter, and creating questions about ties between all unique pairs of alters. The last module is used to calculate structural measures. The program will elicit exactly the same number of alters (that number chosen by the researcher) from each respondent so that structural measures (centrality, cliques, components) are comparable without normalization. Question files can be shared with colleagues.

Sesión en Español 4

La red inter-empresarial de la transnacional mexicana

Claudia Simesen de Bielke y Alejandro Ruiz León

Las nuevas formas de relaciones inter-empresariales, entre ellas la alianza estratégica (AE), han resultado del cambio tecnológico y de la nueva competencia en la globalización. Estos cambios permitieron a las empresas transnacionales (ET) una integración que les da ventajas competitivas (Dunning, 1999) En años recientes, tales relaciones tomaron especial atención en la agenda de varios investigadores. Los estudios sobre AE aplican generalmente un análisis tradicional como el de costos de transacción. No obstante, hoy en día inicia una tendencia a estudiar las alianzas estratégicas bajo una perspectiva del análisis de redes sociales (ARS), con la intención de tender un puente entre la teoría y la práctica que permita valorar con precisión la dinámica de tales alianzas. El artículo aborda tres cuestiones principales sobre AE: 1) tipos de relaciones establecidas, 2) características y propósitos, y 3) dinámica. Para responder a estas cuestiones exploramos ocho ET mexicanas que durante los años 90's tuvieron una destacada actividad en la construcción de este tipo de relaciones como respuesta a la nueva competencia global. Empleamos ARS para explicar el comportamiento de estas empresas, poniendo el énfasis puesto en su posible relación con el cambio tecnológico actual.

Tipos de redes empresariales y mecanismos de control

Cristóbal Casanueva Rocha y José Luis Galán González

El estudio estratégico de las redes de empresas ha estado ligado al estudio de fenómenos particulares como las alianzas, los procesos de subcontratación, los sistemas industriales locales o los stakeholders. Sin embargo, la investigación no ha conseguido una diferenciación de las distintas estructuras presentes en las redes interempresariales y las consecuencias estratégicas de tipos estructurales distintos. Este artículo busca identificar una tipología básicas de redes empresariales seg·n su estructura y las implicaciones de esas diferentes estructuras en el control estratégico de las redes. Para dicha identificación se parte de la idea de estrategia colectiva de Astley y Fombrun (1983) y de las colectividades organizativas ligadas al mismo. Se pretende demostrar que los mecanismos de control son distintos para cada tipo de red, partiendo de la literatura derivada de distintos enfoques: resource-based view, sistemas productivos locales, relaciones interorganizativas y estrategia colectiva. Se analizó una red de pequeñas y medianas empresas del calzado en un distrito industrial español utilizando la metodología del análisis de redes sociales. Dicho estudio permitió comprobar la existencia de distintas formas de control (jerárquico, orgánico, de empresas líderes o de asociaciones profesionales) en cada forma estructural de redes empresariales (conjugadas, orgánicas, confederadas y aglomeradas).

La Conferencia Nacional de Gobernadores como aplicación de red política en México

Octavio García Ramírez

Reflexionar en torno a la noción de red política en México, con especial interés en el estudio de nuestra reciente experiencia con la creación y avance de la Conferencia Nacional de Gobernadores, asume particular importancia en la formulación de los escenarios de gobernabilidad democrática, que en el mediano plazo podrá ser determinante en la renovación del pacto federal y en el proceso de Reforma del Estado. Este un intento de análisis, desde la teoría del neo-institucionalismo, del papel de estas redes en cuanto su articulación regional para el desarrollo nacional y su vinculación con las redes económicas y sociales, concurrentes en su campo de acción local. Se propone, desde la perspectiva metodológica, su institucionalización como organismo de coordinación fiscal, para propiciar la ampliación del conocimiento p·blico sobre los procesos, acciones y decisiones políticas.

Estructura de la red de comunicación sobre sexualidad en escolares de una secundaria mixta de Guadalajara

José Ramiro Caballero Hoyos

Se describe la estructura de la densidad y centralidad de la red de comunicación sobre sexualidad de una secundaria mixta de Guadalajara, México en un estudio transversal, descriptivo y asociativo, bajo el enfoque de redes sociométricas. Se parte de un censo a 523 alumnos de segundo y tercer año (noviembre de 1999 a enero de 2000), y de la aplicación de un cuestionario de auto-administración sobre redes sociales, prácticas sexuales y aspectos sociodemográficos. El análisis abarca: a) densidad; y b) centralidad grupal. Los resultados muestran en cuanto a a) Prácticas sexuales: 3.8% reporte de experiencia coital, en las que 25%, usaron anticoncepción en la primera relación, y 30% fueron sexualmente activos. Respecto de b) Densidad: promedio 0.01+ 0.1, patrón de homofilia por salones ($p<.001$), género ($p<.001$) y experiencia coital ($p<.05$), y con respecto a c) Centralidad: se detectaron dos salones de tercer año con alto grado de conexión: 1) uno conectado a actores con mayor centralidad (rango eigenvector: 3.2-47.1, rango intermediación: 1.1-4.5) y conformado por 20% de los casos con experiencia sexual en la red; y 2) otro poco conectado a nodos centrales. En conclusión, la estructura podría favorecer construcciones sexuales de género diferentes con un discurso dominante de masculinidad y reforzar la cultura de bajo uso de anticoncepción y protección en el grupo con experiencia coital.

Redes sociales en los tribunales de organización de empresas

Cristóbal Casanueva Rocha, Francisco Espasandín Bustelo y José Luis Galán González

La estructura social configurada por los científicos en cada campo de conocimiento tiene importantes repercusiones en los temas de investigación, en las posibilidades de progreso intelectual y profesional de los científicos o en la difusión de los avances conseguidos. En las áreas de conocimiento referidas a las ciencias sociales este fenómeno se reproduce de igual forma. Este trabajo plantea la existencia de una estructura social subyacente en el proceso de elección de los miembros de los tribunales de tesis doctorales. Para comprobarlo se han considerado las tesis leídas en el ·ltimo lustro en España en el área de conocimiento de organización de empresas. Con las elecciones de tribunales se ha elaborado una red social en las que se pueden identificar varias relaciones relevantes. Se ha utilizado la metodología del análisis de redes sociales para el estudio de esta red, que ha permitido identificar los elementos centrales de la misma y dividirla en subredes características.

Networks and Performance 2

Competitive advantage of market orientation: Consequences of network structure on market orientation

David J. Dekker and Edwin J. Nijssen

Market orientation is proposed to be a source for competitive advantage for organizations. As a culture, market orientation can be seen as a shared attitude between individuals that is beneficial to an organization. Social influence network theory suggests that social network structures affect individuals' attitude formation. In this paper we empirically study the effects of individuals' market orientation on customer satisfaction and the effects of social networks on market orientation formation. We collected customer data on the satisfaction of customers of a utilities organization. Also, we collected data on the market orientation and on the network structure of the employees in this organization. To analyse the effect of employee's market orientation on customers' satisfaction we use a hierarchical linear model. Furthermore, we use a social influence model to determine social influence market orientation equilibriums of the employees. Our results show that indeed employee market orientation affects customers' satisfaction. We show that given the social influence parameter certain relationships are critical to maintain market orientation. We propose that, because employee market orientation affects customer satisfaction, these critical relations are fundamental to the competitive advantage market orientation can bring about.

Multiple organizational network structures in public school administration: Gender, administrative position, and experience

Julie M. Hite, Ellen J. Williams and Steven C. Baugh

In the literature, many aspects of the egocentric and whole network structures of intra-organizational networks are related to individual actor's characteristics such as gender, power and resource access. This literature suggests that individuals may be able to manage their egocentric networks and, hence, their overall position with the network. In the context of educational organizations, this study of a public school district administrator network hypothesizes that administrators' individual characteristics of gender, administrative position and administrative experience will be related to their egocentric network structure as well as their overall network centrality. These relationships are examined across four distinct, functional networks within the same set of district administrators. Findings from across these networks suggest that gender and experience of administrators have limited structural effects within these intra-organizational networks. Administrative position has clear structural implications for the network. Administrative position also serves as a proxy for organizational power sug-

gesting that power is related to both egocentric and whole network structure. Implications include that as educational administrators are able to manage their own egocentric networks, they may be able to strategically manage their position within the larger network structure.

Interpersonal affect and the formation of joint production networks

Tiziana Casciaro

I analyze the role of interpersonal affect in the formation of joint production networks, defined as webs of relationships in which social actors systematically interact with each other to accomplish instrumental goals that they would not be able to realize on their own. In two studies of MBA students at a large U.S. business school and employees in a prominent information technology company, respectively, I illustrate that interpersonal affect is a primary determinant of the formation of work networks. I further show that actual and perceived interpersonal affect operate as distinct mechanisms for the creation of instrumental ties. Finally, I demonstrate that the effect of perceived affect on the formation on work ties varies depending on characteristics of the dependence relationship between actors in a joint production task. I discuss implications of these findings for social network theory and the management of organizations.

Multiplex structure of the communications network in a small working group

Geoffrey Canwright and Åsmund Weltzien

We have analysed the communication patterns of a small working group (11 individuals), based on measurements of communication volume in five different media. Our analysis employs several novel concepts developed for this (weakly) multiplex experiment. Specifically, we generalize the concept of eigenvector centrality to multiple types of links, and define centres as local maxima of centrality. As strong ties and low social overhead dominate our working group, we find support for the notion that tightly bound social groups will use more media than loosely bound groups. Therefore, we define tie strength as based on both the total volume of communication and the number of different media that any two nodes use. These measures give an accurate and consistent picture of the group's structure (verified from direct knowledge of the group). In particular, the group leader is a strong centre, distinguished by his/her exceptional use of the multiple media. Finally, we find a clear ranking of the five media. Face-to-face conversation is clearly the dominant medium for this small group, followed by email (which was ubiquitous, but lower-volume), and telephone (sparse), with two media-instant messaging and SMS-being both sparse and much lower in volume.

Academic Networks

The interaction between social and cognitive networks

Peter van den Besselaar

The production of scientific knowledge is a collective enterprise, based on social networks of researchers. The resulting knowledge can be represented by networks of journals and papers. Consequently, we can study scientific change on two levels, that is, change in the network of researchers, and change in the cognitive networks of journals and documents. As research fields grow, they show patterns of differentiation and split into different sub-fields. In earlier work we showed that the cognitive differentiation of research fields is reflected in similar patterns of change in the social structure of the research fields (Van den Besselaar 2000, 2001). In this paper we will use longitudinal data (1980-1998), scientometric methods, and social network analysis in order to answer two questions: Does the change in the social network follows the change in the cognitive network, or the other way around? And, are the remaining links between the emerging sub-fields mainly cognitive, mainly social, or both?

Scientific network in Italian population studies: An application of social network analysis

Giulia Rivellini, Susanna Zaccarin and Ester Rizzi

The scientific community organises its relationships into network patterns, where the nodes may represent individuals (scientists) and the links may stand for acquaintance and common work, usually presented in workshops and conferences and/or published in books and scientific journals. A reference review on Population Studies of Italian Scientists is delivered every two years by the Italian National Group for Demography. The review is exhaustive for academic demographers. The Italian demographers group and their scientific production can be analysed according the network perspective. More specifically, the 86 demographers working in Italian Universities in 2000 will be considered in the study. The scientists will be represented as nodes and the papers they wrote (single or co--authored) between 1998-1999, as the ties between them. In this paper, the properties of the demographers' network will be analysed with the aim to identify the factors that can influence the relations among the 86 actors. Also, the probability of cooperation between couples (dyads) of demographers will be modelled according to observed characteristics of the dyads present (sex, academic position, and university affiliation). Main results suggest that "closeness" - defined in a wider sense - and not simply as geographical proximity, plays a major role in determining the actors' relationships.

Networks of networks: the integration of discussion across social network research traditions

Iain Lang and Ann Vogel

Within the social sciences, discourse about networks and network relations is spreading. However, differences in the understanding and operationalization of networks persist. Despite apparent commonalities between discussions of (for example) social network analysis, actor-network theory and network society, work in each of these areas is not routinely well connected to work in the others. There are various explanatory schemas relating to the production of scientific knowledge, such as those involving predecessor selection (Camic), bandwagon formation (Clarke), invisible colleges (Crane) and social worlds theory (Becker and Strauss). Social network analysis has been identified as constituting normal science (Hummon and Carley). However, these explanations under-theorize the presence of coterminous but separate discussions such as those mentioned above. In this paper we analyze patterns of citation within social-science discussions of networks in order to assess the extent of such ignoring of other work. We present a preliminary theorization of the levels of integration present in terms of the history, aims, and contexts of the different research traditions.

Is scientific production related to network cohesion? Patterns of ties among scholars in Mexico

Narda Alcántara Valverde, Jorge Gil-Mendieta,
Alejandro Ruiz León and Jorge A. Castro

CuellarPreliminary results are present about co-authorship patterns among 1175 Mexican scholars of the hard-core sciences, during the last fifty years. We explore three patterns of relations. One the relation between professor and student, two the relation between peers within UNAM, and three, the relation between peers of UNAM and other research institutions. We propose that after the late seventies, when the rules changed within Mexican academia and publishing became the key to success in science, more researchers tended to publish with foreign peers. Consequently, these collaborations yielded more successful results, while local teams remained behind.

Sex, Diseases and Networks

Usefullness of network analysis to understand a tuberculosis outbreak in Oklahoma

McKenzie Andre, Peter McElroy, Kashef Ijaz, Jon Tillinghast,
Phillip Lindsey and Valdis E. Krebs

As the U.S. incidence of tuberculosis (TB) declines, new tools may be needed during outbreaks. We examined the usefulness of network analysis during a TB outbreak investigation in southwest Oklahoma. Hospital, health department, and city jail records were reviewed and TB case-patients interviewed. Contacts, of TB case-patients, were evaluated for latent tuberculosis infection (LTBI) and active disease. Routinely collected contact investigation data, including tuberculin skin testing results, were entered into InFlow, a network visualization program. Before diagnosis, the index case-patient had fever and cough for 8 months, during which he lived in three different counties. The investigation yielded 293 contacts from home, workplace, the city jail, and three hospitals. Through April 5, 2002, a total of 35 case-patients have been identified, including 12 pediatric case-patients. Overall, 860 contacts have been evaluated; 179 (21%) were candidates for LTBI treatment. A network-informed approach provided insight to prioritizing contacts for further evaluation. Delayed diagnosis of one infectious TB case-patient was associated with a ten- fold increase in TB cases in three rural counties. Network analysis proved feasible and augmented routine TB control efforts, and may prove beneficial in future TB investigations.

Networks analysis reveals genesis of syphilis outbreak in North Carolina

John Potterat, Stephen Muth, Peter Leone, Michael Hilton

During the last 2 years, Robeson County (pop. 123,000) North Carolina experienced the highest attack rate of infectious syphilis in North America (50 and 73 cases per 100,000 population, respectively, in 2000 and 2001). To visualize syphilis transmission dynamics in Robeson and adjacent counties, more than 20,000 contact tracing records, systematically collected since 1994 using STD*MIS, on cases and their contacts for syphilis and other sexually transmissible cases were matched to identify unique individuals, in preparation for network analyses. Using Pajek and NetDraw, regional syphilis and HIV networks (N=9239) are examined, focusing on two key counties, Robeson (largest component=628), and Columbus (largest component= 261). Socio-sexual networks, visualized through time, reveal a seldom seen phenomenon: network configuration of a phase shift from endemic to epidemic transmission. Social networks analysis provides a powerful epistemological tool, suggesting appropriate questions and corroborating ethnographic observations. Importantly, network insights clearly implicate, as the driving force of this continuing syphilis outbreak, increasing sexual mixing, within a crack prostitution milieu, between previously sexually separate Native American and African American populations in affected counties.

Use of sexual network analysis to investigate transmission of gonorrhea during an outbreak in Northern Alberta, Canada

Ann M. Jolly, Prithwish De, Ameeta E. Singh,
Tom Wong and Wadieh Yacoub

Social network techniques were used in addition to traditional case control and case and sex partner (contact) investigations during a gonorrhea outbreak. Epidemiologic data were collected for all individuals with gonorrhea and their named contacts. Inspired by social network analysis, we also asked respondents participating in the case control study to name popular bars or billiard halls which they patronised. Sexual network analysis of case (n=107) and contact (n=75) links revealed components ranging in size from 1 - 39 individuals, all of which were acyclic, except the largest, which contained three cycles. In the case control study, attendance at a bar was found to be significantly associated with gonorrhea infection when compared with uninfected controls. Individuals who reported patronising the bar had significantly higher information centrality (Kruskal-Wallis, p= 0.05) within each of their components. When social interaction links through the bar were considered, together with sexual links, a large network of 89 individuals was constructed, (49% of the population), conjoining all eight of the largest networks containing 4 or more individuals. These preliminary results suggest that requesting names of meeting places and analysing centrality may be useful in understanding the spread of sexually transmitted infections.

Linking molecular genotype data with sexual network data: the transmission dynamics of Chlamydia trachomatis in Manitoba, Canada

John L. Wylie, Ann M. Jolly and Teresa Cabral

Molecular genotype data was linked with sexual network data to analyze the transmission dynamics of Chlamydia trachomatis. We addressed two questions: 1) Do the transmission routes proposed by sexual network analysis of routinely collected case-contact data agree with molecular genotype data? 2) Does the molecular genotype data identify distinct subgroups within a large sexual network? For question 1), we examined the concordance between C. trachomatis genotype data (359 specimens) and sexual network data. A high degree of concordance was found between transmission events based on molecular data and proposed transmission events based on sexual network data indicating that the use of contact tracing data for the construction of sexual networks is a valid approach. Discordant results may mark core groups or identify areas where contact tracing is relatively ineffective. For question 2), we compared the demographic and risk data associated with the cases from which a given genotype was isolated. Most of the genotypes appeared to be associated with relatively distinct subgroups of the network. For example, genotype D was circulating amongst a group of cases in Northeastern Manitoba characterized by high partner numbers, aboriginal status, and young age. This data indicates that chlamydia genotyping is useful for breaking down a large network into its component parts.

Sesión en Español 5 (Sun 16)

Redes sociales y subsistencia en una comunidad campesina de los Valles Calchaquíes Andinos de Argentina

Laura Susana Teves Regairaz

La metodología del análisis de redes sociales es adecuada para describir relaciones económicas inter-regionales, integrando diferentes niveles - local, regional y global- de interacción, que están fundadas en las posibilidades del medio ambiente y en las propias estrategias de los campesinos del Valle Calchaquí. Los procedimientos estadísticos de la metodología de redes sociales describen importantes propiedades de la red resultante, tales como centralización y cohesión. La puesta en relación de los patrones emergentes de este análisis con patrones de asentamiento y desplazamiento de los campesinos del Valle, aportará información relevante a la caracterización del modo de vida en esta región de los Andes Meridionales. Esta es una investigación etnográfica del modo de vida en una comunidad en la región andina del noroeste argentino, caracterizada por la textilería tradicional, junto a la agricultura y la cría de ganado de altura, la venta de pequeñas manufacturas y el trabajo asalariado. Estas actividades económicas se dan entre los campesinos del área. El estudio de la actividad textil, en particular, como secuencia de tareas, nos conduce al reconocimiento de dominios que involucran nuevas y complejas relaciones sociales y económicas.

La gestión de redes asociativas en el trabajo comunitario: promesa y realidad. ¿Cómo trabajar con redes sin hacer un enredo?

Vicente Espinoza

Durante la década del 90 las orientaciones del desarrollo comunitario incorporaron crecientemente la conceptualización de "redes" para referirse a su actividad. La intervención comunitaria con redes sociales establece contactos entre asociaciones locales previamente desvinculadas, bajo el supuesto que tal coordinación redundará en beneficios para todos los afiliados. Ahora, en la medida que estas vinculaciones se desarrollan, los afiliados pierden de vista la estructura del conjunto de la red. Los afiliados, en realidad, no pueden gestionar la red sino que pasan, en alguna medida, a ser gestionados por ella. Sobre la base de la experiencia de una investigación en curso (Fondecyt 1020273), reviso cuatro nudos críticos en la gestión de redes asociativas: Convocatoria y mesa de trabajo: comunicación, orientaciones y resolución de conflictos · ¿Red u organización?: Rol de la coordinación, riesgo de oligarquización, efecto de las comisiones de trabajo. ¿Hasta dónde puede crecer una red?: Diferenciación del entorno. Iniciativas para la densificar las relaciones. Problemas de segmentación y especialización. Sentido de la acción colectiva: ¿la forma de la sociedad civil? la tensión corporativa / ciudadana.

El Consejo Mexicano de Hombres de Negocios y sus redes de poder

Marcela Briz Garizurieta

Se exploran las redes de los miembros del Consejo Mexicano de Hombres de Negocios (N 53), con el fin de identificar los lazos endógenos que promueven la cohesión en el interior del grupo, así como los lazos exógenos que extienden relaciones con empresarios que no forman parte de este organismo. Se comparan dos momentos del CMHN relacionados con umbrales críticos económicos y políticos de México (1994-1995 y 2001) así como los cambio ocurridos en la estructura de estas redes . El trabajo se sustenta en el análisis empírico de una base de datos electrónica construida con información de la Bolsa Mexicana de Valores y con entrevistas a profundidad realizadas a miembros y ex-miembros del mencionado grupo.

Game Theory

Coevolution of cooperation and selective interaction: An experimental study

Jun Kobayashi, Hirokuni Ooura and Hideki Ishihara

We investigate by experiments how cooperation evolves when persons can choose partners. Dawes suggests that cooperation may emerge in the Prisoners' Dilemma Game of any person if people can form networks of partners. In such selective interactions, theoretically, cooperation evolves as co-operators escape from defectors. Cooperators may form networks to exclude defectors. We test this "co-evolution of cooperation and escape" by experiments. We observe that (i) co-operators try to escape from defectors while defectors try to invade groups of co-operators, (ii) but in most cases defectors earn more payoffs than co-operators. Therefore, cooperation may co-evolve with the escaping strategy, yet it needs enough mobility. For instance, the co-evolution requires enough group number or enough frequency of escaping. We conducted seven experiments of the Business Game. In an experiment, 20 subjects play the game on a computer. They repeat to make simultaneous decisions in about 40 trials. In each trial, they choose whether to work hard or lazily in a business firm. In every six trials, they can move to another firm.

Building a better organization and a better racecar: Task, socioemotional and communication networks in Cornell FSAE

Michael L.W. Jones

Engineering project groups are charged with the task of designing, manufacturing and testing complex interdependent systems. To do so effectively not only requires technical skill but the social and organizational infrastructure to coordinate available skills effectively. As is the case in technical systems, social or organizational failure can lead to overall systems failure, even assuming a strong skills base. Cornell University Formula SAE Racing is a engineering team of 30 students that designs, builds, tests and races a functional formula-style racecar. The team's success in the FSAE competition can be tied to leadership attention to both social and technical forces. Self-report network data collected in the team context suggests that team members can play central roles in the organization in both task and social dimensions. Analysis of the team's electronic mail network and weekly report data also suggests that certain team members can become effective informal leaders or liaisons via engaging other members in communication. Task, social and communication networks operate interdependently to create a cohesive team structure and greatly facilitate the production of a world championship racecar.

Embedded ties versus arm-length ties: A theoretical exploration of the main differences

Axel Marx

The aim of this theoretical paper is to further explore the significance of the difference between arm-length ties and embedded ties, which was developed by Uzzi in order to analyse inter- firm networks. Arm-length ties are characterised by lean and sporadic transactions and function without any prolonged social contact between parties who do not enter into recurrent or continuing relations. They are characterised by minimal-publicly available-information exchange and are grounded in mutual distrust. Embedded ties are characterised by their strength, redundancy, transmission of tacit, thick and additional information and their grounding in norms of trust and reciprocity. The paper focuses on differences in information processing and transmission, strategies vis-α-vis network partners and liabilities related to these two types of ties. In relation to information-processing the paper discusses differences in the amount and nature of information processed, information asymetries and the possibilities of knowledge creation in network ties. In relation to strategies, vis-α-vis network partners, the paper focuses on the use of voice-strategies versus exit-strategies (cfr. Hirschman), and on the differences in power bargaining, commitment, co-ordination, and technological change. Finally in relation to liabilities the paper discusses the liabilities of over-embeddedness versus under-embeddednes, and liabilities and risks related to loyalty versus opportunism.

Interlocking Directorates

Access and mobilization: Balancing social capital in the networks of top management

Martin Gargiulo and Andrej Rus

We formulate and test a model of social capital that conceptualizes the context in which actors operate along two dimensions of uncertainty, namely uncertainty about ego's access to resources and uncertainty about the mobilization of actors controlling those resources. We argue that actors must apply dual strategy of network diversification and network cohesion within the same network in order to realize the benefits from their social capital. Competitive advantage accrues to actors who balance the benefits of cohesion and structural holes within their social network. We apply our model to studying the effectiveness of chief executive officers (CEOs) in helping their organizations to respond to a sudden increase in market uncertainty that threatened the survival of their firms. Using a representative sample of Slovenian firms in the early nineties, we show that, after controlling for the level of exposure to the market shock, CEOs who could rely on the mobilization of a cohesive top management team and whose networks were relatively more focused on their external constituencies than on their internal contacts were better positioned to increase sales to the domestic and Western market economies, thus dampening the negative impact of the shock caused by the separation from former Yugoslavia.

Networks of influence among boards of directors

William B. Stevenson and Robert F. Radin

Many scholars have argued that the attributes of CEOs and board members such as expertise, and education should lead to financial performance. However, those studying boards have not looked at the internal processes that lead to board level outcomes. Theories of board performance such as Managerial Hegemony Theory or Agency theory assume that the CEO dominates the board and board members have difficulty acting as a countervailing power to the CEO. In this study we look at the internal processes that take place when boards are faced with difficult decisions. We find that the social relationships among the board members are important determinants of influence on decisions. In looking at 13 boards of directors of small and medium sized companies we find that networks of ties between board members and membership in cliques increases the influence of the board members.

Corporate coteries: Formalising group structures in the network of interlocking directorates

Eelke Heemskerk

The key question of this paper is: how can we best formalise the 'old boys network' and what are the concurrent properties of this group? The concept of a social group has received a great deal of attention of sociologists. Yet, although there is little misunderstanding with regards to the intuitive concept, it has proven much harder to formalise this concept of a social group. Here we will develop a strategy of analysis for finding group structures in the network of interlocking directorates. An interlock is created when a director holds more than one board position. Often denoted as 'old boys network', this set of corporate directors includes indirect relations, but is as a communication network limited by its diameter. We will consider several measures, such as n-cliques, n-clans, group overlap and Galois lattices. Furthermore we pay special attention to the bi-partite (or dual) nature of such an affiliation network. In addition we take into account recent advantages in the theory and methods of large-scale (and scale-free) networks with respect to the relevant group structures. We will use several (subsets of) the networks of interlocking directorates in the Netherlands as a touchstone.

Strategy network and technological performance in the U.S. network industry, 1994-2001

Sreenivas Rajan

The relationship between the structure of the inter-organizational network and the technological performance of the focal organization has been investigated and documented by several organisational scholars (Shan, Walker and Kogut, 1994; Powell, Koput and Smith- Doerr, 1996, Ahuja, 2000). In my dissertation, I contribute to this literature by investigating the influence of the inter-corporate director network on the technological performance of the focal organization. I develop cohesive and structural equivalence models of the influence of the inter-corporate director network, and test these models on a sample of 200 firms over a period of 7 years in the U.S. network industry. Preliminary results indicate support for all the hypotheses.

Sweden Incorporated? Corporate networks in Sweden at the end of the 20th Century

Mattias Smångs

In this paper a somewhat novel approach is adopted to the study of inter-corporate relations in general and interlocking directories in particular. The supposed novelty is firstly in the explicit addressing of the question of how closely interlocks actually follow capital patterns. Secondly, in the use of the social network analytical technique QAP (Quadratic Assignment Procedure), which allows for testing whether two social networks are systematically related to each other. Hypotheses regarding network structure and correspondence between networks of interlocking directorships and ownership links are derived from five different theoretical models (the finance capital, bank control, class cohesion, resource dependence and managerial models). These hypotheses are subsequently tested against data on interlocking directorships and ownership links among the 92 companies listed on the primary list at the Stockholm Stock Exchange in 1999. The results from the analyses reveal that the resource dependence and bank control models are exceedingly more appropriate in relation to the finance capital, class cohesion and managerial models, when it comes to accounting for the structure of big business in Sweden at the end of the 20th century.

Risk Networks & HIV

Variations in the social networks of Mexican-American non-injecting heroin users

Avelardo Valdez, Charlie D. Kaplan and Alan Neaigus

The rapid growth of non-injecting heroin use (NIU) has serious consequences for the spread of HIV/AIDS and other infectious diseases. Mexican Americans in South Texas are experiencing an increase of NIUs among a drug using population that has consistently been characterized by high rates of drug injecting and AIDS risk behavior. In this study, we provide a qualitative description of the various social networks of Mexican American NIUs in an urban population. Observation and qualitative interviews were conducted with NIUs who were recruited from non-treatment settings. Participants were asked about their heroin use and other drug use practices, and the characteristics of the people with whom they used drugs. These networks of NIUs include those based on kinship, residential proximity, drug dealing networks, criminal associations (younger and older), and running partners (ex-gang members). Discussed are the various dimensions that distinguish these networks including non-injecting heroin practices, other drug use, structure of group, association with injecting heroin users, criminal involvement and sexual risk behaviors. The network characteristics of Mexican- American NIUs varies by the type of functional tie and relationship. Such variation may be related to different risks of transitioning to injecting and to differences in the sexual risk of infection with HIV, hepatitis B and other sexually transmitted infections.

Share and share alike: An examination of HIV status disclosure patterns among street drug users

Scott Clair, Peg Weeks, Stephen B. Borgatti and Katie Mosack

The HIV epidemic in Connecticut has disproportionately affected drug users. Despite various prevention efforts new cases among drug users continue to appear. One key piece of information that would potentially reduce transmission rates is by knowing the HIV status of their drug using peers. Obviously disclosing one's HIV status does not come easily and is a selective process for everyone. This paper will examine HIV disclosure on two levels. First, we will examine the characteristics of alters that increase the likelihood of disclosure at the individual level. Second, we will examine characteristics of ego that are associated with higher rates of HIV disclosure across individuals. In other words, part one examines specifically who an individual is likely to disclose to among their network members while part two looks at what characteristics of the individual make them more likely to disclose to their network members overall. While there has been some work on disclosure patterns among other populations the research on HIV disclosure patterns among street drug users has been relatively limited. The proposed paper addresses this gap.

Making unbiased estimates about hidden populations using respondent driven sampling

Matthew Salganik and Douglas Heckathorn

Injection drug users and men who have sex with men constitute both populations of great interest to academic researchers and public health professionals. The behavior of these groups often affects the spread of diseases like HIV/AIDS. Because these groups lack a sampling frame, are small in size, and often attempt to avoid detection they are called hidden populations. Unfortunately, current statistical procedures for making estimates about the composition and behavior of hidden populations are plagued with problems. In this paper, we further develop a new technique called 'respondent driven sampling', which uses a chain-referral sampling selection procedure to collect a sample from the target population. Instead of attempting to make estimates from the sample directly to the target population, we first make estimates about the social network connecting the target population. Information about the social network is then used to estimate the proportion of the population falling into distinct groups. We will show that if certain reasonable conditions are met, these population estimates are asymptotically unbiased. This result holds even if the researchers are not able to select the initial seeds randomly. The techniques in this paper could be used to answer important questions such as what percentage of the injection drug users in a city are HIV+.

Sexual networks: Mechanisms of action for the influence of social determinants on STD/HIV rates

Sevgi O. Aral

Social epidemiology has been successful in demonstrating strong associations between social determinants and chronic diseases; it has been less successful in specifying mechanisms of action through which social parameters influence health outcomes, particularly infectious diseases. Data is reviewed from diverse studies and surveillance efforts, to show that changes in sexual network patterns may be a powerful mechanism of action through which social, economic and political factors influence STD and HIV rates. Preliminary results show that sexual mixing patterns, prevalence of concurrent partnerships, prevalence of sex work and volume of contact between sex workers and their clients are all highly responsive to societal parameters such as poverty, inequality, racism, and war. In turn these parameters are strongly and causally associated with rates of STD and HIV. Future STD/HIV prevention efforts should include network approaches and network based structural interventions.

Networks and Civil Society

Inter-organizational networking in building civil society

Marya Doerfel and Maureen Taylor

Civil society is premised on citizen and organizational relationships. A variety of entities contribute to civil society development, including grass-roots organizations that act on behalf of special interests, media organizations, and funding organizations. Special interests are seen in non-governmental organizations (NGOs) whose missions include women's rights, the environment, etc. Media organizations include those that are formerly government-run, private, and fringe. Funding organizations direct support moneys to NGOs on behalf of civil society efforts and include the Soros Open Society, USAID, and British

Know-How Fund. All of these organizations have their own specific needs/missions, but also engage with each other because of their overlapping interest in civil society. This study includes a network analysis among 18 Croatian civil society organizations and compares two points in time. Time-1 analyzes the inter- organizational relationships among the NGOs, media, and funding organizations immediately following Croatia's first democratic elections that were held in 2000. Time-2 provides an inter-organizational network analysis two years following this election, during a time depicted by maintenance-not creation-of civil society and democracy. We use a resource dependence and structural holes approach to describe the various organizational roles in the maintenance of democracy.

Who is a foreign in a network? Macro-meso factors influencing categorization of cross-national friends

Alexis Ferrand and Ainhoa de Federico de la Rúa

It is argued that macro belongings to abstract 'imagined communities' (Anderson 1983), such as nations, are grounded on the generalized inductive transfer, encouraged by institutions to the inhabitants of a certain territory, of the interpersonal experience of trust and solidarity. These are first learned in the interactions taking place in the sphere of kinship. Later on, it is through friendship that individuals are able to go into more abstract solidarity in universalistic societies as ours (Eisenstadt 1956). However, there is not an exact correspondence between the two kinds of relationships. In fact, the ideal fraternity announced by the nation serves to hide and justify the power that the order of the nation-state exerts. Friendship might sustain the social contract at the same time as it is relegated to the private sphere due to its subversive potential (Paine 1969). Provided this is the case, what would happen then with cross-national friendships? The paradoxical figure of the 'foreign friend' would introduce a tension between the foundations of abstract solidarity and the experience of interpersonal solidarity. A cross-national friend should be considered as a foreigner. Using hierarchical regression analysis we examine the effects of macro (institutional and ideological) and meso (dyadic friendship and trust guaranteed by the network) factors on the categorization of cross-national friends in a sample of 218 European exchange students.

A general typology of personal networks of immigrants with less than 10 years living in Spain

Isidro Maya Jariego

Personal networks of immigrants are a relevant predictor of the psychological adaptation to the new context, and the building of a typology is a useful tool to describe the social support networks of this group (Maya Jariego, 2001). Based in five different studies with Latin-American and African immigrants, in this paper we propose a general typology of the social support networks of immigrants with less than 10 years living in Spain. The size and composition of support networks are the dimensions used in the classification. Endo-group and exo--group oriented personal networks are distinguished. Family reunification and the incorporation of Spaniards are two basic strategies to re-build personal networks in the host society, with clear consequences in the functionality of the support structure. The implications of the typology according to the chain migration studies of Massey and the acculturation model of Berry are discussed.

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