CONNECTIONS

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CONTENTS

small print

NETWORK NOTEBOOK

Connecting with This Issue

At the Sunbelt Social Network conference, BERNARD-KILWORTH-SAILER paled our suntans by demonstrating severe inadequacies in respondent-reported network data. Why should conference-goers be the only ones to suffer?--we bring you their chilling final report, along with a thoroughly-deserved rebuttal from LINTON FREEMAN plus 20+ pages of abstracts, new books, meetings calendar, teaching aids, and--of course--Network Notebook.

Institutional Completeness

We are enclosing an Institutional order form for CONNECTIONS. Please send it to your library journals department, etc. with a polite note that they subscribe as so many students and colleagues are stealing your copy. We charge libraries twice as much as individuals, so that the more libraries which subscribe, the easier it is to hold individual subscription costs down and avoid major price rises.

Please write your library NOW. All that is needed is a note saying: "Dear Library. I strongly urge you to subscribe to CONNECTIONS, an important social science journal, which many of my colleagues wish to consult. I enclose an order form."

INSNA's European Editor Moves On

Wolfgang Bick, our European Editor since 1979 is moving to Duisburg, West Germany as a researcher in its city government. (Until now he has been at Köln's Institut für Angewandte Sozialforschung.) The constraints of his new job mean that he can no longer carry on as our European Editor.

The European Editorship was a job created by Wolfgang and fulfilled diligently by him. He worked hard to keep INSNA members in touch with European affairs and to recruit new members. He helped keep us truly an international network.

We would like to maintain Wolfgang's tradition by continuing the European Editorship. Please write to Barry Wellman at INSNA if you are interested and European-based. The work is not great, and it is a nice way of keeping connected.

Networkers in the News

Ronald Breiger appointed Professor of Sociology, Cornell University...J. A. Barnes elected Fellow, British Academy...Charles Tilly admitted to (U.S.) National Academy of Science...Stephen Berkowitz organizing University of Vermont Summer Institute.

The WORLDNET Closes In: A Recent Letter to INSNA (Honest!)

"Citibank is aware that an international organization such as yours has diverse banking and investment requirements. Accordingly, the International Services Division was formed by Citibank with a view to meeting such special financial needs through the introduction of a new level of sophistication in financial management and planning. In an effort to acquaint you with these special services, we are enclosing an Institutional Banking Services brochure for your review.

"The International Services Division, drawing on the global resources of Citibank, is uniquely placed to provide specialized financial services. The Division provides banking, asset management, and fiduciary services through a network of offices in strategic financial locations around the world. Its staff of over 500 specially trained professionals guarantees not only a high level of quality and banking creativity but also the greatest possible degree of personal attention to our banking relationships.

"If, after reading our brochure, you feel that you would like additional information about the various services offered by the International Services Division, please mail the attached form or contact us directly. It is our hope that you will be interested in establishing an account relationship with this special area of Citibank. We would be delighted to discuss ways in which we might be of service to your organization and look forward to hearing from you."

(Signed David Schau, International Services Division)

Letter to the Editor: Network MSS Wanted

"We've recently reviewed past issues of Social Forces to spot realms of emphasis and neglect. Although we've published a few pieces on network analysis, we'd like to do more in this rapidly developing and quite exciting field.

"That's why I'm writing you. Since you're doing work that's directly or indirectly pertinent to network analysis, I wanted you to know of SF's interest. I should add that, since Social Forces goes to a general audience, not one of specialists, we will be looking for papers that bear clearly on substantive issues--i.e., the application of network analysis to corporations (corporate interlocks), national elites, communities, intermarriage patterns, small group structures, networks of scientists, political elites, exchange networks and the like.

"So--think of SF when you have a paper that is powerful in substance, provides a stunning example of network analysis, has the imperative logic of good mathematics and the parsimony of vivid poetry. We'd be most pleased to have a chance to review one of your MSS. as a prospect for publication in SF."

(signed Everett Wilson, editor, Sociology, University of North Carolina, Chapel Hill, NC 27514)

Dial-A-Network

Does anyone have information about the application of network analytic techniques to telephone dialing information by scholars, governments, or telephone companies to render sociological information about phone users? Please contact Michael Singer, Center for Investigative Reporting, 1419 Broadway, Room 600, Oakland, Calif. 94612, USA.
Hint to the puzzled: was Efraim Zimbalist, Jr. really a cluster analyst?

Power Structures

New Mexico People & Energy have produced two research reports on Western USA power structures, reportedly containing corporate interlock information:

. "Power Brokers in the Rockies: Privately-minded in the public interest," by Beth Wood and Tom Barry. 1980, 24pp. $1.50.

. "New Mexico, The Military, and The Bomb," by Svannah Davis, Naomi Harmon, and Craig Simpson. 1980, 36pp. $3.00.

Write NMPE, Box 4726, Albuquerque, New Mexico 87196 USA. Over 30 power structure reports on land, industry, finance and the federal and state governments, and nearly 25 corporate profiles are available. (Source: Rain, 7/81.)

NIMH Grant-Getting

The U.S. National Institute of Mental Health announced the following network-ish grants recently:
. Alfred Dean (Albany Medical College), "Stressful life events, social support and illness" - $202,267.
. Charles Kadushin (Center for Policy Research, NY), "Stress and peer support among Vietnam veterans and controls" - $125,280.
. Lois Verbrugge (Public Health, Michigan), "Sex differences in morbidity and health actions" - $159,705.
. Barry Wellman (Sociology, Toronto), "East York Social Networks Study", - $32,628.

The Volkswagen Foundation's granting priorities are for "Change and elements of crises in democratic industrial societies" and "Comparative European history and historiography." It encourages international collaboration between German and non-German scholars along the lines of working groups, although proposals for such collaborative projects must involve significant cooperation with German scholars. For information write Stiftung Volkswagenwerk, Postfach 26 05 09, Kastanienallee 35, 3000 Hannover 26, West Germany.

Data Sets Available

The 1900 Public Use Sample Tape of the U.S. Census contains 27,069 cases with 100,438 individuals (1/760th sample). Each case contains information on the location and composition of the household, and the nativity, literacy, occupation and demographic characteristics for each individual. (The 1900 census was the first to report the number of children born and the number surviving for each woman.) To order, send $100 to the Graduate Dean's Discretionary Fund, at the Center for Studies in Demography and Ecology, DK-40, University of Washington, Seattle, Washington 98195, USA.

The Immigration History Research Center Archives contain information on 24 North American ethnic groups: Albanians, Armenians, Bulgarians, Byelorussians, Carpatho-Ruthenians, Croatians, Czechs, Estonians, Finns, Greeks, Hungarians, Italians, East European Jews, Latvians, Lithuanians, Macedonians, Near Eastern

peoples, Poles, Romanians, Russians, Serbs, Slovaks, Slovenes, Ukrainians. The Archives contain 450+ individual collections, ethnic newspapers, plus records of fraternal and political societies, churches, publishing companies, and the personal papers of ethnic leaders, clergy, journalists, labor leaders, writers, poets and politicians. For information contact the Center at the University of Minnesota, 826 Berry St., St. Paul, Minn. 55114, USA. (Source: _Quantum_ 18.)

Food for Thought

"Gels are mostly fluid, given form by a network of polymer strands. A balance of forces maintains this state of affairs, disturbing it infinitessimally can bring on a phase transition and collapse the gel." Toyoichi Tanaka, "Gels", Scientific American 244 (January, 1981).
If stirred lightly, yields catastrophe theory!

Ethnic Research News

Gerald Gold (Anthropology, York) has received $38,965 from the Canadian Multiculturalism Directorate to study inter-ethnic relations in Timmins, a northern Ontario mining town, using household interviews.
Other noteworthy projects at York's Institute for Behavioural Research include Anthony Richmond, "Immigrants in Canada and Australia"; Michael Lanphier, "Third World Immigrants in Canada"; Gerald Gold, "Cajun Revival in Southern Louisiana"; Clifford Jansen, "Italians in Vancouver"; Lawrence Lam and K. B. Chan, "Indo-Chinese refugees in Quebec."
Carolyn Hillhouse and associates (Boley Manor, St. Petersburg) are implementing a Social Network Therapy program for deinstitutionalized psychiatric patients. They work on building and maintaining friendship networks and encouraging the development of natural support systems which can offer help during stressful times. Three networks are in operation, with plans for expansion.

Has the End Come so Soon?

Stephen Berkowitz (Sociology, Vermont) is organizing the 1982 Vermont Summer Institute around two themes: "one highly specific substantive area...'Death and Dying'...and one closely related methodological approach...'Social Network Research'." He is soliciting expressions of interest from those who might participate as faculty or students, give program advice, etc.

Who Is That Network Analyst? And Why Is He Laughing?

Here are two jokes submitted by Anatol Rapoport (Institute for Advanced Studies, Vienna):

1. "Three people are stranded on a desert island: a physicist, an engineer, and a mathematician. They have three cans of beer. The physicist finds two sticks, builds a fire, suspends the can over it, waits for the can to explode, and drinks. The engineer finds a rock, and then a harder rock, forms a chisel, aims at just the right angle, opens the can, and drinks. The mathematician assumes his can is open and drinks."

2. "A mathematics professor is busy demonstrating a very complex proof to his students, furiously chalking the blackboard with equations.
'As you can see, it is obvious that step G follows from step F.'
The professor begins writing again.
'But professor,' calls out a student, 'is it obvious?'
The professor looks at his work for a moment, and suddenly shuffles over to another blackboard and starts writing new equations with equal vigor. Half an hour later he turns to his class and says, 'Yes, it is obvious.'"

(Source: Toronto Globe and Mail, 28 Feb 1981)

"NETWORKING: Getting in Touch with Yourself by Getting in Touch with Others"

An adult education course offered by the Ottawa Board of Education. "This six-week networking experience will assist participants to make the changes in mind frame and life style to be a true networker. See how Networking succeeds where books, counseling, formal organizations--yes, and even educational courses--fail."

New Journals

Ageing and Society will publish theoretical, methodological, research and policy articles from any field of social gerontology, including age-related phenomena in the earlier stages of life. Contributions from all disciplines wanted. Send papers to Malcolm Johnson, Editor, Policy Studies Institute, ½ Castle Lane, London SW1E 6DR. Individual subscriptions, US $25, from Cambridge University Press, 32 E 57 St, New York, NY 10022.

Process is "a networking forum for those active in citizen participation." Founded by people in the Ottawa area, it solicits camera-ready copy from others interested in citizen participation. Information from Chris Bradshaw, P. O. Box 3405, Station D, Ottawa Ontario, Canada K1P 6H8.

    Other Networks is a newsletter "devoted to promoting better, more efficient, self-organizing communications among people in communities everywhere, while concentrating on the specific needs of the Philadelphia area. It is about networking." It includes "Small World," a skills exchange. Contributions and subscriptions ($15) to Public Interest Media Project, P.O. Box 14066, Philadelphia, PA 19123.

    Science of Society is an international journal which publishes theoretical and research papers "on all areas of the science of society." Most contributors are "scientists from the Socialist countries." Editors, Ignacy Malecki and Bohdan Walentynowicz, Polish Academy of Sciences. Subscriptions (Dfl. 50/US$25) from D. Reidel, Box 17, Dordrecht, Holland or 160 Derby St., Hingham, Mass.

Any Canadian Experiences?

    Ralph Matthews (Sociology, McMaster) wants manuscripts for the Canadian Experience series, published by PMA Books. Topics wanted: community and ethnic studies, women's studies, regional studies, health and aging, education, public policy, unions, protest groups and political parties, other groups and organizations.

Social Change and Collective Action

    Recent working papers on this topic from the University of Michigan Center for Research on Social Organization (330 Packard St, Ann Arbor, MI 48109):

Brian Brown, "Lancashire chartism and the mass strike" #203
Samuel Cohn, "Keeping the navvies in line" #206
Robert Liebman, "Repressive strategies and working class protest in Lyon, 1848-1852" #188
Leslie Page Moch and Louise Tilly, "Immigrant women in the city" #205
R. A. Schweitzer, "A study of contentious gatherings in early 19th-century Great Britain" #209
R. A. Schweitzer, Charles Tilly and John Boyd, "The texture of contention in Britain, 1828-1829"
Carl Strikwerda, "General strikes and social change in Belgium" #215
Charles Tilly, "Sociology, meet history" and "Sinews of war" #193
_____, "Social movements and national politics" #197
_____, "Proletarianization: theory and research" #202
_____, "Demographic origins of the European proletariat" #207
_____, "Charivaris, repertoires, and politcs" #214
_____, "Contention and peasant rebellion in 17th century France" #208
_____, "States, taxes, and proletarians" #213
Charles Tilly and R. A. Schweitzer, "Enumerating and coding contentious gatherings in 19th century Britain" #210
Louise Tilly, "Women and collective action in industrializing France, 1870-1914" #190
_____, "The family wage economy of a French textile city, Roubaix, 1872-1906" #192
Louise Tilly and Charles Tilly, "The rise and fall of the bourgeois family, as told by Lawrence Stone and
    Christopher Lasch" #191

Disconnecting Structuralists

    "It is said that Althusser's personal feud with the psychoanalyst, Lacan, whose patient he had been for more than 20 years, played no small part in the breakdown which led to the murder charge. [A is charged with murdering his wife.] Lacan will testify to this when the case comes before the courts." New Society 5, Feb 81.

Temporary Disconnections

    The Canadian postal workers were on strike from 1 July, 1981 until early August. (For the benefit of American readers, such strikes are legal here, as in other civilized countries.) We regret any disruption which this strike may have caused INSNA and CONNETIONS' communications with our members.

Community Networks - Review Papers Wanted

    The "Community Networks" session at the ISA will concentrate on major analytic review papers, critiquing extensive paradigms and offering a network analytic (a.k.a. structuralist) alternative. Such papers should also applying the network approach to a substantive issue, and provide substantial empirical evidence as to the analytic utility of the approach.   There is a good probability that the papers presented will form the basis of a book on "Structuralist Approaches to Urban Sociology".

    Those interested in presenting papers should send abstracts to Barry Wellman (Sociology, Toronto) by 15 October 1981, and completed papers by 1 January, 1982.

MEETINGS CALENDAR

SUNBELT SOCIAL NETWORK CONFERENCE - SESSIONS SCHEDULE ANNOUNCED

(Chairs in parenthesis: see INSNA Directory for addresses)
   Friday 12 February 1982
   3 p.m.   Keynote address
   4 - 7 p.m.   Bridging theory and applications (Peter Mariolis)

   Saturday 13 February 1982
   9 - 12 noon   Collecting and processing network data (John Sonquist)
                  Communications networks (Everett Rogers)
   4 - 7 p.m.   Combinatorial and algebraic models (Stephen Seidman)
                  Health and mental health (Muriel Hammer)

   Sunday 14 February 1982
   10 - 12.30   Networks and attitudes (Bonnie Erickson)
                  Family, kinship and demography (Nancy Howell)

In addition, poster sessions open to all comers will be held Friday afternoon and all day Saturday. (J. Jerome
Singer)   Location: Bay Harbor Inn, Tampa, Florida. Conference Organizers: Alvin W. Wolfe and H. Russell
Bernard.

SPECIAL NETWORKS SESSION FOR 1982 AMERICAN SOCIOLOGICAL MEETINGS

   Peter Marsden (North Carolina) is soliciting completed papers, to be submitted by 10 January, 1982. The
ASA meetings will be in San Francisco, September 6-10, 1982.

WORLD FUTURES SOCIETY

   The Society's Fourth General Assembly, with the theme "Communications and the Future", will be held in
Washington, D.C., July 18-22, 1982. Proposed sessions include "Electronic cottages--working at home", "Elec-
tronic mail", "Reviving rural communities through telecommunications", "Centralizations vs decentralization",
"Body language", and "Anticipatory democracy through vote-at-home technology". For information, write 1982
Assembly Committee, World Future Society, 4916 St. Elmo Avenue, Washington, D.C. 20014, U.S.A.

PAST MEETINGS

CANADIAN PSYCHOLOGICAL ASSOCIATION - SESSION ON "PERSONAL PROJECTS AND SOCIAL NETWORKS", June 5, 1981, Toronto.

   Brian Little (Psychology, Carleton) "Introduction to personal projects analysis".
   Jharna Chatterjee (Psychology, Carleton) "Personal projects analysis and social network analysis".
   Alison Rapley and Pit-Fong Loh (Psychology, Carleton) "Personal projects, social networks and the adap-
tation of Indochinese refugees in Canada".
   Barry Wellman (Sociology, Toronto) "From support system to social network".

RESEARCH REPORTS

*SOCIAL NETWORKS: A BEGINNER'S BOOKSHELF**

Linton C. Freeman, School of Social Sciences, University of California, Irvine

During the past several months I've been approached often by people asking about how they can get started in the study of social networks. Not only have undergraduate and graduate students come up with this question, but professional social scientists and mathematicians are increasingly showing interest in the networks approach.

All agree that what is needed is a beginner's bibliography--a basic bookshelf--that will define the approach and provide the background for continued reading in the literature. This note is designed to meet that need. It provides a short reading list, containing 48 items, that will give the newcomer a basic orientation to the study of social networks.

The unified and explicit study of social networks is a creature of the 1970s. Its several origins are much older and they are based variously on traditions in anthropology, communications science, human geography, information science, political science, social psychology and sociology. Although networks-type ideas are not new in any of these disciplines, such ideas have always been marginal in each. The social networks approach, then, represents a genuine departure from any traditional mainstream of social scientific thought.

Social scientists have always talked vaguely and intuitively about concepts that are probably intended to relate to relations among persons--concepts like social structure and social role. But in conducting actual research, they have always concentrated almost exclusively on the traits and characteristics of individual persons.

In contrast, the social networks outlook explicitly focuses attention on attributes of the relations among people rather than on the properties of individual persons; thus, we are finally systematically exploring the social part of behavior.

Social networks concepts have developed more or less independently in each of the fields named above. In each case they were, at origin, loose intuitive ideas designed to sensitize observers to the interpersonal dimensions of behavior. All were concerned with the forms or structures of the social relations that link individuals together into networks and with the processes through which such networks emerge, evolve and exhibit consequences for behavior.

Increasingly, however, as the networks concepts has become explicitly grounded in algebra, the theory of graphs and in probability theory, there has been recognition of the fact that the several earlier intuitive conceptions all share a common intellectual core. This recognition has provided a foundation for the emergence of a single cross-disciplinary social networks perspective.

The potential for scientific growth resulting from this new approach is great. The social networks perspective is firmly grounded in an explicit mathematical representation. It provides the basis for exact development of some of the more suggestive of our traditional intuitive concepts--like status and role. It affords an explicit substructure for the development of formally defined process models. And it has generated a sense of excitement among the participants in its development.

The potential of the social networks perspective is also great with respect to practical applications. Applications of the concepts and findings of network analysis have begun to be made in corporate and political organizational behavior, the diffusion of information and structure of individual support systems.

The present bibliography is designed to provide an introduction to the traditions and current concepts regarding social networks. It will begin with a list of several general overviews of the whole field. There will be a section that cites several early pieces that illustrate the intellectual origins of network study. This will be followed by a section showing appropriate materials for the study of formal tools for network analysis and one on main current theoretical themes. Finally, there is a section on applications. Reviewing the material on these citation lists should put the reader in a position to read anything in the current social networks literature.

A. Overviews of the Study of Social Networks

A number of writers have, in the past few years, published general overviews of the social networks perspective. In many ways they are, of course, similar. Each, however, is importantly different; each reflects the background, training and perspective of its author. And in an emerging specialty that is bringing together people from diverse backgrounds, varying perceptions of the origins, nature and goals of the effort are inevitable.

In an attempt to capture the range of this variation, five essays are listed below as suggested readings. Any one will provide a reasonably coherent look at social networks research, but together they can give a sense of the range of views among students of the field.

A1. Barnes, J.A. "Social Networks," Addison Wesley Module, No. 26, Boston: Addison-Wesley, 1972.

A2. Burt, R.S. "Models of Network Structure," Annual Review of Sociology, 1980, 6:79-141.

A3. Mitchell, J.C. "The Concept and Use of Social Networks," in J.C. Mitchell, ed., Social Networks in Urban Situations. Manchester: Manchester University Press, 1969, 1-50.

A4. Mullins, N.C. "The Structuralists: Tracking Something," Chapter 10 in his Theories and Theory Groups in Contemporary American Sociology. New York: Harper-Row, 1973.

A5. Wellman, B. "What is Network Analysis?" Research Paper No. 1A, Structural Analysis Programme, Department of Sociology, University of Toronto, Toronto, Ontario, Canada, M5S 1A1, 1980. $2.00.

B. Origins of Social Networks Analysis

The essential idea of studying networks of human relations is very old. Elaborate geneologies, for example, have traditionally been maintained by peoples throughout the world. For these people, an individual's social identity was thought to be largely determined by where that person fit into a kinship network.

The origins of contemporary systematic network studies are variously attributed to a great many sources. The idea is natural; it was probably rediscovered again and again. At this moment I know of five articles that seem to me to have influenced subsequent work in directions that are reflected in contemporary work. They range in date of publication from 1882 to 1978 (though this last one was written in the 1950s and circulated as a fugitive but influential piece for over 20 years before publication). They are listed below:

B6. Bavelas, A. "Communications Patterns in Task-Oriented Groups," Journal of the Acoustical Society of America, 1950, 22: 725-730.

B7. Macfarlane, A. "Analysis of Relationships of Consanguinity and Affinity," Journal of the Royal Anthropological Institute, 1882, 12: 46-63.

B8. Moreno, J.L. Who Shall Survive? Washington, D.C.: Nervous and Mental Disease Publishing Company, 1934.

B9. Pool, I. de S., and M. Kochen. "Contacts and Influence," Social Networks, 1978, 1: 5-51.

B10. Radcliffe-Brown, A.R. A Natural Science of Society. Glencoe, Illinois: Free Press, 1957.

C. Formal Tools

One of the main bases for the recent surge of interest and sophistication in social networks analysis has been the increasing availability of mathematical tools that are designed specifically for such applications. Like the parallel and interdependent development of physics and analysis in the 18th century, social networks and certain kinds of mathematics are currently enjoying a mutually productive collaboration.

Social networks students are defining new problems and mathematicians—particularly those working in graph theory, probability theory, linear and abstract algebra and algebraic topology—are developing new tools. As a matter of fact, a good deal of joint work has been conducted by mathematician-social scientist pairs (e.g. Harary-Cartwright, Holland-Leinhardt, Wasserman-Leinhardt, Witz-Lehman, Killworth-Bernard, Neiminen-Everett, Seidman-Foster), and a growing number of mathematicians are publishing applied work in the social networks area (e.g. Kemeny, Snell, Norman, Atkin, Hubert, Frank, Copobianco).

Reading current materials in social networks, then, requires a certain amount of mathematical background. The reader without that background would do well to consult some general text or texts if he or she runs into difficulties. A list of such resource materials in mathematics is provided in an Appendix.

In any case, there seem to be three areas of emphasis in the development of formal tools for the study of social networks. They are listed below, along with some suggested readings for each:

1. Representation and Specification of Structural Properties

   C11. Alba, R.D. "A Graph-Theoretic Definition of a Sociometric Clique," The Journal of Mathematical Sociology, 1973, 3: 113-136.

   C12. Doreian, P. "On the Connectivity of Social Networks," Journal of Mathematical Sociology, 1974, 3: 245-258.

   C13. Hubert, L. J. "Some Applications of Graph Theory to Clustering," Psychometrika, 1974, 39: 283-309.

   C14. Seidman, S.B., and B.L. Foster. "A Graph-Theoretic Generalization of the Clique Concept," Journal of Mathematical Sociology, 1978, 6: 138-154.

2. Homomorphic Reduction

   C15. Arabie, P., S.A. Boorman, and P.R. Levitt. "Constructing Blockmodels: How and Why," Journal of Mathematical Psychology, 1978, 17: 21-63.

   C16. Lehman, F.K., and K. Witz. "Prolegomena to a Formal Theory of Kinship," in P. A. Balonoff, ed., Geneological Mathematics. Paris: Mouton, 1974.

   C17. Lorrain, F. "Social Structure, Social Classifications, and the Logic of Analogy," in P.A. Ballonoff, ed., Mathematical Models of Social and Cognitive Structures. Urbana, Illionois: University of Illionois Press, 1974.

   C18. Light, J.M., and N.C. Mullins. "A Primer on Blockmodeling Procedure," in P.W. Holland and S. Leinhardt, eds., Perspectives on Social Network Research. New York: Academic Press, 1979.

3. Determining Distributions

   C19. Frank O. "Sampling and Estimation in Large Social Networks," Social Networks, 1978, 1: 91-101.

   C20. Holland, P.W., and S. Leinhardt. "Structural Sociometry," in P.W. Holland and S. Leinhardt, eds., Perspectives on Social Network Research. New York: Academic Press, 1979.

   C21. Hubert, L.J., and J.V. Schultz. "Quadratic Assignment as a General Data Analysis Strategy," British Journal of Mathematical and Statistical Psychology, 1976, 29: 190-241.

   C22. Wasserman, S. "Analyzing Social Networks as Stochastic Processes," Journal of American Statistical Association, 1980, 75: 280-294.

D. Main Theoretical Themes

   As a whole, work in the social networks area is still somewhat diffuse. At the moment, however, there does not seem to be some focus on a set of problems of particular theoretical interest. Five such problem areas strike me as central in recent work. They are listed below, along with suggested readings in each:

1. Clique Analysis

   D23. Alba, R.D., and C. Kadushin. "The Intersection of Social Circles: A New Measure of Social Proximity in Networks," Sociological Methods and Research, 1976, 5: 77-102.

   D24. Burt, R.S. "Cohesion versus Structural Equivalence as a Basis for Network Subgroups," Sociological Methods and Research, 1978, 7: 189-212.

2. Social Position or Role

   D25. Mandel, M., and C. Winship. "Roles, Positions and Networks," (preprint available from Professor C. Winship on request to Northwestern University, Department of Sociology, Evanston, Illionois, 60201).

   D26. Sailer, L.D. "Structural Equivalence: Meaning and Definition, Computation and Application," Social Networks, 1978, 1: 73-90.

3. Hierarchy or Stratification

D27. Allison, P.D. "Measures of Inequality," _American Sociological Review_, 1978, 43: 865-880.

D28. Freeman, L.C. "Centrality in Social Networks: I. Conceptual Clarification," _Social Networks_, 1979, 1: 215-239.

4. Structural Balance, Clustering and Transitivity

D29. Holland, P.W., and S. Leinhardt. "An Omnibus Test for Social Structure Using Triads," _Sociological Methods and Research_, 1978, 7: 227-256.

D30. Leik, R.K., and B.F. Meeker. "Chapter 4. Graphs, Matrices, and Structural Balance," in _Mathematical Sociology_. Englewood Cliffs, N.J.: Prentice-Hall, 1975.

5. Cognition and Social Structure

D31. Coxon, A.P.M. "Perspectives on Social Networks," in P.W. Holland and S. Leinhardt, eds., _Perspectives on Social Network Research_. New York: Academic Press, 1979.

D32. Bernard, H.R., and P.D. Killworth. "Informant Accuracy in Social Network Data, II," _Human Communications Research_, 1977, 4: 3-18.

E. Applications

Finally, a wide range of applications of networks ideas to specific problems have been attempted. These attempts have met with varying success, but in every case they have raised important new questions. I have divided them into three broad areas and suggested readings in several sub-areas in each category.

1. Structure of Groups and Organizations

a) Organizational Behavior

E33. Mackenzie, K.D. _Organizational Structures_. Arlington Heights, Illinois: AHM, 1978.

b) Interorganizational Structure

E34. Turk, H. "Interorganizational Networks in Urban Society: Initial Perspectives and Comparative Research," _American Sociological Review_, 1970, 35: 1-19.

c) Interlocking Corporate Directorates

E35. Burt, R.S. "A Structural Theory of Interlocking Corporate Directorates," _Social Networks_, 1979, 1: 415-435.

d) Community Power Structure

E36. Laumann, E.O. _Bonds of Pluralism: The Form and Substance of Urban Social Networks_. New York: Wiley Interscience, 1973.

e) Intellectual Elite Structure

E37. Kadushin, C. _The American Intellectual Elite_. Boston: Little Brown, 1974.

f) Science Structure

E38. Mullins, N.C., L.L. Hargens, P.K. Hecht, and E.K. Kick. "The Group Structure of Cocitation Clusters: A Comparative Analysis," _American Sociological Review_, 1977, 42: 552-562.

g) Academic Structure

E39. Hunter, J.E., and R.L. Shotland. "Treating Data Collected by the 'Small World' as a Markov Process," _Social Forces_, 1974, 52: 321-332.

h) International Structure

E40. Erickson, B.H. "International Networks: The Structured Webs of Diplomacy and Trade," _Sage Professional Papers in International Studies_, No. 02-036, 1975.

i) Informal Group Structure

E41. Coombs, G. "Networks and Exchange: The Role of Social Relationships in a Small Voluntary Association," _Journal of Anthropological Research_, 1973, 29: 96-112.

2. Information Flow

a) Structure and Flow

E42. Rogers, E.M. "Network Analysis of the Diffusion of Innovations," in P.W. Holland and S. Leinhardt, eds., _Perspectives on Social Network Research_. New York: Academic Press, 1979.

b) Distance and Flow

E43. Morrill, R.L., and F.R. Pitts. "Marriage Migration and the Mean Information Field: A Study in Uniqueness and Generality," _Annals of the Association of American Geographers_, 1967, 57(2): 401-422.

c) Flow Among Organizations

E44. Czepiel, J.A. "Word-of-Mouth Processes in the Diffusion of a Major Technological Innovation," _Journal of Marketing Research_, 1974, Vol. II, 172-180.

d) Flow Between Social Categories

E45. Freeman, L.C., and M.H. Sunshine. "Race and Intra-Urban Migration," _Demography_, 1976, 13: 571-575.

e) Flow in Informal Structures

E46. Granovetter, M. _Getting a Job: A Study of Contacts and Careers_. Cambridge, Mass.: Harvard University Press, 1974.

3. Ego-centered Support Systems

a) Mental Health

E47. Pattison, E.M. "Psychosocial System Therapy," in R.G. Hirschowitz and B. Levy, eds., _The Changing Mental Health Scene_. New York: Spectrum, 1976.

b) Family

E48. _Family and Social Network_, 2nd ed. New York: Free Press, 1971.

This, then, is at least one person's view of a starting bibliography for people interested in the study of social networks. I've tried to keep it short enough so that it won't scare people away. That means, of course, that I've neglected a lot of really important network materials. Most of the readings listed here, however, are fairly recent. Each contains its own citations, and a beginner who is really turned on can go on more or less forever from this start. I hope it will be helpful in opening up a new approach to social science for people who haven't been previously exposed to network thinking.

Appendix: Resources in Mathematics

A good general text to consult in case of problems with formal statements is:

Kim, K.H., and F.W. Roush. _Mathematics for Social Scientists_. New York: Elsevier, 1980.

Or, if the treatment there is not extensive enough, the reader might want to choose from among the following selection of specialized texts:

a) In graph theory

Harary, F., R.Z. Norman, and D. Cartwright. _Structural Models: An Introduction to the Theory of Directed Graphs_. New York: John Wiley & Sons, 1965.

b) In probability theory

Feller, W. _An Introduction to Probability Theory and its Applications_ (3rd ed.). New York: John Wiley & Sons, Inc., 1968.

c) In linear and abstract algebra

MacLane, S. and G. Birkhoff. _Algebra_. New York: Macmillan, 1967.

Clifford, A., and G. Preston. _The Algebraic Theory of Semigroups_. Providence: American Mathematical Society, Vol. I, 1961; Vol. II, 1967.

SUMMARY OF RESEARCH ON INFORMANT ACCURACY IN NETWORK DATA, AND ON THE REVERSE SMALL WORLD PROBLEM

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I. Introduction

Recently, we completed a series of experiments in network analysis, under support from the Office of Naval Research, Division of Organizational Effectiveness. In this report, we summarize our research and our findings. The experiments are in two major areas of social network analysis. The first concerns the accuracy of data collected by asking people to recall their communications with others. Since virtually all theories of organizational structure, and of information diffusion are based on such data, it seemed important to know whether the data are accurate.

The second area of research tries to address directly the problem of structure in the diffusion of information. How does one acquire data about such structure? If we know the social structure (how people are related to one another), then we should be able to predict the spread of information and to interpret diffusion data, without relying on possibly inaccurate information.

We will summarize our findings here, taking each of the major areas separately.

II. Informant accuracy in social network data

a) Ultimately, many things, from theories about social structure to major policy decisions about community development programs, depend on the quality of fundamental data about the information diffusion process. Large scale behavioral studies of information diffusion are difficult to do. Consequently, scholars have tried to use communication recall data to describe the network along which information is assumed to flow. Many studies, following the classic example of Coleman, Katz, and Menzel (1957) treat communication recall networks as isomorphic with the social structure of a given group. But what if merely _asking_ people whom they talk to produces inaccurate results? What if people honestly try to tell us (by rank ordering, or scaling, or just randomly recalling), their communications, but simply cannot handle cognitively the amount of data required in order to do so accurately?

We have phrased this problem as follows: data about communication networks are collected by using an instrument. The instrument is a query, usually some form of "who do (did) you talk to over x period, and for how long and how often?" As a chemist might use a thermometer to test the temperature of a liquid, this instrument is "inserted" into a respondent; it is extracted, and data are recorded. A chemist would insist that the error bounds of the thermometer be known (i.e., "above 200°C, for each 50 degrees, add .001 degree due to changes in the physical structure of the instrument"). Similarly, we ask "what are the error bounds of the instrument 'who do you talk to?'".

In an attempt to test the error bounds, we conducted a series of seven experiments. In each of these, we asked a variety of questions of the genre "who do you...?" in a variety of ways. We have always found that asking people who they talk to, and how much, produces totally inaccurate results. Furthermore, standard socio-economic indicators do not account for the inaccuracy. We have concluded two things. First, people do not know, with any acceptable accuracy, with whom they communicate; in other words, recall of communication links in a network is not a proxy for communication behavior. Second, data manipulations which depend on respondents' ability to rank or scale accurately whom they talk to, are useless if what one wants is a description of behavioral social or communications structure. The meaning of these conclusions for diffusion studies is clear: finding out, incorrectly, who people talk to by asking them, and then using the information to impute diffusion structures and flows, can only yield incorrect results.[1]

In the next two sections, we will describe the seven data sets from our experiments, and summarize our results. In subsection d) we will present a summary description of some structural analyses we have performed in order to try to improve the accuracy of our data. Then, in subsection e), we will offer some suggestions for how we might proceed to study information diffusion behaviorally.

b) The Data

Deaf 1

The first experiment (Killworth and Bernard, 1976) was conducted in 1975. We asked some of the members of a naturally-occurring group (the deaf owners of teletype machines in the Washington, D.C. telephone call area) to "rank the members of the group in the order in which you communicate with them." After answering our questions, the group logged their TTY communications until they had data for each of at least 21 days, thus providing a behavioral comparison for the ranking data. Thirty-one out of 32 persons in the group did the ranking, and 25 provided TTY logs. Of these 25, four had no communication with any other person in our sample during the logging period, and some people spent as much as three months before they logged 21 days of TTY use.

Forty-two percent of the time an individual was able to rank his or her first communicant first, second, third, or fourth. Forty-eight percent of the time our respondents did even worse than that. There was no significant difference between respondents in terms of how accurate they were. No obvious factors (e.g., gender, length of time they had owned a TTY, amount of communication, etc.) produced significant trends in accuracy. In order to account for only 40% of a person's total communication, and with only 75% reliability, his or her first 17 rankings (out of 31) had to be included. Accounting for 70% with 95% reliability required 24 rankings. These last findings made the entire ranking procedure seem pointless.

Deaf 2

Since our first experiment dealt with a group of deaf teletype users, we returned to this population for replication. Sixty members of the deaf community in Washington were selected randomly from amongst the then 387 registered teletype users. They were each presented with a list of all 387 persons in the "local deaf TTY community" and asked to select the persons with whom they might communicate in the next month. Eventually, 54 respondents provided data, and they communicated with 594 different people on their TTYs. Twenty-eight of the 54 ranked the persons they chose, by "amount of communication," and the other 26 scaled those chosen from 1 to 5, or from "very little" to "a lot" of communication. Several criteria were used for ranking and scaling. These were a) amount of communication (in lines); b) frequency of communication (i.e., number of contracts with an individual); and c) importance of communication (a purely subjective measure). All ranking informants used criterion a); most used criterion b) and c) also (86, 89%, respectively). Virtually all scaling informants used all three criteria.[2]

Following the collection of these data, all 60 persons were asked to log their TTYs for a month, noting who they called and who called them, and how many lines of TTY output they generated on each call. As a result of illnesses and vacations, 28 of the rankers finished the logging, as did 26 of the scalers. The concatenation of these logs (54 in all) enables two sets of behavioral data to be calculated: (1) the amount of communication (in lines) between any two individuals (at least one of whom is among the 54), and (2) the frequency of communication between two individuals. Since members of families were treated as separate individuals, a large total of 594 different names eventually occurred in the behavioral data.

At the end of the month, each person was visited again. They were asked (1) to select from the deck of all registered TTY users those with whom they had communicated; and (2) to rank or scale those chosen. In this phase of the experiment, most of the participants felt it was too cumbersome to rank or scale on three criteria (amount, frequency, and importance of communication). They were thus asked to make their judgements on the basis of "amount of communication," i.e., how many lines of TTY output were generated. As in our earlier experiment, a few persons used video display units rather than TTYs. They logged in minutes, and this was converted, as in Deaf 1, with the corrected value of two minutes to one line. These data, and those in the next three experiments, are described in detail in Bernard and Killworth, 1977.

Hams

Our next set of data comes from a group of amateur radio operators (called "hams") in West Virginia, western Pennsylvania, and eastern Ohio. The hams belong to the Monongalia Wireless Association (MWA), which owns and maintains WR8ABM, a two-meter, FM repeater station.

With the cooperation of the MWA, we monitored all conversations on WR8ABM, around the clock for 27 days. This was done by using a voice-operated relay between a receiver and a tape recorder. By law, hams identify themselves with their "call" (a combination of letters and numbers) every ten minutes. Thus, all communicants could be monitored, and the length of their conversations (in minutes) could be recorded.

At the end of the 27-day monitoring period, a list of 54 users was drawn up who accounted for all but a small fraction of the air time. Each person was mailed a sheet with all 54 "calls," and asked to scale them from 0 to 9. A total of 44 usable responses were obtained.

This experiment yielded three sets of data: the amount of time any two persons were in contact; the number of times any two persons were in contact; and the 0-9 scales by 44 persons over the list of 54 users of the repeater.

Office

These data are from a small social science research firm (with 45 employees). This group is composed of several research project teams, each having senior staff, lower level assistants, clerks and typists.

Recall, or cognitive data were collected from 40 persons; behavioral data were collected from 44 persons. At time 1, an observer walked through the office on four nonconsecutive workdays, covering the same ground every 15 minutes for five hours each working day. He noted every dyadic contact, including those contained in n-tuple conversations. At time 2, seven weeks later, the same observational procedure was followed. This was "mildly obtrusive" data collection. That is, the observer's presence was obvious, but he did not interact with the subjects actively.

Between times 1 and 2, each participant was given the familiar deck of cards containing the names of other participants. They arranged (i.e. ranked) the cards from "most" to "least" on how often they talked to others in the office during a "normal working day." The question of frequency, amount, and importance of

contact was raised often by the participants (they are, after all, social science researchers), but this was deliberately left vague. They were told to make up their own minds. Because their judgments were explicitly based on a "normal working day" the behavioral data from time 1 and 2 were aggregated here. They do differ significantly, but whether this is due to day-to-day fluctuation (which we do not define!) or to a systematic time variation in the group can not be answered easily.

Tech

The tech data, from our fifth experiment, are from a graduate program in technology education at West Virginia University. The program contains faculty, graduate students, and secretaries in three locations: two converted houses at the bottom of a hill, and a suite of offices "on the hill" in the main education building at the university. There are 37 persons in the program; three of these are on full-time field assignment over 100 miles from the university.

For one week a team of observers walked through the office spaces of the tech program. They covered the same ground every half hour, and noted all occurrences of persons in verbal contact. Any two persons in contact were scored. N-tuples were scored by dyads. The same comments on obtrusiveness apply as for the office data.

After a week of observation, each of the 34 persons on the main campus was handed a deck of cards containing the names of all other members of the group, and asked to rank the deck from "most to least communication that week." The question was purposely left rather vague; amount, frequency, or importance of communication was not specified. When the participant finished, he or she handed the deck to the experimenter. The experimenter then laid out the cards in order on a table in front of the participant. The participant was then asked if he or she wanted to make any changes in the order to reflect a "typical week's communication," as opposed to "last week's communication."

This experiment yielded three sets of data: the frequency of dyadic contact; the guesses at last week's communication; and the guesses at a typical week's communication.

Frat

Our sixth data set is a time-series in a college fraternity. The data consist of affective relations (how much i says he likes j); recall of communications (how much i says he talked to j over a period of 5 days); actual communication (from behavioral sampling, how much i $\underline{did}$ talk to j over the 5-day period) for all dyads in a closed group of 58.

Affect was collected on a scale of 1 (least like) to 11 (most like), and cognition on a scale of 1 (don't talk with) to 5 (talk with a great deal). Behavior was measured by an observer passing through the fraternity every 15 minutes for 21 hours a day, over a period of 5 days, at the end of which the affective and cognitive data were collected. Thus behavioral data exists on a 15-minute time scale. This entire procedure was repeated three times, separated by about 6 weeks in each case. These data are described and analyzed in Killworth and Bernard, 1978a.

EIES

Our seventh and final experiment examines the possibility that the inaccuracy we have found is a function of the time period over which informants are asked to recall their behavior. All the previous data sets were based on people recalling their communications during one of three "windows": the previous five days; the previous month; and the forth-coming month. Any period of time, or window, can be characterized by two quantities, which we call "lag" and "width." Width is the amount of time over which informants are asked to recall their behavior. Lag is the amount of time that has elapsed since the beginning of the window. Thus, the five-day windows in some of our previous experiments have a width of five days, and a lag of five days.

The majority of questions asked by students of social networks have a lag equal to the width, and a range of a few days to the lifetime of the informant. It seems plausible that very recent time windows should tend to be more accurate than windows far in the past. "Who did you talk to one minute ago?" should yield more accurate data than "who did you talk to for a minute at this time last month?". Similar variations in accuracy could be caused by different widths: "who did you talk to during a period of a week, a month ago?". The question addressed in this experiment is "what is the combination of lag and width which yields the most accurate social network data?"

This question was addressed using a computer based conferencing system called EIES (Electronic Information Exchange System). The New Jersey Institute of Technology developed the system under grants from the National Science Foundation. A complete description of EIES, including its technology and design philosophy may be found in Hiltz and Turoff (1978). Briefly, EIES allows an individual to exchange messages with others on the system by leaving the message in a central computer for pick-up during the next time the "receiver" logs on.

Between December, 1978 and April, 1979, 57 paid volunteer EIES users participated in our experiment. An invitation to participate in the experiment was sent to over 150 EIES members. Depending on the rate of their EIES use, each informant took up to 37 interviews, each for a specific lag and width. The informant was given a window and was then asked to list the people with whom he or she communicated during that window. Next, informants were given an opportunity to add or to delete names from the list, and were asked to estimate the number of messages and the number of lines sent to and received from each communicant recalled. Finally, they were asked to rate their confidence, on a scale from 1-7, about the information provided. At the end of each interview, informants were given the opportunity to send the experimenters a message containing any observations or suggestions they wished to make. Twenty-seven windows were established ranging from "one day, two days ago" to "one month, two months ago." Windows were selected for informants in random order. The remaining 10 windows we call "last on"; for these windows people were asked to recall their communications during the last time they were on EIES. This ranged from several weeks to several minutes in lag, and from several minutes to several hours in width.

Two questionnaires were also administered. The first interview collected data on all our informants' age, sex, self-reported EIES use, and self-reported estimates of memory ("how well, on a scale from 1-7, do you remember birthdays?"). The second interview was taken by the 22 informants who completed all 27 of the basic window interviews. It again asked for information on EIES use, and also asked informants to report the 20 people with whom they believed they communicated most. For each of those 20, informants were asked to rate (on a scale of 1-7) the importance of the communication, how satisfying it was, how desirable communication was with that person, and how interesting it was.

The data produced by this experiment are known as the EIES (pronounced "eyes") data; they are quite rich, and quite vast, offering many possibilities for measuring respondents' accuracy. (We have concocted 48 different measures of accuracy, most of which have been used previously in our series of papers.) A full report of the findings of this experiment are contained in TR #BK-120-80, which is still under publication review (Bernard, Killworth, and Sailer, 1980a).

c)   Summary of Findings

In addition to the findings already cited, the comparisons between our informants' predictions of their behavior with their actual behavior (who they talked to on their TTYs) showed that 66% of all predictions made were erroneous. Furthermore, there was no way to predict which guesses were erroneous; there was no systematic effect on the accuracy of a respondent by any of the parameters we examined. These parameters included gender, amount of use of the TTY, number of communicants, length of time since acquiring a TTY, and so on. This left the unpleasant possibility that error in reporting behavior is produced by psychological or sociological factors which we will have to uncover before we can know the accuracy of any self-reported behavioral data.

Referees and other critics of our early work were very helpful, and quickly pointed out many apparent defects in our data. Among these were:

1. TTY communication, while natural to the deaf community, is not (on the face of it) a plausible proxy for other, more prevalent communication modes, including face-to-face voice contact.[3]

2. TTY communication is essentially dyadic, whereas communication among people often takes place in groups. Does this affect accuracy?

3. The deaf community might have been giving cognitive data based on "typical communication" (e.g., an "average month") rather than on the actual three weeks under consideration; this would effectively magnify the observed error.

4. Different individuals might have been giving data based on various criteria (e.g., amount of communication, frequency of communication, importance of communication, etc.). This would produce gross inaccuracy when treated similarly.

5. Ranking individuals in a list may not be the most accurate way to collect data. Perhaps asking for scaled data (i.e., "on a 1 to 5 basis, who do you _____?") would have revealed much less error.

6. Most of the communication in the deaf data took place outside the group. Perhaps people in a more fully closed group would be more accurate.

7. The data we collected were essentially precognitive. Perhaps postcognitive data would be more accurate. In other words, data about past events might be more accurate than data about future events.

As may be seen from the description of the data in subsection b), we have addressed each of these problems in at least one subsequent experiment. It is obvious, of course, that many replications of our experiment are required. Still, our work has produced monotonously similar findings. Intercomparisons among the various data sets yield the following results:

1. Postcognitive data are (mainly) more accurate than precognitive, but not significantly so.

2. With the curious exception of one's first ranked informant, there is no systematic variation in accuracy between asking for a "typical week's" data and "last week's" data.

3. There is no systematic variation in accuracy between data sets.

4. There do not seem to be any obvious personal, or socioeconomic data which have any bearing on accuracy.

5. Keeping (or using) communication logs does not improve accuracy significantly.

6. Asking people if they believe themselves to be accurate produces unreliable results.

7. There is (somewhat equivocal) evidence to suggest that informants judge on frequency rather than amount of communication.

8. Affective questions (e.g., "importance") are not systematically less accurate than effective questions which ask people to recall their behavior without regard to affective content.

9. Using the $\hat{A}$ accuracy score introduced in our first paper on this subject (see Killworth and Bernard, 1976), on average, over all data sets, people can recall or predict less than half their communication (measured on amount of frequency).

10. Even with a leeway of ±3, only the rank of the most-communicated-with person is reliably reported more than 50% of the time. The rank of the 2nd, 3rd..., 6th most-communicated, even with a ±3 leeway, cannot be relied upon half the time.

11. There is no evidence that any but a tiny percentage of communication can be accounted for by an informant's first "few" ranks (3, 5, 7, or whatever), or top "few" scales with any reliability whatsoever. Including more ranks or scales only makes matters worse.

12. Slightly obtrusive observation, such as occurs in behavioral sampling (the Tech data and Frat data, for example) has no noticeable effect on informant accuracy.

13. There is no obvious reason to prefer either ranked or scaled data on any measure of accuracy we have considered. Therefore, we recommend the use of scales on the grounds of convenience.

14. Telling people in a group that we expect them to get more accurate in repeated experiments over time produces no significant improvement in accuracy of reporting communication.

15. Attempts to predict communication from cognition (what one hopes one is doing by measuring cognition or recall) is not helped by including affect. In other words, how much i talks to j, as predicted by how much i thinks he talked to j, is not better predicted if one substitutes or includes knowledge of how much i says he likes j.

16. Although lag and width of the time window account for some of the variation in the accuracy of informants (small lags and width tend to be more accurate than large ones), the amount of variance accounted for is typically about 10 percent.

17. One positive finding emerged from our data: although people do not know with whom they communicate, people en masse seem to "know" certain broad facts about the communication pattern of a group. This may result from random errors in recall canceling each other out. But we don't know.

d)   Structural Analyses

All our findings lead to one major conclusion: people do not know, with any acceptable accuracy, to whom they talk over any given period of time. Furthermore, the inaccuracy can not be accounted for by any of the usual characteristics of people or groups.

This leads to two interpretations. One is that there are two distinct networks, at least in communicative structures: cognitive and behavioral. Essentially, who people think they talk to and who people really talk are different networks, and should be treated as such. This may be true, but is hardly helpful if one is trying to study group structure: what one's instrument measures must have an existence -- or at least a

correlate -- outside the bounds of the instrument itself, or else the instrument is useless. Of course, what we call cognitive data are statements by people about what they do. The correlate of these data may be simply what they think they do, with no correspondence assumed between an informant's thoughts about his or her behavior (say, communication) and his or her behavior. But then, what structure are we uncovering when we subject such data to analysis? If a group of 10 persons were all asleep and each person were dreaming of talking to at least one person in the group, then is there a group structure to be uncovered?

The other conclusion is that although the signal-to-noise ratio is extremely poor at the dyadic level, it may be somewhat better if one considers higher order structural elements.

Triadic-level Analysis

One step above the dyadic level of structural analysis is the triadic level of interaction. Holland and Leinhardt (1975) have provided the methodology for the examination of structure at the triadic level. Essentially a binary sociomatrix X_{ij} (where $X_{ij} = 1$ if i communicates with j, and = 0 otherwise) is scanned, and a triad census computed. This is a count of how many times each of the 16 possible triads occurs within the data (definitions of the triad types will be found in Holland and Leinhardt, 1975). The triads are distinguished by counts of the number of mutual, asymmetric and null dyads within them, together with other directional information when this is insufficient. An investigator, armed with the triad census, can then enquire whether some proposed structure (e.g., transitivity) occurs more often than chance in a set of data.

There are a great many possible structural building blocks which one might choose to examine.[4] We examined ten different potential structures: some familiar, like transivity and positive balance, and some created specially for the analysis, in order to make the point that many different kinds of structure do occur in data.

The following conclusions were drawn from our analysis of the triadic level of structure in behavioral and cognitive data:

1) There is an amazing amount of structure in both behavioral and cognitive data. There is so much structure, and the findings are so consistent (even for algebraic structures which we concocted just for the analysis) that one wonders what are the properties of triadic level structures which do not occur significantly often?

2) In the main, structure derived from ranked cognition data is very similar to structure derived from behavioral data treated as ranks. Similarly, structure derived from scaled cognition data is very similar to structure derived from behavioral data treated as scales. However, structures produced by ranking and structures produced by scaling are quite different. The methodological implications of this are obvious: how one treats data directly affects the qualitative and quantitative conclusions which may be drawn from it.

3) More than one set of structural tendencies can be drawn from the same set of behavioral data, depending on how it is treated numerically.

4) Since both behavioral and cognitive data showed similarly high counts of various (say, transitive) triads, this appeared to be an improvement in accuracy over comparisons by dyads in the data. However, this apparent increase in accuracy as the level of structure went up disappeared on close examination. In fact, when compared triad by triad, things got much worse. On average, any non-all-null behavioral triad is reported incorrectly 76% of the time. Thus, no reliance can be placed on the reporting of triads.

The Clique-level of Analysis

A step above the triadic level, we believe, is the clique-broker-link level of analysis; i.e., the level at which we assumed most of us consciously perceive group structure.

Cliques are typically obtained by applying some algorithms to cognitive or recall data. The assumption is that the cliques found in the cognitive data are those which would be found if one had corresonding behavioral data. It is quite possible that i states that he talked to j and k, when in fact he talked to l and m. This would produce great inaccuracy on both the dyadic and triadic levels of structure. But if i, j, k, l, and m form a clique, then i's report is a reflection of his interaction with that clique, though not its members. Thus a good clique-finding algorithm would be one which puts i, j, k, l, and m into a clique when applied either to cognitive or behavioral data. In other words, a good clique-finding device should reduce the noise which shows up as informant inaccuracy at the dyadic or triadic levels.

Since we possess matched pairs of behavioral and cognitive data on who talks to whom in a variety of groups, we were able to do a comparison on clique-finders. We chose three essentially different and popular approaches: 1) factor analysis (Macrae, 1960); 2) an iterative correlational block modeling technique (CONCOR, see Breiger, Boorman, and Arabie, 1976); and 3) a graph-theoretic approach based on overlap of maximally complete subgraphs (COMPLT, see Alba, 1973).

There are many problems associated with comparing results from different clique-finders. First, all three of the algorithms which we chose (precisely because of their dissimilar approaches) differ in their data requirements. Most sociometric data are binary, while our data (collected by rankings and scalings) are not. Second, suppose that an algorithm is used on a matched set of behavioral and cognitive data; this produces two sets of cliques. How can we measure how similar such cliques are? Third, assuming that we have an adequate clique dissimilarity measure, how do we measure the difference between two sets of cliques (i.e., structure)?

A detailed account of how we treated our data, and the rationale for our dissimilarity measures for cliques and sets of cliques may be found in Bernard, Killworth, and Sailer (1980b).

The three algorithms (COMPLT, CONCOR, FACTOR) were applied to four pairs of data (Office, Tech, Hams, and Frat). This produced twelve sets of comparisons between behavioral cliques and cognitive cliques.

Given our definition of clique dissimilarity (see Bernard, Killworth, and Sailer, 1980b) the best dissimilarity (D) in the entire set is 0.50 (for COMPLT on Hams). The reader will immediately appreciate what this means:

For three major clique finders, run on four different sets of data, there is never more than a 50% concordance between the clique structure produced by people's recall of their interaction, and that produced by their interaction.

Second, the different algorithms produce widely varying answers on the same set of data. The average "best" D, over all four data sets, is 0.89 (for comparison, the mean D over all comparisons is 1.6). The average D for COMPLT, CONCOR, and FACTOR were 2.18, 1.15, 1.48, respectively. (The variation between data sets is sufficiently large that no algorithm is significantly better than any other, on a one-way analysis of variance.)

Roughly speaking, then, the clique structure determined from a set of cognitive data differs 160% from the behavioral clique structure it is supposed to represent. For example, for any algorithm, the behavioral clique (1-2-3-4-5-6) is typically represented by the cognitive clique (1-7-8-9-10); this is, of course, the cognitive clique that best represents the behavioral clique.

We expected, at the outset, that Ds of 0.2 or so might occur: indeed, even 40% inaccuracy would be better than that seen at dyadic and triadic levels. After all, representing (1-2-3-4-5) by (1-2-3-4-6) was not, we felt, too bad a misrepresentation. A useful by-product of our clique level analysis, we had hoped, would be to find algorithm which most nearly fitted these reasonable demands on accuracy. But none did.

e) Discussion: where do we go from here?

It seems obvious to us that accuracy of clique representation could be improved by tinkering with default parameters, choosing individual cutoffs for binary data production, and so on. But how can a researcher know a priori how to do this? We are now convinced that cognitive data about communication can not be used as proxy for the equivalent behavioral data, at least at the dyadic, triadic, and clique levels of analysis. This leaves us with a problem, however, which must be resolved. Over the years, researchers have used their favorite clique-finding devices in order to provide managers with descriptions of the structures over which they (the managers) preside. Sociometry in the classroom is used in order to help teachers make decisions about groupings of children. Sociometry has been used in industry and in government to assess information flow in evaluations of productivity. Sociometric (or network) analyses have been used in the basis for the reorganization of task production units, and even for hiring and firing people.

We have used our own algorithm (called "catij," see Bernard and Killworth, 1973; Killworth and Bernard, 1974) in applied settings, and we have always found teachers, managers, and bureaucrats enthusiastic with the results. We ask people to rank order their communication with others; we produce a map of cliques and brokers between cliques; and we present the maps to members (usually managers) of the group. In one case, a colleague used catij to describe the structure of a tiny, isolated village in the mountains of Greece.

In all cases, the persons with whom we shared the maps offered spontaneous interpretations for the particular groupings, isolates, brokers, links, and so on. In other words, the maps made sense to our clients or village informants, even though (as we have shown) these maps could not have been even a close approximation of the actual dyadic, triadic, or clique structure of communication flow. Our colleagues report that, using their own favorite algorithm, their clients and informants are similarly enthusiastic with the results. Their clients, too, respond immediately and spontaneously, putting the flesh of human explanation on the bare bones of the sociometric-cum-network maps placed before them. To make matters worse, as we have shown, different clique-finders produce very different results from one another. How can all this be reconciled?

We suspect that the answers may lie in discovering the regularities of a fourth level of structural analysis, the "folk" level.

When people say "members of clan A always marry members of clan B," they are engaging in folk structural analysis. When people in Ann Arbor say "there is a town-gown split here; the merchants and the university people simply don't know one another," this is a folk structural analysis. When academics say "graduates from school A are hired by school B, but not the other way round," they are making a folk structural analysis. When the Purum of Burma explained the rules for cross-cousin marriage to Professor Edmund Leach, they were making a folk structural analysis. Everyone is familiar with the discrepancies between ideal, normative behavior (every man should marry his mother's brother's daughter) and reality (what does one do if one's mother has no brother?). People everywhere rationalize these differences, and create new rules for dealing with the problems created by old rules. Our next step, then, must be to conduct a series of investigations to see whether people can predict, as well as rationalize, ex post facto, the general form of the maps produced by clique-finders.

This is important if we are to construct a theory of information diffusion. Any such theory must be able to predict how information flows through the system, how quickly it will go from point A to point B, and how likely it is to be trapped in pockets and loops. This, it seems to us, is the goal of diffusion research. In order to address this goal, we have taken two approaches. The one described here, is an attempt to learn how to measure communication flow accurately. The other, described in Section III of this report, is an attempt to understand the decision making process by which information is retained or transferred along any of the multiple lines each of us has in our network.

For the future, we feel that a program of research is needed which will test the accuracy of many behavioral recall instruments. This must be done in many cultures, as well as in Western societies. We also need better measurements of communication per se. This means that we shall have to treat naturally occurring situations as experiments; and, above all, we must devise procedures for automated data gathering. (A crude, first approximation is the EIES experiment.) We will have to concentrate on the two ends of the methodological spectrum: the essentially unverifiable ethnographic method may allow us to understand how people deal with and organize the overwhelming data of communications reality; the automated experimental technique may allow us to describe that reality. From our work thus far, we are convinced that the more convenient, intermediate methods (questionnaires, card sorts, and other forms of behavior recall prods), produce too much error to be a proxy for either the folk level or the behavioral level of reality. Furthermore, the error is so great, that statistical and numerical techniques for washing data collected by recall instruments, can not solve the problem.

III. Small-worlds, reverse small-worlds, and their role in social structure

a) Introduction

The diffusion of information, innovations, a contagious disease, or whatever, through some population has been thoroughly studied by social scientists for many years, dating back at least to Tarde (1903).

The classic diffusion study of Coleman et. al. (1966) provided the impetus for diffusion researchers to ask sociometric questions of the members of the social system. Leaving aside the obvious problems of whether or not an individual knows the answers to the sociometric questions to any useful degree, have sufficient sociometric data been obtained to be useful in interpreting diffusion studies? Have the right types of data been obtained? How does one acquire the right type, whatever that might be? And so on.

There seems to be little doubt that the more we understand social structure (here defined as the patterns of who knows whom), the more likely we will be able both to predict diffusion (of, say, ideas) and also to interpret the diffusion data themselves.

So, how should one acquire data about real-world social structure? At first glance, all we need to do is ask each member of the structure for a list of all the people he or she knows. With unlimited patience, a huge computer, a lot of luck, and assuming all informants managed to remember the thousands of people they know, this procedure would suffice; in real life, of course, it would be disastrous.

Clearly we need to find out both *less* and *more* information than this. We need *less* information because many of one's acquaintances serve no useful purpose for us in our lives; we only need to determine the acquaintances who are, in some sense, useful. (Exactly what is meant by useful is rather difficult to define.) We need *more* information because, of an individual's useful acquaintances, we need to know how and why that individual knows them. For example, a farmer in Iowa may have a best friend in Kuala Lumpur. By no stretch of the imagination can, say, a contagious disease spread directly between them; but a snippet of information can. So just knowing links in a network of acquaintances tells us little unless we also know something about those links.

Traditional sociometric tools are, as we know from our work on informant accuracy, inefficient at gathering this kind of information. We approached this problem by considering the small-world method, due originally to Milgram (1967), and how we might improve on the method in order to produce the kind and amount of

information required for a theory of social (i.e., communications) structure. The resultant methods, invented under this contract, are known as the reverse small-world, and the informant-defined reverse small-world method.

b) The small-world method: the experiment

Although Milgram's now classic 1967 experiment began the accepted chain of small-world (henceforth SW) papers, the origins of the problem it was designed to solve lie in 1958. In that year, Pool & Kochen wrote a paper which circulated rapidly through the academic underground, finally reaching publication in 1978. They - and Milgram - were interested in the answer to a deceptively simple question: "starting with any two people in the world, what is the probability that they know each other?" The probability, about 5×10^{-5}, wasn't very enlightening, so the problem was expanded: "given any two people in the world, person X and person Z, how many intermediate acquaintance links are needed for X and Z to be connected?" Pool & Kochen (1978) had already estimated that 50% of such pairs could be connected by two intermediate links (assuming, of course, that X and Z were aware of these connections, itself an unlikely event).

This problem proved tractable by one of the most elegant (and cheap, the total cost being $680) of all social science experiments. Milgram created a pool of *starters* (henceforth Ss). These were individuals in various parts of the U.S. who were prepared to help with the experiment. There were two groups, functioning independently: 145 persons in Kansas and 160 persons in Nebraska. Each S in each group was given a folder containing some background information (name, address, occupation, marital status, etc.) about a *target* (henceforth T) person. The T for the Kansas group was the wife of a divinity student in Cambridge, Massachusetts; the T for the Nebraska group was a stockbroker in Boston.

The Ss were given the task of getting the folder to the appropriate T through a chain of acquaintances, as rapidly as possible. In other words, each S chooses the person that S thinks is most likely to know T (or most likely to know someone who is most likely to know T, etc.) and gives or sends the folder to that intermediary. The intermediary then effectively becomes a new S and the chain continues, until one intermediary either actually knows T or, for some reason, drops out of the experiment.

Milgram (1967, 1979) wanted to know such things as: how many steps, on average, it took to get from any S to the T?; and were there qualities of the Ss or Ts which affected the number of steps involved? However, we might also think of the experiment as an attempt to discover how many people know T in a "useful" sense. After all, those people in the chains who actually passed the folder to T from a well-defined group: they are a (subset of the) class of people who know T. Would this be a large or small group? The questions were intriguing, and the freshness of the method generated a great deal of interest among structural theorists.

c) The small-world method: results

Of all the SW chains initiated by Milgram, only 44 were completed (this appalling attrition rate - about 25% per step of the chain - is typical of "real world" experiments). Remarkably, the average chain length from S to T was 6.2 steps, with a mode of 7.

Knowing a mean path length tells us little about social structure, of course. Travers & Milgram (1969) performed the first expansion of Milgram's original experiment by using the same T for two groups of Ss: One in the same city (Boston) as T, and one half a continent away. The "local" chains were significantly shorter (5.4 vs. 6.7). Obviously, some form of social distance, with a geographical component, is at work here.

Perhaps the most useful of their findings for social structure - and, indeed, of the papers which followed, which are reviewed elsewhere (Bernard and Killworth, 1979) - was a clustering effect observed as chains neared T. Forty-eight percent of all chains reaching T in their study came in through just three penultimate links. So incoming networks are highly structured. Presumably outgoing networks are, too (i.e., if T was to serve as a starter to many new targets, he might choose some intermediaries very often and others hardly at all).

Although the SW technique had, by the last '70s, been performed in businesses, multinational dormitories and the like, one gets the impression that the information obtained is not in quite the best form to use in a theory of social structure. The (repeatable) facts that SW experiments produce are the *results* or output of the social structure, and it is not easy to see how to plug these back into a theory. In fact, it is fair to say that models of the SW experiment have yielded more information germane to social structure than the experiments themselves. We generated a model of Milgram's experiments (Killworth and Bernard, 1979), and created a flow chart which we felt represented the thought processes undergone by a participant in a SW experiment.

Surprisingly, almost all the predictions of the model agreed with observations. For example, we computed the mean complete path lengths to T from three categories of starter: far (not in a circle of 7×10^6

population), far but occupation-connected, and within 7×10^6 population with S at the center of the circle. The path lengths were 6.5, 5.8, and 5.0 respectively; Travers & Milgram (1969) found 6.7, 6.4, and 5.4 respectively in their experiments.

The SW technique is thus generating ideas for models of social structure. But can the method be adapted to yield richer, more directly applicable data? We felt that it could, and the result was the reverse small-world experiment (RSW).

d)   The reverse small-world method: the experiment

No matter how many Ss one uses, one obtains, per target, three pieces of information: a) how many people comprise his incoming network, assuming an awful lot of starters were used; b) the mean path length to that T, and hopefully a fit to various SEC indicators of Ss and Ts on this; and c) scattered snippets about intermediaries in the chains. To get all this requires vast resources, due to the attrition rate, and therefore a concomitant increase in complexity and cost.

We (Killworth and Bernard, 1978a) attempted to avoid these problems by eliminating the SW task entirely. Instead of many Ss and one T, we decided on fewer Ss but many Ts, with no passing of folders involved. We created a long list of mythical targets (1267 in total). First and last names were paired from different telephone directories; 168 names were suitably ethnic in origin (e.g., Wong Fuk Lam). An address was provided for each T, roughly reflecting the U.S. population; 100 were foreign (i.e., non-U.S.); 100 were local (i.e., in the two neighboring states to West Virginia, where the experiment took place, and in West Virginia itself). Half were male, half female. Each T had an occupation, spanning the Duncan (1961) scale. The list was then shuffled, printed up as an instrument, and presented to starters.

Each of the 58 starters, who were paid for their lengthy (8 hours apiece) participation, considered each T on the list. Armed with the knowledge of T's name, location, occupation, ethnicity (Blacks were indicated) and sex (unless the name was Oriental), each S made his or her choice for an intermediary in a SW chain to that T. They provided the choice's name, and relationship to S (friend, acquaintance, or one of the 21 types of relative), and checked one of four possible reasons for making that choice: location, occupation, ethnicity, or other (the latter being left unspecified).

This provided two sets of interrelated data. We had a list of targets about which we knew occupation, sex, ethnicity, whether they lived in a large or small town, and location by state (or country). We also had, per starter, a list of choices, one per target, about whom we knew sex, relationship to starter, and a reason for choice. Additional starter information (e.g., their sex, age, income, religion, etc.) was also obtained.

e)   The reverse small-world method: results

Of immediate interest was the size of an individual's network, i.e., how many different choices were generated by the list. The average number was 210 (ranging from 43 to 1131), with a highly skew distribution (all but two Ss making less than 400 choices). Monitoring the mean number of choices generated for the first n targets on the list, as n increases, we found that at the end of 1267 targets, the number of choices was still increasing. (The shape of the curve refused to fit any plausible model assumption, unfortunately.) We estimate that over 2000 U.S. targets and 500 foreign targets would be necessary to exhaust an individual's network.

Some choices were far more "popular" than others. On average, only 35 choices were required to account for half of all the targets (and only 3 for 10% of the targets). Similarly, choices were used more often for one one reason than another: 45% were chosen most often for location reasons, 47% for occupation, and only 7% of choices were mainly based on ethnicity or other reasons.

Eighty-two percent of the time a friend or acquaintance was used for a choice (the terminology differs according to sex of starter, with males preferring acquaintances and females friends). For any given target, indeed, the type of choice used most often was never a family members.

Characteristics of Ss and Ts enabled many strong predictions to be made. For example, the most likely sex of the choice, for any given target, can be predicted accurately 82% of the time. The sex is male, unless both starter and target are female, or if the target has a low-status occupation. Similarly, the most popular reason for a choice, for a given target (always location or occupation) can be predicted accurately 81% of the time. Essentially, location is preferred as a reason except for targets with a high-status occupation or in faraway small towns. This preference agrees very well with the experimental results of Travers & Milgram (1969) for their stockbroker target (occupation level 85 out of 100).

We were also able to quantify such common phrases as "one's man in Idaho". Virtually never was a single choice used for every target in a single U.S. state. However, the choice accounting for *most* of the Ts in any state (when location was the reason) accounted for 69% of those Ts. Defining a choice to "handle" a state (i.e., to be "a man . . .") if that choice accounted for two-thirds or more of the Ts in that state, we found that almost half the states in the U.S. were handled by a (usually different) single person.

This suggests that most Ss have some kind of cognitive map of the entire U.S., which they tap when approached by social scientists requesting information (do they use this map in normal life? or is it an artifact of our experimentation?). What makes some targets seems like others to an S, who proceeds to use the same choice for them both? As an experiment, we considered the first 100 Ts. We argued that if a starter used the same choice for two Ts, he or she perceived that pair as similar, and that the more Ss who did the same, the more similar that pair of Ts were. We performed a multi-dimensional scaling on such a matrix of similarities, placing the 100 Ts into a two-dimensional space to that similar Ts were close, and dissimilar Ts were far apart.

The resulting map was rotated to resemble a genuine map of the U.S. The resemblance is certainly very good, with the South, New England, and Far West states basically placed correctly. California and Texas were misplaced, and high-status targets migrate toward the edge of the diagram. Clearly there is some kind of - not necessarily geographical - map in informants' heads.

One of the problems with RSW was the size of its data (at least 73,000 informant-target pairs alone). There is a tendency to assume that because the fits to the data accounted for so much variance, and because we had so much data, that the *quantitative* results should be applicable elsewhere, but the INDEX experiment described later failed to fit these results. However, there seems little doubt that all the qualitative results should hold for further data, with minor parameter adjustments, etc.

We felt, then, that RSW had provided a great deal of information about some aspects of social structure, and an embarrassingly high number of significant straight lines in the data. But yet there were at least two shortcomings. First, we had gathered very little information about the choices. We knew their names (and therefore, usually, their gender) and whether they were relatives or friends of the informant. But if all the choices made by an S are to be something meaningful, then there must, we hope, be a pattern amongst those choices; something that announces this group of people to be connected with S. The sheer labor of investigating $210 \times 58 = 12,180$ choices after the experiment does not permit such analysis. So we know - at least statistically - why S chooses certain types of people for certain types of T; but not why S knows them in the first place.

Second, the RSW instrument was closed-ended. It provided only a few pieces of information about each target, because SW experiments do. In turn, SW experiments provide such information because accepted sociological theory tells us such information is important. For the same reasons, informants were only allowed to check certain reasons for their choice, whereas the actual reasons might be very complex.

In fact, informants' comments about the RSW experiment revealed two interesting details. They occasionally asked about other target information which was not provided; and frequently (when we checked) choices were made on the basis of location who had never lived anywhere near T. But informants claimed their choices to be *associated* with T's location because, for example, the choice's children might have gone to college in the same town as T lived. (This led to the model discussed earlier.)

If this is the case, then might it not work in reverse? If an S were told where T's children had gone to school, might that not be of use to S in making a choice? Or knowing T's hobbies might be useful, or . . . the list was endless.

By this time, it was obvious that the only persons who knew what information about T was required would be the starters themselves. This led us (Bernard, Killworth and McCarty, 1980) to perform an "informant-defined experiment", or INDEX. The idea is to study social structures experimentally, but to allow the subjects of the study to define the information which is collected.

f)   The informant-defined small-world method: the experiment

A great deal of pretesting revealed that the list of targets had to be kept short, both to maintain informants' interest and to prevent the data from getting out of hand. We settled on 50 targets, all mythical. Each target was assigned a name, gender, occupation, location and a racial identity as before. New information was then added for each target: an age, a religion, an education level, and marital status. After pretesting, a maximum of five hobbies and five organizations were added, together with details of number of children, etc.

The reverse small-world procedure was explained to each of 50 informants. We explained that we had complete life histories of 50 people from around the U.S., but with names and characteristics shuffled to protect anonymity. Targets were presented in a random order, to minimize learning effects. Informants were given no information about any target. However, they were instructed to ask any questions they liked about each T; the questions were all answered.

Of course, it frequently occured that a question was asked without an answer in the target's dossier. Either the informant was told the information was not available, or else (more frequently) it was made up on the spot, and later added to the dossier. There were, predictably, many problems with this procedure, and these are discussed in detail in Bernard, Killworth, and McCarty, 1980.

Each question ever asked was assigned a unique number, with no connotation as to order. For example, question 3 refers to target's occupation, and question 14 to target's location. For each target, then, the code number of each question asked was recorded in sequence. When informants had asked enough questions, they stated their choice. Then they provided a "few sentences" which explained why they had selected that choice (i.e., "because he's a real estate agent", or "because his girl friend's father is a pharmacist"). Next, informants ranked the questions they asked by the degree to which the answer had helped them make their choice. They were required to select a first-ranked question, and could rank up to four more. All other questions were graded by the informant as "helpful" or "not helpful". The relationship of each choice to the informant was recorded.

Finally, after completing the test, each informant answered a questionnaire. This consisted of basic sociometric data, and a personal response to any question ever asked by the informant about any target.

Most of this information thus presented was straightforward to code (with reservations about location, for which we provided five distinct definitions). The problem lay with the "few sentences". Four concepts were introduced, the "direct hit", the "associated hit", the "via", and the "intervening choice". If an explanation revealed that a characteristic of a choice matched exactly to a characteristic of the relevant target, this was a direct hit. For example, if a target lives in Los Angeles and the choice lives in San Francisco, then if, and only if, the informant said he selected the choice on the basis of location, this counts as an "associated hit". Associated hits can occur for a wide variety of reasons. If an informant says he chose a pharmacist in order to get a physician because "they are both in the medical field", then this is an associated hit. Similarly, a farmer and a tractor salesman may be associated by occupation; a student choice may be associated with a college administrator; a choice who plays a jazz trumpet as a hobby may be associated with a target who collects jazz records, and so on. The concept of "associated location" and "associated occupation" has been introduced earlier. Our experience in this experiment has broadened the concept to include associations such as hobbies, organizations, religions, etc.

In fact, our experience with these data has shown that simple associations are not enough to describe all the relationships which informants claim exist between their choices and the targets. This led to the "associated via" and "intervening choice" categories. Consider the case of a choice who is a coal miner linked, by an informant, to a target who lives in Kentucky. The coal miner choice may, in fact, live in Ohio. But if the informant says, "I chose him because he is a coal miner and he could contact people in Kentucky where there are lots of coal miners", then we believe this is best described as "associated with target's location via choice's occupation". Some other examples include the following: "I chose her because she belongs to the Sierra Club and the target works for the Environmental Protection Agency", then this counts as "associated with target's occupation via choice's organizational affiliation". "I chose him because he does cross-country skiing and the target lives in Vermont" is coded as "associated with target's location via choice's hobby". "I chose him because he collects rocks and the target is a geology student" is coded as "associated with target's field of study via choice's hobby".

Finally, many of our informants were apparently thinking two steps into the small-world problem when they said such things as "I chose him because his girlfriend worked at Kroger's grocery and the target owns a grocery store". This counts as "associated with target's occupation via intervening choice's occupation". The *choice* was not associated with the target by any characteristics of his own; but his girlfriend (whom the informant may not have known well enough to name as his choice) is associated with the target's occupation. For simplicity, we code the fact that the girlfriend is an intermediary choice, and that she is somehow associated with the target's occupation. Another example is the following: "I chose her because her father used to be a professional pool hustler. He could contact the target who likes to play pool." This was coded as "associated with target's hobby via intervening choice's occupation".

g)   The informant-defined reverse small-world method: results

As we had hoped, the two most frequently asked questions (out of 82 different questions created by informants) were indeed target's occupation and location (asked, respectively, on 92% and 90% of all occasions). Other questions were much less frequently asked: age of target (42%), sex (36%), marital status (24%), and hobbies (21%). Put another way, location and occupation together contributed 38% of all questions ever asked; age and sex, when added, contribute over 50%.

Furthermore, the dominance of location-occupation continues if one examines "most helpful", "at all helpful", or even "unhelpful" questions. This lack of dependence on whether questions are useful suggests that the same questions tend to be asked about all targets. However, the distribution of the "most useful" questions differs subtly from the others: location-occupation account for 64% of all "most useful" questions, with hobbies and organizations raising the total to 75%. We have thus concluded that the basic set of questions:

> target's location
> occupation
> hobbies

organizations
age
sex
marital status

supply the basic information about any U.S. target (to an S who lives in the U.S., at any rate). Name of target does *not* feature on this list.

We were able to show fairly accurately how a string of questions is created by an S, following a flow-chart. Even when a question like sex of target is asked first, informants find it necessary to ask location and occupation and then proceed on the basis of how useful the results of such questions were. The later stages of all such flowcharts are all very similar.

Thirty-five different probabilities (e.g., that location is the most useful; that marital status is not useful, etc.) can be described with more than 40% of variance accounted for (up to 71%, in fact) by linear combinations of target data. Here target characteristics control most of the questions which informants ask.

The choices made by Ss (i.e., family or friends) and their sex, again reflect the findings of RSW. Of the 50 targets, location was the most popular reason 23 times and occupation 25.

Surprisingly, the probability of a direct hit (as defined earlier) is 90%. Of course, location and occupation were the most likely to be direct hits (19%, 15% respectively). The chance of a location direct hit was fitted (75% of variance) by target characteristics: the nearer and more urban the target, the more likely a direct hit.

Similarly, associated hits have a 95% chance of occurring, with corresponding vias at 88%. Location-occupation accounted for over 60% of all associated hit. Intervening reasons (and vias) are distinctly less likely, at 10% probability. Thus in all cases, location-occupation retains its dominant role in question and choice selection.

We assumed that S selects a choice for a given T because, in some sense, S perceives the choice to be similar to T. Furthermore, given several similar choices, S chooses the most similar such choice. How can we model the complex cognitive processes yielding such a similarity? As a simplification, we assumed a choice and T to be perceived as similar if and when some facet of the choice (e.g., where the choice went to school) and some facet of the target (e.g., where one of T's children lives) are either connected, or, at best, identical.

Each such facet of a target's personal history we term a "tag". On average, targets developed 16 tags (we counted tags in each of location, occupation, hobbies, organizations, age, sex, and religion, the latter three categories having one apiece), with 5 given over to locations. We deduced choice tags from the question responses, since we knew nothing else about the choices. On average, choices have two tags (but one had 12).

This enables a test of simple hypothesis. We can predict the most likely choice for a given T by comparing tags until we find maximal agreement. The procedure is biased, of course, by the backward way of discovering the choice tags, but this is allowed for statistically. We measured the accuracy of the model by "easy" and "difficult" scores. The easy score is unity whenever the actual choices are among the optimal choices, and zero otherwise. The difficult score is 1/(number of optimal choices) if the actual choice is among the optimal choices, and zero otherwise. In other words, the easy score counts how often the actual choice was correctly (but not necessarily uniquely) predicted; the difficult score counts how often we would be correct if we chose at random among optimal choices.

The model works well with an average easy score of 89%, and a difficult score of 60%. Both are significantly (better than 1% level) higher than expected by the biased way the data were calculated. However, no weighting of tags (either by direct or indirect hits, or by giving more weight to, say, location tags, or whatever) improved the accuracy. As defined here, all tags have an equal utility. We deliberately did not restrict the target's tags to what each informant knew of the target (i.e., we compared choice location tags with a target's places of travel whether or not the informant had asked about T's travel) as this would further - but artificially - increase accuracy.

h)   Conclusions and future research

It may be that the kind of data we week (i.e., for all members of a group: who does each member know, and why?) are far too unwieldy to elicit any firm laws about structure. After all, the motion of a liquid or gas is best understood at the bulk motion level, and not by considering the quantum dynamics of each atom in turn. Perhaps in small-world studies we are still (incorrectly?) looking at the atomic level of structure. If this is so, can we achieve the bulk motion level by simple averaging over people?

We also need to know more precisely what information about a target is needed to "define" that target to an informant. The list of questions we presented, after all, relates specifically to the experiment we performed. But at least one could test this, in a small-world context, very easily. One creates three sets of SW experiments, all with the same target. One group of Ss is given the answers to *all* the different questions ever asked in the INDEX experiment; one group can request information just as in the INDEX experiments; and the last group (which could be subdivided) is given just T's location and occupation (or perhaps hobbies, etc.). Then one examines whether SW chains differ significantly in length; either way one learns something, whether they do differ or not.

So perhaps we can define the essentials of a target – at least for basically Western European informants. (There is an obvious need for cross-cultural comparison – provided we know what to compare. The concept of a "useful" choice probably differes between the U.S. and a Mediterranean culture, for example. How can we handle this, let alone account for it?)

But how can we define an informant as a unit in the structure? After all, something as useful as the tag concept still founders when one asks *"what* makes Ss have more, or different, tags than others?" It is simply not good enough to blame "personal history of informants" for this failure of basic SES variables to account for differences in tags between informants. And yet aggregating our informants (i.e., ducking the problem entirely!) may not be the answer. Over what group of informants should one aggregate? All Bostonians? All violin players? All the U.S.? Just because these subgroups make (occasional) sense to us doesn't mean they are correct, after all. But surely we don't need to factor analyze data from the whole world population to find how to aggregate?

Obviously what is desperately needed are testable, falsifiable *theories* of social structure. The falsifiable criterion is vital. Heider's balance theory still has its proponents despite its refusal to occur in data; so small-group research needs better theories. We assume tacitly that a theory, however unlikely or implausible – an awful lot of physical science is thoroughly implausible – can be modeled so that predictions can be made, and tested.

But what predictions should be made, and why? (Granovetter, 1979, raised the same awkward question.) We suspect that at this stage in our knowledge, or practically any subject, let alone social structure, we do not really know (a) what we would do with perfect, complete, noise-free data, and (b) how we should compare that data with theories.

This is certainly pessimistic. Now in some scientific areas (e.g., meteorology) we have some very practical ways of checking predictions: did it rain today, like the computer said it would? But in the social sciences, except those based firmly in the public domain, we have been content for too long merely to *describe* the situation. Perhaps now the pendulum is beginning to swing back, and we shall try to *understand* and *predict* what is happening in a real social structure.

NOTES

1. Some scholars argue that what people talk about is as important as how often they talk to each other, or for how long they talk. We take the position, using Occam's razor, that the content of conversation is not demonstrably important in understanding structural change in human relations, and that it is not measurable. We claim that amount and duration of interaction between persons is measurable (or ought to be), and until it can be shown that measurable quantities do not yield adequate data about social structure, there is not reason to cloud the field further with attempts to include meaning.

2. An aside is in order here. It has been suggested that giving an informant a list of names may well influence who he actually contacts (though not, presumably, those who contact him). This may be true. It is also likely that asking children in a classroom for their three favorite friends will influence their later behavior, but this is usually ignored in the literature. Any act of data gathering must induce a quantum jump in the system being observed, whether the system be a social network or a hydrogen atom. The difficulty arises because one can compute the expected magnitude of the jump for a hydrogen atom, but not for a social network. It is not obvious, in other words, how both to obtain data and to stop informants thinking about their choices afterwards. Leo Tolstoy, as a boy, believed that any wish would be answered if only, after making it, he could stand facing a wall and not think of a white bear.

3. We are constantly amazed at this criticism, because it comes up so consistently in much social science literature. In physics, a finding about the behavior of waves in the Baltic Sea would never be faulted on the grounds that "the Baltic is not typical of seas". Such a criticism, in fact, would be absurd. (It may be the case that wave forms in one sea are different from those in another.) Is eating with a fork or chopsticks more "typical" of current human behavior? If chopsticks are more typical, then are forks abnormal?

4. See Killworth and Bernard, 1979a, for a discussion of how we converted non-binary data into a socio-matrix. Scaled and ranked data, of course, must be treated differently. More importantly, however, there is more than one way to handle behavioral (or any valued) data in order to produce a sociomatrix. It turns out that different conversion techniques produce widely differing structural tendencies. How the data are treated, alas, determines the answers one gets from the analysis.

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RUSSELL'S PARADOX (PART II)

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Among the classic paradoxes of self reference, several involve set membership. According to Hofstadter (1980, p. 20):

"The most famous is Russell's paradox. Most sets, it would seem, are not members of themselves—— for example, the set of walruses is not a walrus, the set containing only Joan of Arc is not Joan of Arc (a set is not a person)—and so on. In this respect, most sets are rather "run-of-the-mill". However, some "self-swallowing" sets *do* contain themselves as members, such as the set of all sets, or the set of all things except Joan of Arc, and so on. Clearly, every set is either run-of-the-mill or self-swallowing, and no set can be both. Now nothing prevents us from inventing R: *the set of all run-of-the-mill sets.* At first, R might seem a rather run-of-the-mill invention—but that opinion must be revised when you ask yourself, "Is R itself a run-of-the-mill set or a self-swallowing set?" You will find that the answer is: "R is neither run-of-the-mill nor self-swallowing, for either choice leads to paradox."

This kind of paradox seems to emerge again and again. In its most recent incarnation, it turns out— still—to be associated with the name Russell. (This fact, itself, raises all sorts of questions for speculation.) Russell Bernard, Peter Killworth and Lee Sailer (Killworth and Bernard, 1976; Bernard and Killworth, 1977; Killworth and Bernard, 1979; Bernard, Killworth and Sailer, 1980) have published a series of papers on the inaccuracy of informants in social networks research.

Russell and his colleagues have come to the conclusion that people are unable (or unwilling) to give accurate reports of the others with whom they interact. People are, it seems, completely intractable in this respect. Whatever the question—however it is put—people both interact with others they don't report and they report interactions with those with whom they don't interact.

This conclusion is embodied in the research papers in which Russell and his colleagues report their interactions with the people who were their subjects. But, indeed, if we believe their conclusion that people err in reporting their interactions, and since Russell et al are people, it is clear that we cannot possibly accept their report of *their* interactions with their subjects. We must, therefore, reject their conclusion.

But if we reject their conclusion, we are free, of course, to accept their interaction report—but that entails their conclusion. This is, of course, a new expression (dare we say reincarnation?) of Russell's paradox.

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GOEDEL'S SPOOF: A REPLY TO FREEMAN

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Let P represent "Linton Freeman's opinions regarding our work", and Q represent "false". We shall also use two variables a and b, both left for the moment unspecified, to prove that P = Q, or "Linton Freeman's opinions are false".

We note

$$a^2 - b^2 = (a - b)(a + b) \qquad (1)$$

as an identity, true for all values of a, b. Let us take in particular b = a, so that (1) reads, for this value of b,

$$a^2 - ab = (a - b)(a + b) \qquad (2)$$

or, factoring the left-hand-side,

$$a(a - b) = (a - b)(a + b) \qquad (3)$$

Dividing both sides by the common factor (a - b), we have

$$a = a + b \qquad (4)$$

or, as b = a,

$$a = 2a \qquad (5)$$

or, dividing by a,

$$1 = 2 \qquad (6)$$

Subtraction of 1 from both sides implies

$$0 = 1 \qquad (7)$$

and multiplication by (P - Q) gives

$$0 = P - Q \qquad (8)$$

Addition of Q gives

$$Q = P \qquad (9)$$

i.e. "Linton Freeman's opinions are false".

Q.E. almost D.

A Structuralist Manifesto!

(contributed by an anonymous fellow with a big black beard)

A specter is haunting sociology: the specter of Category. All the powers of the Old Establishment have united to preserve this specter: Chairmen and Curriculum Committees, Intellectual Anarchists and Mindless Numbercrunchers, Ethno-metho-obscurantists and Born-Again Marxists.

Where the Department which has not bowed down to the whims of its adolescent clientele? Where the Faculty which has not undercut even these standards? Where the Graduate students whose pursuit of science is greater than their pursuit of Dogma? Two consequences result from these facts: (1) curriculum has been frozen or rots, and (2) Sociology cherishes the harmless and irrelevant ... It is time for a Manifesto of the Serious ...

The history of all hitherto existing paradigms is a history of crass struggles ...

(An extract from a preface to a contribution to an authorized version of some sort)

THE NORWEGIAN CONNECTION: EILERT SUNDT AND THE IDEA OF SOCIAL NETWORKS IN 19TH CENTURY ETHNOLOGY

Douglas Caulkins (Anthropology, Grinnell College)

How did the social network concept arise in the social sciences? According to prevailing creation myths, this analytic approach was born of the union of post-functionalist British social anthropology and microsociology (Killworth and Bernard 1974, p. 336; Leinhardt 1977, pp. xiii-xviii; Whitten and Wolfe 1973, pp. 718-720).

Anthropologists usually credit J. A. Barnes with the first non-metaphorical use of the network concept (Bott 1971, p. 313; Noble 1973, p. 4; Aronson 1970, p. 222; Mitchell 1969, p. 1; Mitchel 1974, p. 280). Ronald Frankenberg (1966, p. 43) embellishes the creation myth with the suggestion that Barnes' field work during 1952-53 in Bremnes, a coastal parish in Western Norway, gave Barnes "the opportunity to ponder on a drift-net piled up in a corner of a fishing boat." The product of this cogitation, presumably, is the following often-quoted passage:

> The image I have is of a set of points, some of which are joined by lines. The points
> of the image are people, or sometimes groups, and the lines indicate which people inter-
> act with each other . . . . A network of this kind has no external boundary, nor has
> it any clear-cut internal divisions, for each person sees himself at the center of a
> collection of friends (Barnes 1954, p. 43).

Sociologists tend to trace the inspiration for network analysis not to Norwegian fishing nets but to the "Social circles" of German sociologist Georg Simmel (Breiger 1974; Fisher 1977, p. 17; Kadushin 1966, p. 88; White, Boorman and Breiger 1976, p. 730). Simmel's 1922 essay, translated by Reinhard Bendix as The Web of Group Affiliations (Simmel 1955) is more accurately as well as more literally translated "On the Intersection of Social Circles" according to sociologists at Columbia and Harvard (Kadushin 1966; Breiger 1974). The elements of social circles, like some networks, have indirect interaction, a common focus of interest and a low degree of institutionalization (Kadushin 1966, p. 786). The image of social circles derived from Simmel's writing even suggests some set-theoretic means of measuring the overlap or inter-section of social circles (Alba and Kadushin 1976).[1]

These formulations of Barnes and Simmel were anticipated by Norwegian ethnologist Eilert Sundt who, writing in 1856, described aspects of peasant social organization in terms which clearly foreshadowed contemporary network analysis. Describing the rural Norwegian social structure a century before Barnes, Sundt (1968, p. 202) wrote about the bedelag, a form of "social circle" (selskabskreds). The bedelag, encompassing several neighboring farms, was activated for the celebration of life-crisis ceremonies, particularly weddings and funerals. One valley of dispersed farmsteads might have a number of bedelag, as Sundt (1968, p. 203) describes:

> Consider a settlement of 100 farms and imagine that there is an average of 10 farms in
> each bedelag. You may leap to the conclusion that there should be 10 bedelag in all.
> But there are 100. Each farm has its own particular bedelag. Everything will be clear
> if one thinks of the farms in a community as arranged like letters in the alphabet.
> Farm E could have its bedelag from A to I, and farm F its from B to K, and the bedelag
> from farm G encompasses the farms from C to L. And in this way every family is brought
> into the whole complex social field (Sundt 1968, p. 203).

Sundt shows how each family interacts with a different, but overlapping set of families each time it attends an event at a different bedelag. In current terminology, the bedelag are action sets, with linkages among families "purposefully used for a specific end" (Whitten and Wolfe 1973, p. 724; Mayer 1966).

Equally important, the network of bedelag is unbounded:

> Yes, these groups of associations which were created by the traditional folkways even reach
> across the established boundaries of parishes and administrative districts which, strange-
> ly enough, in many places are thought to separate rural people from each other. If we let
> the letter Z stand for the most peripheral farm in a parish and A for the nearest farm
> in the neighboring parish, then Z can have its bedelag, for example, from X in one to D
> in the second alphabet and so on (Sundt 1968, p. 203).

Or, as Barnes (1954, p. 43) observed about friendship networks a century later, "this network runs across the whole of society and does not stop at the Parish boundary."

In a footnote to his explanation of the organization of bedelag, Sundt anticipates the image of inter-section of social circles and hints at the posibility for systematic measurement of their characteristics. "A mathematician," he writes,

would perhaps demonstrate graphically that the rural settlements are divided up into non-
concentric circles, each with one farm at the center and a number of others at the peri-
phery. Thus, each circle always intersects several others (Sundt 1968, p. 203).

Sundt's formulation of the network approach is as concrete as that of Barnes and perhaps more empiric-
ally grounded than Simmel's, yet it remained undeveloped and unnoticed for a century. The sections of
Sundt's work that I have cited are but a small part of a wide-ranging untranslated volume, On the State of
Morality in Norway, published in 1857. How did he come to engage in this research which earned him a
reputation as Norway's first ethnologist (Allwood 1956; Vogt 1968)?

Born in 1817 into a provincial tradesman's family, Sundt studied for the ministry at the university
in Oslo, or Kristiania, as it was then. As a student he was caught up in the emerging national romanticism
which glorified the folk traditions of that newly independent nation. In his first job as a Sunday School
teacher in a prison, Sundt encountered a Gypsy who had been jailed for failing to prepare for confirmation
in the state Lutheran Church (Derry 1973, p. 44). Intrigued by this representative of an exotic ethnic
group, Sundt was able to obtain a travel grant from the government to study the condition of Norway's
1,145 Gypsies (Derry 1973, p. 44), who were increasingly the focus of public concern. In 1850 Sundt
published his Account of the Gypsy People in Norway, which was based on extensive field work. His research
had immediate policy implications as he was able to dissuade the government from embarking on a program of
enforced sedentarization of the Gypsies.

Sundt's first field work brought him into close contact with the rural peasantry to which he turned
his attention in subsequent ethnographic surveys. Between 1851 and 1869 he received an annual stipend
from parliament to continue his research. A prolific writer during the period, Sundt produced a series
of books and reports which included On Mortality in Norway (1855), On Marriage in Norway (1955), On the
State of Morality in Norway, in which he developed the network focus (1857), On Temperance Conditions in
Norway (1959), On House Construction in the Norwegian Countryside (1862), On Domestic Industry in Norway
(1867), On Cleanliness in Norway (1869), and an extensive series on his continuing study of Gypsies. In
the course of this work Sundt developed a flair for careful ethnographic observation which he reported in
a lively and accessible style.[2]

Sundt's many books and articles belong to a distinctive branch of 19th-century literature in which,
according to Peter Keating, "a representative of one class consciously sets out to explore, analyze, and
report upon, the life of another class lower on the social scale than his own" (Keating 1977, p. 13). Like
the "social explorers" Henry Mayhew, Charles Booth, and a number of other English contemporaries, Sundt's
goal was to contribute to social knowledge and particularly to the illumination "of the lower class' con-
ditions and morals" (Sundt 1968, p. 332). During his ethnographic reconnaisance trips throughout Norway,
Sundt stayed in the homes of smallholders and cottars, rather than with the crown officials or large
landowners.

As the editor of The People's Friend, the journal of the Society for the Enlightenment of the People,
Sundt hoped to reach an audience of the common people too. Contrary to his expectations, however, the
most avid readers of his works were the urban middle class (Allwood 1957, p. 77) who were fascinated by his
accounts of the unknown rural poor. Disraeli's 1845 characterization of "two nations" of the rich and
poor in England was only slightly less true of Norway.

In his later writings Sundt became increasingly relativistic and functionalist in his interpretation
of culture. "To study the life of the people from a scientific point of view," he argues, "becomes the same
thing as to search out and reveal the reasons why things are as we find them" (Allwood 1957, p. 93). This
attitude was unpopular with some of the reformist elements of the middle class. For example, Sundt and
folklorist Peter Christen Asbjornsen became embroiled in what the newspapers called the "porrige war"
(Hovde 1948, p. 747) in which Asbjornsen criticized the peasants' culinary customs as wasteful and in-
efficient while Sundt defended them. Similarly, Sundt's conclusions that peasant households were, by
and large, acceptably hygenic, was unwelcome to doctors who supported public health reforms. The political
support for Sundt's work declined and parliament terminated his stipends after 1869. Some administrators
argued that Sundt's demographic studies could now be taken over at less expense by the state bureaucracy.

Forced to take a more sedentary position as a parish clergyman, Sundt continued ethnographic work in
the district around his home. He had hoped that his work would be carried on by a junior colleague who had
already begun some minor studies. These plans were thwarted when the protege died in 1872, three years
before Sundt himself.

Sundt's demographic studies and his investigations of Gypsy culture has assured his place in the ranks of important early Scandinavian social scientists. Unlike Frederick Engels and Frederic Le Play, his more famous contemporaries, he did not participate in or cultivate a theory group or network of researchers which Nicholas Mullins (1973) argues is necessary for the development of the initial beginnings of a theoretical approach. Since Sundt wrote in a minor European language and only one of his works has been translated, there have been few opportunities for the diffusion of his ideas into the more central arenas of social science thought (Øyen 1968, p. 12). His anticipation of the network approach is but one example of the undeveloped potential of his research.

Footnotes

1. In their methodological paper on "The Intersection of Social Circles: A New Measure of Social Proximity in Networks" (1976), Alba and Kadushin clearly evoke Simmel without actually citing his work. They note that
    the degree to which the interpersonal environments of any two individuals overlap is a plausible measure of their proximity in terms of affiliation. The overlap of their interpersonal environments is a direct measure of the extent to which they are members of the same "crowd" or social circle (1976, p. 85).
    The measure which authors develop is a variant of the coefficient of similarity proposed by Jaccard in 1908 (Sokal and Sneath 1963, p. 129) which is computed by dividing the set-theoretic intersection of two social circles by set-theoretic union of the circles. The similarity of the circles then ranges between zero or no overlap and one, or complete overlap.
    See also Alba and More (1978) for a discussion of the measurement of "Elite Social Circles."

2. For a complete bibliography of Sundt's major works, see Vogt, 1968.

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HOW TO PREPARE CAMERA-READY COPY FOR CONNECTIONS

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NEW BOOKS

Howard E. Aldrich (Cornell). _Organizations and Environments_. Englewood Cliffs, New Jersey: Prentice-Hall, 1979. $14.95.

Both a text and a theoretical treatise, Aldrich argues "(1) that examining populations of organizations distinguished by common manifestation of some organizational form can lead to insights which studying individual organizations is not likely to yield; (2) that focusing on change of organizations is more likely to generate contextually rich explanations for the currently observed state or organizational affairs than is focusing on static structures; and (3) that the two procedures...are likely to generate research and theory of general sociological interest...". "Loose coupling" and inter-organizational networks are among the matters explored. (Excerpted from The American Journal of Sociology review, 5, 81 by John Freeman.)

Edna Bonacich (California-Riverside) and John Modell. _The Economic Basis of Ethnic Solidarity: Small Business in the Japanese American Community_. Berkeley: University of California Press. $16.50.

This book explores the relationship between class and ethnic solidarity. Using middleman minority theory, the authors analyze the history of the Japanese American community until the wartime evacuation. The study then turns to the second generation and analyzes the theory in more detail. (Publisher's blurb.)

G.P.A. Braam. _The Influence of Business Firms on the Government_. The Hague: Mouton, 1981. $26.00.

In this study, a new procedure—demonstrated by a sample of 130 business firms in the Netherlands—is outlined for observing as accurately as possible the actual influence processes, taking into account the absence of influence processes (non-decisions) as well. (Publisher's blurb.)

David Brown (U.S. Dept. of Agriculture) and John Wardwell (Montana State), eds. _New Directions in Urban-Renewal Migration: The Population Turnaround in Rural America_. New York: Academic Press, 1980. $29.50.

This book focuses on the determinants and consequences of the resurgence of population and economic growth in rural America, with investigations at the national, regional, and local levels.

The first three chapters document the decentralization of population and the economic activities that occurred in the 1970s. Public policy implications are identified and discussed. The next section, consisting of six chapters, examines the complex socio-demographic and economic conditions that sparked the turnaround. The authors deal primarily with the United States, but also give attention to the fact that similar developments have occurred in most developed and highly urbanized countries. The third section analyzes the impacts and implications of recent changes in mogration patterns in specific locales. In the context of low and stable birth and death rates, migration is foreseen as the primary source of population change within the United States during the remainder of this century. The final two chapters discuss data resources for population distribution research. (From publisher's blurb.)

Larry Brown. _Innovation Diffusion_. London: Methuen, 1981.

The concern of presenting a multifaceted, yet integrated picture of spatial aspects of the innovation diffusion process will be found throughout this book. Chapter 2 considers the antecedents of the present work. This includes a review of the various traditions of diffusion research in geography and an indication of how these reflect the broader trends of the discipline and social science in general. Chapters 3 and 4 present the market and infrastructure perspective, the first of these focusing on diffusion agency establishment, the second on diffusion agency strategy and innovation establishment. The structure of both these chapters is one that alternates a conceptual or theoretical statement with an illustrative case study from the United States. Specific innovations examined in this context include Friendly Ice Cream Shops, cable television, the bank credit card, Planned Parenthood affiliates and four agricultural innovations. Chapter 5 briefly summarizes the conceptual framework pertaining to that phenomenon. More important to the argument of this book, it also draws upon the market and infrastructure perspective to demonstrate communalities in the diffusion of technological and consumer innovations, and raises a new set of questions pertaining to the way in which technological innovations are made available to potential adopters. A review of the economic

history perspective is presented in Chapter 6. Chapter 7, the first dealing with the development perspective, demonstrates the applicability of the market and infrastructure perspective in a Developing or Third World setting. Two case studies are used in this respect: one on the diffusion of several crop innovations in an area of Kenya; another on the diffusion of commercial agriculture in an area of Mexico. Chapter 8 articulates the development perspective in a more conceptual manner, dealing among other things with equity aspects of innovation diffusion, particularly as they pertain to individual welfare and regional disparities. One case study of the diffusion of co-operatives in Sierra Leone also is presented. The concluding ninth chapter presents a brief summary of the material in this book and addresses its policy implications. (From Introduction.)

Dieter Ernest, ed. *The New International Division of Labour, Technology and Underdevelopment: Consequences for the Third World. Frankfurt am Main: Campus-Verlag, 1980.* $35.00.

This book reviews in detail some new forms and mechanisms of technological dominance/technological dependence confronting developing countries today as a result of the internationalization of capital. Its main focus is on identifying operational alternative policy approaches towards strengthening the technological self-reliance of developing countries. The contributions draw together material and analytical approaches relevant to the key areas of the dynamics of the presently evolving "New International Division of Labour, Technology and Underdevelopment". For each of these areas, issues for debate and research priorities are presented and discussed. (From publisher's blurb.)

Benjamin Gottlieb (Guelph), ed. *Social Networks and Social Support. Beverly Hills, California: Sage, 1981.*

CONTENTS: 1. Benjamin Gottlieb, Social networks and social support in community mental health; I: Social Support and Life Stress; 2. John Eckenrode and Susan Gore, Stressful events and social supports: the significance of context. 3. Manuel Barrera, Jr., Social support in the adjustment of pregnant adolescents: assessment issues; 4. Brian Wilcox, Social support in adjusting to marital disruption: a network analysis; 5. M. Robin DiMatteo and Ron Hays, Social support and serious illness; II. Social Network Analysis and Social Support; 6. Barton Hirsch, Social networks and the coping process: creating personal communities; 7. Barry Wellman, Applying network analysis to the study of support; 8. Benjamin Gottlieb, Preventative interventions involving social networks and social support; III. Blending Lay and Professional Resources: Prospects for the Provision of Human Services; 9. Peter Lenrow and Rosemary Burch, Mutual aid and professional services: opposing or complementary?; 10. Charles Froland, Diane Pancoast, Nancy Chapman and Priscilla Kimboko, Linking formal and informal support systems; 11. Roger Mitchel and Daniel Hurley, Collaboration with natural helping networks: lessons from studying paraprofessionals.

Hans Joachim Hummel (Duisburg), ed. *Anwendung mathematischer Verfahren zur Analyse sozialen Wandels. Duisburg: Verlag der Sozialwissenschaftlichen Kooperative.*

CONTENTS: 1. I Gadourek, Towards more realistic, more encompassing models of social change: some methodological dilemmas of the application of mathematical models to the study of ongoing change; 2. F. Nielsen, Dynamic analysis of electoral change: the Flemish movement in Belgium after World War II; 3. A.B. Sørenson, Career patterns and job mobility; 4. R.L. Hamblin and J.L.L. Miller, The diffusion of collective violence; 5. A. Diekmann, A stochastic version of the Pitcher-Hamblin-Miller diffusion model and some estimation problems; 6. K.G. Jöreskog, The LISREL approach to causal model building; 7. M. Nowaśkowska, A theory of social change.

Philip Mayer (Rhodes), ed. *Black Villagers in an Industrial Society: Anthropological Perspectives on Labour Migration in South Africa. Cape Town: Oxford University Press, 1980.*

CONTENTS: 1. Philip Mayer, The origin and decline of two rural resistance ideologies; 2. William Beinart, Labour migrancy and rural production: Pondoland c 1900-1950; 3. Andrew Spiegel, Rural differentiation and the diffusion of migrant labour remittances in Lesotho; 4. C.W. Manona, Marriage, family life and migrancy in a Ciskei village; 5. P. A. McAllister, Work, homestead and the shades: the ritual interpretation of labour migration among the Gcaleka; 6. M.C. O'Connell, Xesibe Reds, Rascals and Gentlemen at home and at work; 7. J.K. McNamara, Brothers and work mates: home friend networks in the social life of black migrant workers in a gold mine hostel.

NORG Working Bibliography on Neighborhood Issues. Bloomington, Indiana: Neighborhood Organization Research Group. 1981.

An annotated compilation of more than 200 articles, books and reports. Topics covered include neighbourhood organizational structures; neighbourhood definition; revitalization and displacement; historic preservation; neighbourhood change, planning and land use; neighbourhood quality; history of neighbourhood organizing.

Paul Oquist (Casa de Gobierno, Managua, Nicaragua). *Violence, Conflict and Politics in Columbia*. New York: Academic Press, 1980. $25.00.

Between 1946 and 1966, the Republic of Colombia was the scene of one of the most intense and protracted instances of widespread civilian violence in the history of the twentieth century. Known in Colombia simply as La Violencia, this social process left a toll of at least 200,000 fatalities, including 112,000 in the 1948-1950 period alone.

This book formulates an explanation of the appearance and subsequent development of La Violencia. What caused this violent process? What might account for its intensity, duration, and geographical distribution? These are the questions that have guided this study. The search for answers to these queries has also led to the tasks of seeking a rigorous description of the phenomenon to be explained; of specifying the socio-historic context of La Violencia, with regard both to previous instances of social violence in Colombian history and to the evolution of the nation's basic social structures.

This book is based on the first research project to deal with all of these questions and collateral task in an integrated fashion. The result of this approach has been the production of an approximate explanation of La Violencia that differs significantly from existing interpretations.

The violence of the 1946-1966 period is explained in this study as having begun due to intensive partisan rivalries. These sectarian conflicts were particularly acute since hegemonic, exclusivitic party politics has survived into an era in which the state had acquired such an importance in national life that no sector within the dominant groups of society would accept exclusion from state power and its benefits. The sectarian conflicts led to a decrease in the efficacy of the state to the point that one may speak of a partial collapse of the state. This in turn conditioned the simultaneous maturation into violent conflicts of an entire series of different types of social contradictions in those areas that were affected by the partial collapse of the state. This is what accounts for the intensity of the violence. (Publisher's blurb.)

Proceedings of the 1st, 2nd. and 3rd. Annual Conference on the Small City and Regional Community. Stevens Point, Wisconsin: UW-SP Press. 1980. $12.50.

All three conferences in one volume.

Gerda Wekerle, Rebecca Peterson and David Morley (York, Canada). *New Space for Women*. Boulder, Colorado: Westview. 1980. $29.75.

Articles by architects, planners, historians, psychologists, sociologists and urban activists examine how the existing design of homes, neighbourhoods, and organizations reinforces traditional sex roles. Alternative home and community designs to generate and support women's participation in the public sphere are discussed. The book also considers the emerging role of women as environmental activists and innovators—designing organizations, spaces, and services to support their changing lives. (From publisher's blurb.)

Papers include Sylvia Fava, Women's place in the new suburbia; Mary Cichocki, Women's travel patterns in a suburban development; David Popenoe, Women in the suburban environment: a U.S. – Swedish comparison; Judy Stamp, Towards supportive neighbourhoods: women's role in changing the segregated city; Richard Butler and Susan Phillips, Women at City Hall.

Janet Salaff (Toronto). *Working Daughters of Hong Kong: Filial Piety or Power in the Family?* New York: Cambridge University Press. 1981. $8.95.

This study of the effects of industrialization on family life in Hong Kong examines the lives of ten Chinese unmarried, employed daughters and their families. It focuses on the problems of women caught in intricate patterns of obligation to family, co-workers and peer groups. (Publisher's blurb.)

Janet Abu-Lughod (Northwestern). *Rabat: Apartheid in Morocco*. Princeton, New Jersey: Princeton University Press, 1981. $12.50.

(The author) argues that French colonial policies in Moroccan cities effectively segregated Moroccans from Europeans. She focuses on Rabat and on French colonization between 1912 and 1956, and accuses the French administrators of a 19th century racism concealed behind a rhetoric of 'respect for the natives'. (From publisher's blurb.)

Juan E. Mezzich and Herbert Solomon. *Taxonomy and Behavioral Science: Comparative Performance of Grouping Methods*. New York: Academic Press, 1980. $25.00

Evaluates quantitative taxonomic approaches and cluster analyses in a number of social science applications.

SPECIAL JOURNAL ISSUES

Abstracts from NETWORKS: AN INTERNATIONAL JOURNAL 11, No. 1, Spring, 1981

RYAN, Doris R. and Stephen CHEN (Bell Laboratories). "A Comparison of Three Algorithms for Finding Fundamental Cycles in a Directed Graph."

Given a connected directed graph and a spanning tree, we consider the problem of finding the set of fundamental cycles. In particular, for each cotree arc i and tree arc j, we need to know whether or not i and j are in the same fundamental cycle, and if so, whether or not arcs i and j are oriented in the same direction. This problem has application in primal network flow, longest cycle, and all-cycle algorithms. In this paper, we describe and compare three algorithms for finding fundamental cycles. Computational results are presented on a variety of directed graphs produced by a network generator. Although each of the algorithms has worst case complexity $O(kp)$, where k and p are the number of cotree arcs and nodes, respectively, a variation of a root traceback algorithm is shown to be the fastest in almost all cases.

COLBOURN, Charles J. (Toronto). "On Testing Isomorphism of Permutation Graphs."

A polynomial time algorithm for testing isomorphism of permutation graphs (comparability graphs of 2-dimensional partial orders) is described. It operates by performing two types of simplifying transformations on the graph; the contraction of duplicate vertices and the contraction of uniquely orientable induced subgraphs.

SMITH, J. MacGregor (Massachusetts), D. T. LEE (Northwestern), and Judith S. LIEBMAN (Illinois). "An o(n log n) Heuristic for Steiner Minimal Tree Problems on the Euclidean Metric."

An $O(n \log n)$ heuristic for the Euclidean Steiner Minimal Tree (ESMT) problem is presented. The algorithm is based on a decomposition approach which first partitions the vertex set into triangles via the Delaunay triangulation, then "recomposes" the suboptimal Steiner Minimal Tree (SMT) according to the Voronoi diagram and Minimum Spanning Tree (MST) of the point set. The ESMT algorithm was implemented in FORTRAN-IV and tested on a number of randomly generated point sets in the plane drawn from a uniform distribution. Comparison of the $O(n \log n)$ algorithm with an $O(n^4)$ algorithm clearly indicates that the $O(n \log n)$ algorithm is as good as the previous $O(n^4)$ algorithm in achieving reductions in the ratio SMT/MST of the given vertex set. This is somewhat surprising since the $O(n^4)$ algorithm considers more potential Steiner points and alternative tree configurations.

WEBER, G. M. (Christopher Newport College). "Sensitivity Analysis of Optimal Matchings."

After stating the weighted, perfect matching problem and briefly describing Edmonds' algorithm, certain postoptimality procedures are described. These procedures aid in reoptimizing related matching problems in which a few edge weights are altered. Regardless of the actual implementation of the matching algorithm used, when changing a single edge weight, the postoptimality procedures are on the order of cardinality (N) more efficient than solving the modified problem "from scratch," where N is the node set of the underlying graph.

BOESCH, Frank T. (Stevens Institute), and Frank HARARY and Jerald A. KABELL (Michigan). "Graphs as Models of Communication Network Vulnerability: Connectivity and Persistence."

It is well known that the maximum connectivity k of a graph G with p points and q lines is given by $\lfloor 2q/p \rfloor$. This is restated in two useful alternative forms which minimize q given p and k, and which maximize p in terms of q and k. We define the persistence of a graph as the smallest number of points whose removal increases the diameter. It is shown that the persistence of a graph of diameter d is the minimum over all pairs of non-adjacent points of the maximum number of disjoint paths of length at most d joining them. A similar result is obtained for line-persistence and it is shown that these invariants are independent of each other.

AKIYAMA, Jin (Nippon Ika), Frank BOESCH (Stevens Institute), Hiroshi ERA (Tokai), Frank HARARY (Michigan) and Ralph TINDELL (Stevens Institute). "The Cohesiveness of a Point of a Graph."

The connectivity contribution or cohesiveness of a point υ of graph G is defined as the difference $\kappa(G) - \kappa(G-\upsilon)$ where kappa is the usual connectivity symbol. It is shown that if a point υ of G has negative cohesiveness, then the set of points adjacent to υ is the unique minimum size disconnecting set of G. This theorem has several corollaries including the result that if υ has negative cohesiveness in G, then it does not in $\overline{G}$. Finally we define a cohesiveness triple (n_-, n_o, n_+) of a graph by taking these, respectively, as the number of negative, zero, and positive cohesiveness points of G. The necessary and sufficient conditions for an arbitrary triple to be the cohesiveness triple of a graph are derived.

AKIYAMA, Jin (Nippon Ika), Geoffrey EXOO, and Frank HARARY (Michigan). "Covering and Packing in Graphs IV: Linear Arboricity."

The linear arboricity of a graph is the minimum number of linear forests into which its lines can be decomposed. We find that the linear arboricity of every 4-regular graph is 3. This result enables us to obtain bounds for the linear arboricity of any graph in terms of its maximum degree.

DISCENZA, Joseph Henry. "A More Compact Formulation of the Symmetric Multiple Traveling Salesman Problem with Fixed Charges."

The multiple traveling salesman problem with fixed charges (MTSPF) is an extension of the standard traveling salesman problem (TSP). Previous work by Hong and Padberg showed how to transform to a TSP with $n + m + 4$ nodes, where m is the number of salesmen. The four extra nodes were included to prevent the transformed problem from escaping part of the fixed costs. This paper shows that two of these nodes can be eliminated without sacrificing the formulation of a TSP. Further, all four extra nodes can be replaced by a pair of simple constraints. All formulations produce equivalent solutions.

PLESNIK, J. (Komensky University). "The Complexity of Designing a Network with Minimum Diameter."

Given a graph G with edge lengths and costs, we wish to find a subgraph F of G which connects up all the original vertices and minimizes the maximum distance in F, subject to a budget constraint of the sum of the edge costs. In this note we establish NP-hardness for the design problem, even for the simple case where G is a planar graph with maximum degree 3 and the budget restricts the choice to spanning trees. Moreover, the problem of finding a near optimal subgraph F is also NP-hard.

PERL, Yehoshua (Bar-Ilan University and University of Cape Town) and Yaacov YESHA (Weizmann Institute of Science). "Mean Flow Scheduling and Optimal Construction of a Treelike Communication Network."

Horn's algorithm for weighted mean flow scheduling with treelike precedence constraints is reexamined. A new analysis of an efficient implementation of Horn's algorithm shows an $O(n \log n)$ complexity. This is an improvement on the known $O(n^2)$ complexity of this algorithm. An application of Horn's algorithm to a problem of optimal scheduling of a treelike communication network is presented.

Abstracts from the <u>JOURNAL OF GRAPH THEORY</u> 5, No. 2, Summer 1981.

ANDREAE, Thomas (Freie Universität Berlin). "On the Reconstruction of Locally Finite Trees."

We prove a theorem saying, when taken together with previous results of Bondy, Hemminger, and Thomassen, that every locally finite, infinite tree not containing a subdivision of the dyadic tree (i.e., the regular tree of degree 3) is uniquely determined, up to isomorphism, from its collection of vertex-deleted subgraphs. Furthermore, as another partial result concerning the reconstruction of locally finite trees, we show that the same is true for locally finite trees whose set of vertices of degree s is nonempty and finite (for some positive integer s).

GODSIL, C. D. (Montanuniversität Leoben, Austria) and I. Gutman (University of Kragujevac). "On the Theory of the Matching Polynomial."

In this paper we report on the properties of the matching polynomial $\alpha(G)$ of a graph G. We present a number of recursion formulas for $\alpha(G)$, from which it follows that many families of orthogonal polynomials arise as matching polynomials of suitable families of graphs. We consider the relation between the matching and characteristic polynomials of a graph. Finally, we consider results which provide information on the zeros of $\alpha(G)$.

JACKSON, Bill (Goldsmiths' College). "Long Paths and Cycles in Oriented Graphs."

We obtain several sufficient conditions on the degrees of an oriented graph for the existence of long paths and cycles. As corollaries of our results we deduce that a regular tournament contains an edge-disjoint Hamilton cycle and path, and that a regular bipartite tournament is hamiltonian.

YAP, Hian Poh (University of Singapore). "A Construction of Chromatic Index Critical Graphs."

We prove that if K is an undirected, simple, connected graph of even order which is of class one, regular of degree $\rho > 2$ and such that the subgraph induced by any three vertices is either connected or null, then any graph G obtained from K by splitting any vertex is ρ-critical. We find that various constructions of critical graphs by S. Fiorini are special cases of a corollary of this result.

BILLIONNET, Alain (Conservatoire National des Arts et Metiers). "An Upper Bound on the Size of the Largest Cliques in a Graph."

We produce in this paper an upper bound for the number of vertices existing in a clique of maximum cardinal.*
The proof is based in particular on the existence of a maximum cardinal clique that contains no vertex x such that the neighborhood of x is contained in the neighborhood of another vertex y.

*Also called maximum clique.

KIMBLE, Robert J., Jr. and Allen J. SCHWENK (U. S. Naval Academy) and Paul K. STOCKMEYER (College of William and Mary). "Pseudosimilar Vertices in a Graph."

Dissimilar vertices whose removal leaves isomorphic subgraphs are called pseudosimilar. We construct infinite families of graphs having identity automorphism group, yet every vertex is pseudosimilar to some other vertex. Potential impact on the Reconstruction Conjecture is considered. We also construct, for each n, graphs containing a subset of n vertices which are mutually pseudosimilar. The analogous problem for mutually pseudosimilar edges is introduced.

READ, R. C. and N. C. WORMALD (Waterloo). "Counting the 10-Point Graphs by Partition."

In this paper we discuss old and new theoretical methods for computing the number of graphs with a given partition. We also show how a judicious combination of these methods gives rise to a procedure that is sufficiently powerful to make possible the enumeration of all graphs on 10 points according to their partitions.

KLERLEIN, Joseph B. and A. Gregory STARLING (Western Carolina). "Hamiltonian Groups Are Color-Graph-Hamiltonian."

A group Γ is said to be color-graph-hamiltonian if Γ has a minimal generating set Δ such that the Cayley color graph $D_\Delta(\Gamma)$ is hamiltonian. It is shown that every hamiltonian group is color-graph-hamiltonian.

HOLT, D. F. (University of Warwick). "A Graph which is Edge Transitive but not Arc Transitive."

A graph having 27 vertices is described, whose automorphism group is transitive on vertices and undirected edges, but not on directed edges.

NEBESKY, Ladislav (Charles University). "Every Connected, Locally Connected Graph is Upper Embeddable."

In this Note it is proved that every connected, locally connected graph is upper embeddable. Moreover, a lower bound for the maximum genus of the square of a connected graph is given.

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deCAEN, Dom (Queen's). "A Note on Path and Cycle Decompositions of Graphs."

In the study of decompositions of graphs into paths and cycles, the following questions have arisen: Is it true that every graph G has a smallest path (resp. path-cycle) decomposition P such that every odd vertex of G is the endpoint of exactly one path of P? This note gives a negative answer to both questions.

RUIZ, Sergio (Universidad Catolica de Valparaiso). "On Strongly Regular Self-Complementary Graphs."

It is shown that certain conditions assumed on a regular self-complementary graph are not sufficient for the graph to be strongly regular, answering in the negative a question posed by Kotzig.

Abstracts from the JOURNAL OF MATHEMATICAL SOCIOLOGY 7, No. 1, 1980.

KINDERMANN, Ross P. (Nebraska) and J. Laurie SNELL (Dartmouth). "On the Relation between Markov Random Fields and Social Networks."

Holland and Leinhardt (1977a) introduced a continuous time Markov chain to model changes in a social network. Their model was further studied by Wasserman (1977). Holland and Leinhardt (1977b) have also proposed a general class of probability measures on random networks. The purpose of this paper is to show that these probability measures may be viewed as Gibbs measures induced by a nearest neighbor potential. As such they have a Markov field property which is a natural generalization of Markov chains to spatial situations. The dynamic models are shown to fit into a general class of Markov processes suggested by the study of interacting particle systems. A related "voter model" is discussed.

ROSENTHAL, Robert W. (Bell Laboratories). "New Equilibria for Noncooperative Two-Person Games."

New equilibrium concepts for noncooperative two-person games are introduced and examined. Although these equilibria coincide with the Nash equilibria in all constant-sum games, they differ significantly in other cases. In particular, for finite repetitions of the prisoner's dilemma, some cooperating strategy combinations become equilibria.

EVERETT, Martin (Oxford) and Juhani NIEMINEN (University of Oulu). "Partitions and Homomorphisms in Directed and Undirected Graphs."

Boyle has given a condition for defining a homomorphism in terms of minimal paths for undirected graphs. The purpose of such homomorphisms is to provide a simpler graph which will reflect the structure of the more complex graph, and thereby enable the researcher to make observations which may have been shrouded by a preponderance of nodes and edges. This paper develops Boyle's ideas and introduces further homomorphisms for directed as well as undirected graphs. The relationships between the various homomorphisms are also examined.

BRUMELLE, Shelly L. and Yigal GERCHAK (British Columbia). "A Stochastic Model Allowing Interaction Among Individuals and Its Behavior for Large Populations."

An important aspect of many societal and institutional processes is the way in which the involved individuals interact. Motivated by work of Conlisk (1976) we formulate a model which allows such interaction among a finite number of individuals. Conditions are established under which our model converges to an approximation suggested by Conlisk as the population becomes infinite.

KARMESHU (Delhi) and R. K. PATHRIA (Waterloo). "Stochastic Evolution of a Nonlinear Model of Diffusion of Information."

A theoretical method based on the concept of "system-sized expansion" is applied to a generalization of Bartholomew's model of diffusion of information in a population of size N. The model considers a combination of mass-mediated and interactively mediated messages, with the provision that the spreaders of information may not remain active for an indefinite period of time; it also takes into account the possibility that the parameters governing the process be time-dependent. Explicit expressions for the time evolution of the diffusion process (including the probability distribution of the relevant variable, its mean value and variance) are derived in the asymptotic regime $N \gg 1$. The nonlinear character of the model enables us to exploit our asymptotic expressions for studying finite-size effects as well; the resulting expressions turn out to be reliable for N as low as 10.

KARMESHU and R. K. PATHRIA (Waterloo). "Stochastic Evolution of Competing Social Groups."

A model is considered for a situation in which two social groups compete with each other, ultimately resulting in the possible suppression of one of the groups. Using the method of system-size expansion, an asymptotic analysis of the model, including the time evolution of both deterministic and stochastic aspects of the process, is carried out. The probability distribution of the maximum size attained by the weaker group, just before the commencement of its decline, is examined and the results are compared with the previous work of Osei and Thompson on the "supersession of one rumour by another." The present model, which generalizes the Osei-Thompson model in a number of ways, is also relevant to the problems of opinion formation and attempted conversion of people from one viewpoint to another.

FIKSEL, Joseph (Arthur D. Little, Inc.). "Dynamic Evolution in Societal Networks".

A societal network is defined to be a finite directed graph in which individuals are represented by nodes, and relations between individuals by labelled arcs. Each individual undergoes state transitions at discrete instants of time, so that the societal network may be thought of as a deterministic dynamic process. It is shown that the individuals of such a network may be divided into equivalence classes, so that the original network may be represented by a reduced network containing one node for each equivalence class. Similar results are obtained for a more general type of partition called a "class structure." The application of these concepts is illustrated in the context of "balanced" networks, which have either positive or negative relations between nodes. The long-run behavior of societal networks is then examined, and it is shown that any network will eventually reach either a stable state or a periodic pattern of state transitions. In the case of a probabilistic transition rule, it is proved that the long-run evolutionary pattern is independent of the initial state of the network. Finally, some potential areas of future work are suggested.

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ABSTRACTS

Abstracts from the special session on "Theory and Method in the Study of Economic Elite Structures" at the annual meetings of the Canadian Sociology and Anthropology Association, Halifax, May 28, 1981.

CARRINGTON, Peter J. (Toronto). "Anticompetitive Effects of Directorship Interlocks."

This paper reports evidence supporting the view that directorship interlocks are one means used by Canadian enterprises to co-opt their competitors and thereby reduce competition. The well-established but poorly understood relationship between industrial concentration and profits is partly explained by variation in the density of directorship interlocks among competing enterprises. This is demonstrated by regressions of industry profit margins on concentration and interlocking, using data from 1972 on most of the industries in the logging, mining and manufacturing sectors in Canada.

CARROLL, William K., John FOX and Michael D. ORNSTEIN (York). "Longitudinal Analysis of Directorate Interlocks."

The purpose of this paper is to provide some examples of the use to which longitudinal data on director-ship interlocks may be put. We have collected data for the years 1946-77 on the board memberships of the largest Canadian corporations, law firms, securities dealers, universities, hospitals, and business interest groups, and on top federal and provincial politicans and civil servants. The three sections of data analysis below deal, first, with the replacement of broken ties, second, with temporal changes in the overall density of the network of ties and in the density of ties among significant sectoral groups of firms, and, third, with changes in the "distances" among all firms and among groups of firms.

The analysis of replacement patterns speaks to the question of whether the network is constituted mainly of ties among specific pairs of firms or merely of ties formed by a particular groups of eligible individuals. The finding that most ties between particular pairs of firms are not replaced tells us nothing about changes in the overall density of ties, since it takes no account of new ties that do not replace previously broken ties. It is thus possible that the overall density of the network remains stable, increases, or decreases over the thirty-two years of this study. The second analysis section addresses this question by examining the density of interlocks over time. Also it looks at one particularly interesting firm, the Bank of Montreal, in detail and examines the continunity of ties in the network as a whole at ten year intervals.

The third section of analysis employs multi-dimensional scaling of the matrix "distances" among firms to obtain further measures of temporal change in the integration of the network and to examine changes in the relative centrality of groups of firms, as defined by industrial sector, nationality of control, and head office location. Changes in the relative positions of these blocks of firms bear no necessary relation to the results of the previous analysis of overall network density. The distance measures take into account "indirect" ties between pairs of firms with no common board memhers but which share members with some third company. Multi-dimensional scaling of the distances then provides for mappings of all the firms' relative positions that may be compared over time.

CORMAN, June (Toronto). "Structural Determinants of the Behaviour of State Corporations."

Numerous factors can potentially influence the behaviour of state proprietary corporations. These include: market conditions; state compared to private ownership; self-serving decision-makers, and govern-ment legislation. This paper examines the impact of market and ownership constraints on the behaviour of state proprietary corporations to shed light on the autonomy of decision-makers who act in ways which further their own particular interests.

Insights from research on private corporations and state action are combined to develop a model of the structural determinants of behaviour of state corporations. It is argued that state decision-makers, as well as private sector decision-makers, are structurally constrained to act within a narrow range of appropriate behaviours dictated by the system of market relations and ownership constraints. Government legislation can potentially restrict every aspect of corporate behaviour, but for the sake of brevity, this factor will not be considered.

GALASKIEWICZ, Joseph, Stanley WASSERMAN, Barbara RAUSCHENBACH, Wolfgang BIELEFELD, and Patti MULLANEY (Minnesota). "Corporate Control Through Board Interlocks."

Since the turn of the century, social scientists and interested observers of the business community have pondered the meaning of the board interlock (Fennema and Schijf, 1979). Numerous theories have been offered and thousands of dollars in research grants have been spent in trying to test hypotheses that would support or disprove pet theories . There will be no effort here to review the major findings in the field. Others before us have done this quite well (Aldrich, 1979). Our goals are (1) to present three theories that attempt to explain why an officer from a firm i is on the board of a firm j, and (2) to present data on a regional corporate interlock network to test each theory.

KOENIG, Thomas (Northeastern). "The Effects of Interlock Patterns on Political Contributions: Operationalizing the Interlocking Directorate Network."

To perform a corporate level statistical examination of contribution patterns requires two things. First, a situation must be found in which the exact contribution of the corporation can be measured...the Propositional elections in California provide data which allows the political role of the firm to be quantified.

The second prerequisite for a study directly applicable to the models is more difficult to achieve. Somehow the firms in the Fortune 500 must be divided into interest groups of tightly interlocked firms so that the political gifts from the directors in the group can be examined for evidence of intercorporate coordination. If the assumption that firms use interlocks to develop common policies is correct, then corporations whose leaders wish to maximize the effectiveness of their contributions should tend to coordinate their political activities with the firms to which they are most closely interlocked.

Three of the four models suggest the existence of such policy coordination through interlocks. Each of these, however, predicts a different pattern of interaction. Thus, an examination of interest group campaign contribution coordination patterns can provide an excellent method of testing the models.

The management control position leads one to expect little such coordination. If interlocks are seen as unimportant, they will not be expected to play a significant part in shaping corporate policy. The class hegemony model also suggests there should be few, if any, such interest groups. However, it predicts the existence of a corporate establishment of business leaders with common views on proper action. In general, according to this model, the firms that are most central to the interlock network should be most influenced by the network and therefore contain directors with the most similar contribution patterns. The leaders of the most connected firms should tend to be the opinion leaders of the corporate community.

The finance control model suggests the existence of groups of firms that coordinate their donations because they are all under the domination of a central unit: the bank. Bankers should not want the firms in their interest group to waste money by donating at cross purposes. Since competitive interest groups will take the opposite side on some issues, elections in which the issues divide the corporate community would be best for identifying bank-dominated interest groups.

The reciprocity model is ambiguous about the size of coordinating groups of corporations. Obviously, two firms are sufficient for reciprocity. However, reciprocity arrangements are far more socially significant when they involve a number of firms. A pair of firms lacks the political leverage of a larger group of coordinating contributors. Elite and Marxist theories of power in contemporary America assume the existence of groups of firms that cooperate to dominate the electoral process.

We find that we may well have two types of power flow through interlocking directorates. Firms interlock in order to coordinate policy as predicted by the reciprocity model. This is the only logical conclusion from the tendency of the more vulnerable firms to use interlocks to tie themselves to valuable sources of political leverage. Firms are likely to send their large contributors to sit on bank boards, implying the type of coordinating role of the financiers that the finance control model suggests. However, at the same time, we have found what appears to be a tendency for social network-based coordination. There is some interaction between these two networks, especially among the largest firms and the banks, but centrality clearly possesses a social dimension. It identifies a nationwide core corporate elite whose outside directors behave in similar ways. Further data is needed in order to examine the extent of this similarity.

NIOSI, Jorge (UQAM). "Elite Economique Ou Classe Dominante Une Analyse Comparative."

Plusieurs schémas théoriques ont été employés en sociologie pour classifier les grands groupes sociaux dans la populations d'une société globale. Parmi eux il y a les diverses théories des élites, de la stratification et des classes sociales. Au sein de ces théories l'on a utilisé divers concepts pour décrire le groupe social qui occupe les positions hiérarchiques dans le système économique: classe supérieure, bourgeoisie, élite économique, classe propriétaire et j'en passe. Dans chaque cadre conceptuel, la définition du groups social supérieur est évidemment fonction d'un ensemble plus vaste de critères qui servent à délimiter les différents groupes dans la société. Dès lors, toute analyse comparative des critères méthodologiques et théoriques qui découpent les groupes supérieurs dans les divers schémas, doit nécessairement faire référence à la classification globale impliquée.

Dans ce texte nour poursuivons un triple objectif. En premier lieu, is s'agit de comparer les versions les plus représentatives de la théorie des élites avec les principaux schémas sur les classes sociales qui apparaissent dans le matérialisme historique pour y dégager la définition et l'analyse des groupes sociaux hiérarchiques. En deuxième lieu nous critiquerons tant les théories des élites que plusieurs des modèles marxistes sur les classes. Enfin nous proposerons un schéma des classes sociales et de la classe dominante qui à la fois rende compte des principaux acquis des diverses théories et rencontre les conditions des définitions et des classifications scientifiques. C'est donc un exercice de théorie et d'épistéomolgique sociologiques que je propose ici.

AMINZADE, Ronald and Randy HODSON (Wisconsin). "Social Mobility in a Mid-Nineteenth Century French City: A Marxist Perspective". CDE Working Paper #79-50. 1980.

This paper explores changing patterns of class mobility in the city of Toulouse, France during the middle decades of the nineteenth century. Marxist categories are employed to map out mobility patterns across lo-cations in the social relations of production rather than across locations in status hierarchies. Mobility patterns are situated within the historical context of the changing social relations of production that marked the rise of early industrial capitalism. Data on patterns of intergenerational mobility derived from the marriage records of 1830 and 1872 are used to document the rigidity/fluidity of class boundaries at different points in time, the sources of recruitment of newly emerging working-class positions, and the impact of changes in production relations upon the character and meaning of mobility patterns. The final section of the paper explores the implications of our findings about changing mobility pattern for the analysis of class formation and class alliances.

BARNES, J.A. (Cambridge). "Kinship Studies: Some Impressions of the Current State of Play". Man, 5 (2): 293-303. 1980.

Although kinship was formerly a central category of anthropological analysis, since 1950 it has less often been the focus of study and its analytic utility has been challenged. Kinship terminology has become a so-phisticated area of specialization; relations between kin have been studied in a cultural rather than a social framework. Sociology and social anthropology have converged in their studies of law, religion, politics, and economics but have shunned each other in kinship studies, partly because of the relatively underdeveloped state of Marxist analyses. The revival of sociobiology has prompted anthropologists to waver from an exclusive preoccupation with culture, if only to preserve their stake in the social arena. The study of symbolic struc-tures has been intellectually rewarding but the time has come to resume what Lévi-Strauss postponed, the study of events, a task for which sophisticated mathematical tools are ready for adaption.

BEN-PORATH, Yoram. "The F-Connection: Families, Friends, and Firms and the Organization of Exchange". Population and Development Review 6 (1): 1-30. 1980.

The main theme of this essay is that the identity of the people engaged in a transaction is a major deter-minant of the institutional mode of transaction. Some transactions can take place only between mutually or unilaterally identified parties. Investment in resources specific to a relationship between identified parties can save transaction costs and stimulate trade. Such investment gives rise to what I call specialization by identity-concentration of exchange between the same parties—analogous to specialization by impersonal dimensions of transactions. The organization of activity is determined by the (implicit) attempt to benefit from the returns to scale on the personal and the impersonal dimensions of transactions and the interaction between these returns to scale. The degree to which identity domenates or is subsumed under the impersonal dimensions of specialization shapes the type of transaction or contract. The family is the locale of transactions in which identity dominates; however, identity is also important in much of what we consider the "market", and in fact, recent developments in economics can be interpreted as a departure from impersonal economics.

In recent years economists have devoted extensive efforts to analyzing aspects of family or household behavior using the ordinary tools of price theory and have emphasized the applicability and transferability of this mode of analysis to the nonmarket sector. I do not wish to abandon this approach but to add to it the transactional characteristics. Within this broader framework, one can analyze the transactions in which families have an advantage over other institutions, the conditions that make families of various types more or less efficient than the alternatives in any given transaction, the sorting of individuals into families, and the implications of family membership for transactions with others.

The main question is how political actions can constrain the influence of economic conditions on leadership system composition. The deterministic view that economic pressures are bound to result in a secular trend toward the increasing importance and influence of specialized elites assumes that the established political leadership is powerless to prevent this systemic change. This assumption upholds the primacy of economic forces over the political interests of the leadership, who will be swept away by the current of technological progress. It is possible, however, that other policies and other changes, such as the importation of new technology or the decentralization of the economic sector, may be sufficient to provide the conditions necessary for an economy productive enough to maintain the professional political elite as the controlling element in society. Decisions in regard to the system's evolution would then be in the hands of the political leadership, including the decision as to the place of the specialized elite sub-sets in the system. Indeed, as Robert Putnam observes, political elites act as "gatekeepers" in determining access to the decision-making process. This is especially the case in closed, one-party dominated systems, such as the East European states. Under such circumstances, the inclusion of the technical and managerial elites in the political process is not the result of some growing "economic imperative," but of political evaluations and responses to society's and the leadership's interests and needs.

In order to rest these two competing views of elite recruitment we need to turn to an empirical assessment of elite composition in communist states. This study examines the changes among the national elites of the East European states in the 1954-1971 period. It first looks at the direction and extent of transformation among the elite. The focus is on both the professional political cadres and the elite sub-sets with experience in the specialized areas of socio-economic activity. The aim is to assess whether adaptation to modernity in communist systems has involved a shift within the leadership structure from emphasis on political skills to rational-technical knowledge and experience. In addition, we will look at the sources of change and their impact on the pattern of transformation among communist elites.

The questions raised in the article are: How does the growth in services that typically accompanies economic development affect the lines of differentiation in the social structure and the integration of the various segments of society? Has this change in the economy increased or decreased social heterogeneity and inequality? Has it led to more or less crosscutting of various dimensions of differentiation? For example, has it weakened or strengthened the relationship of occupation to race and to income? Does it imply further fragmentation of society or stronger intergroup relations among its classes and other segments? Applications of a macrosociological theory of social structure (Blau, 1977) suggests answers to these questions. After the gist of that theory is presented, American trends will be examined in order to infer how the growth in services has affected heterogeneity, inequality and the crosscutting of various forms of differentiation. The theory implies that most of the service-growth-engendered structural changes, which tend to make distinct lines of differentiation more orthongonal and intersecting, promote integrative relations among diverse groups and strata. The research needed for testing the theoretical inferences will be briefly indicated in conclusion.

The vast body of literature up to 1970 on fascist movements in Europe in the mid-war years, ranged from biographies on fascist leaders, traditional historical narrative accounts and detailed studies on fascist ideologies.

The Berlin Document Center has stored millions of membership cards of the NSDAP, hundreds of thousands of SS- and SA- files and of other followers of the Nazi movement. Even if one uses sampling techniques, which are not very common among historians, the German files are of such a magnitude that shifting through and systematizing them, represents a workload requiring considerable resources over a period of several years.

The project reported on here, was to a great extent a result of an extreme good data basis. In Norway, the Court Proceedings on war collaboraters after the war have produced an archive of documents of 92,000 cases investigated by the police in the period 1945-1950. For each of these cases, the essential vitae of each member is given, such as the date of birth, the place of birth, occupational status, date for joining the Norwegian Nazi party - Nasjonal Samling - and conviction, if sentence was passed.

In 1969, steps were taken for the transfer of this information on the Nazi members in the file (not all were NS-members, a lot were economic fortune hunters or war criminals) to computer-readable cards, giving the essential vitae of each NS-member. This process of data-transfer including data-clearance, coding, etc. took several years, and was done mainly by employing a group of 20 students for the hard work.

The result was, however, highly stimulating: a research tool represented by an EDP-file of 54,651 registered members of the Nasjonal Samling during its period of existence from 1933 to 1945.

BOYD, John Paul (California-Irvine) 1980. "Three Orthogonal Models of Adoption of Agricultural Innovation." *Rural Sociology* 45 (2): 309-324.

The polynomial form of least squares regression analysis is beset by two major problems when it is used to study curvilinear relations: (1) ambiguous interpretation on the theoretical side, and (2) multicollinearity on the statistical side. This paper specifies the problems in terms of Cancian's theory of the curvilinear relation of economic rank and adoption of agricultural innovations; and solves them by using the first three orthogonal polynomials in the regression analysis. The approach described permits independent specification of the three components of the theory: a linear relationship between rank and adoption, a U-shaped quadratic model, and a one-hump cubic. Statistical support was found for the linear and cubic models but not for the quadratic. A second test using the paired comparison t-test was made on the hypothesis that the cubic term was strong enough to produce an absolute dip in the overall curve. This, too, was statistically significant and overcame possible objections to the particular interval scale used in this study.

BURT, Ronald S. (California-Berkeley) 1979. "Relational Equilibrium in a Social Topology." *Journal of Mathematical Sociology* 6: 211-252.

The purpose of this discussion is to transform the implicit equilibrium assumption endemic to network analysis into an explicit instrument for such analysis. I propose a formal model that brings together Coleman's restriction of Walras' general equilibrium model and recent developments in describing the "social topology" of a multiple network system of actors such that a class of relational equilibria is defined. The specific equilibrium expected in a system is a function of the previously existing stratification of actors in the system. Corresponding to multiple observed networks, the model generates multiple equilibrium networks. The structural analysis of the observed networks can therefore be repeated on the equilibrium networks so as to assess the extent to which the analysis would differ if the observed relations were actually in an equilibrium state. Numerical illustration is provided by an analysis of alternative relational equilibria in the system of elite experts in methodological and mathematical sociology as such a system existed in 1975.

BURT, Ronald S. (California-Berkeley), Katharyn L. LIEBEN (SUNY-Albany) and Michael G. FISCHER (California-Berkeley). 1980. "Network Power Structures from Informant Perceptions". *Human Organization* 39 (2).

The purpose of this paper is to suggest the use of ersatz network data. Gathered from interviews with a small number of strategically selected informants, ersatz network data provide an inexpensive picture of community structure. Based on interviews with up to seven informants in each of 51 cities representative of the distribution of the population in the United States, we generated an ersatz network "power structure" for each city. Our basic concern here is to answer the following question: How accurate are these network data obtained from interviews with such a small number of informants? We consider both random and systematic error in the data. The data are demonstrated to be both efficient and reliable. We close with comments on selecting informants based on a comparative analysis of the 51 ersatz structures. If it is available, of course, the detailed information traditionally obtained in a case study of community structure is preferable to the ersatz network data we discuss here. Our only purpose is to suggest the use of ersatz network data as a means of capturing, very inexpensively, the basic features of overall community structure as a complement to a detailed description of some more-focused aspect of the community such as a single policy or a neighborhood. A discussion of the obvious utility of ersatz network data for comparative network analyses of community structure is given by Burt (1979a). Pursuant to our intracommunity concerns, we begin by explaining how the proposed network data are ersatz.

CHASE-DUNN, Christopher K. (Johns Hopkins) 1980. "Socialist States in the Capitalist World-Economy". *Social Problems* 27, (5).

Recent developments in the Marxist theory of the state and the emerging world-system perspective cast new light on the nature of the contemparary "socialist"states and their role in the larger capitalist world-economy. This essay reviews these theoretical developments, discusses the nature of socialism as a socio-economic system, and suggests a reinterpretation of the history of the countries in which socialist movements have taken state power. I consider the socialist states to represent the intentional logic of socialism, much as labor unions and workers' parties do. But I argue that they have not been able to successfully create a fully institutionalized socialist socioeconomic system because the forces of the capitalist world-economy have shaped the socialist states so that they now play a functional role in the reproduction of capitalism. I discuss the implications of this development for the transition to socialism on a world scale.

CONWAY, Dennis, (Indiana) and Juanita BROWN (NTL Institute for Applied Behavioral Sciences) 1980. "Intraurban Relocation and Structure: Low-Income Migrants in Latin America and the Caribbean." Latin American Research Review 15(3).

In our alternative model, while both the processes and patterns of intraurban relocation are considered, stress is on the relations of this migrant behavior and the intraurban structure as it evolves through phases of sustained urbanization. The construct is based on the character of the migrant's decision-making process and takes into account his attitudes toward relocation, his aspirations, and his group identity and affiliations. Furthermore, the construct accommodates for the societal, economic, and institutional constraints that influence the migrant's geographical routes through the urban system. While acknowledging that "institutional" forces, such as the organization of economic production, the circulation of capital in the formal and informal sectors, and the prevading interests of capitalism that interpenetrate public policy may be important structural determinants in the evolution of the urban system we feel it is appropriate here to model the relocation decision-making behavior as it relates to a generalized evolutionary pattern of urban areal expansion and provide an alternative model to that proposed by Turner. Since our proposed model considers the evolution of low-income settlement patterns as an integral element in the alteration of the geographical routes migrants take into and through their urban environment, it is believed to have utility for developing countries in Latin America and the Caribbean with longer histories of sustained urbanization than Peru, the country whose experience underwrote the Turner thesis.

This treatise is is two parts. First, the evolutionary model is presented and depicted as a set of changing relations between the intraurban relocation of low-income migrants and intraurban structure during three phases of sustained urbanization early continuing, and later phases. Then, utilizing analyses in Mexico City and Port of Spain, Trinidad, empirical evidence is presented to support two of the major themes of the model; one concerned with the evolution of the intraurban structure and its impact on redirecting initial settlement, the other concerned with the continuing role of group and kinship ties in shaping the process of relocation.

COHEN, Abner (London) 1980. "Drama and Politics in the Development of a London Carnival." Man 15(1): 65-87.

The potentialities of the dramaturgical approach to the analysis of links between cultural forms and political formations are explored in the course of discussing a carnival movement in different stages of development, within a complex industrial society. The part played by various individuals and groups in these links is analysed. Leadership is seen as a process by which a collectivity mobilises, revives, modifies, creates and integrates various cultural symbolic forms derived from different cultural and artistic traditions, to deal with changing economic-political conditions. An attempt is made to show how political strategies are melted into a cultural movement and fused with the activities and emotions of people, to produce potent cultural symbols that exist in their own right and are irreducible.

CORNELL, Bradford and Richard ROLL (California-Los Angeles) 1981. "Strategies for Pairwise Competitions in Markets and Organizations." Bell Journal of Economics 12: 201-13.

This paper builds on the theory of pairwise competitions developed by mathematical biologists. After describing the basic model, the results are extended to cover problems related to organizations and markets.

Of particular interest is the role of "uncorrelated asymmetries" in conflict resolution. It is shown that utility maximizing individuals of equal ability may settle conflicts for power within an organization on the basis of characteristics which are uncorrelated with performance. Such a strategy turns out to be optimal for both the individual and the organization as a whole, because it permits the resolution of conflicts without the investment of resources. It is possible that seniority systems are the result of such strategies' being employed. The theory then explains the persistence of seniority systems and supports the intuitive argument that internal strife is reduced by settling disputes on the basis on seniority.

It is argued also that uncorrelated asymmetries may persist, even when there are differences in ability that could serve to resolve conflict on a seemingly more "rational" basis. If ability is detectable without error in the sense that every pair of contestants can be ranked unambiguously, then no uncorrelated asymmetry will be employed. However, if abilities are uncertain or hard to measure without error, the best strategy may be to use a combination of perceived (estimated) ability and an uncorrelated asymmetry. We predict, for example, that seniority will be employed to resolve conflict for promotion in organizations where there is no connection between experience and ability and in organizations where the connection is very strong more frequently than in organizations where there is a medium degree of relatedness.

A biological conflict model was employed also in an asset market context to show how investors should adopt differing trading strategies. Some traders will expend resources in an effort to forecast prices, and others will simply trade without any attempt at "analysis." Given information processing costs, a stable proportion of the population will pursue each strategy. An economic equilibrium will result when the expected payoffs to both strategies are equal and when no individual not already trading has an incentive to begin with either strategy.

Many extensions of the simple models discussed here can be imagined. In the uncorrelated asymmetries model, a formal extension to uncertainties about ability would be desirable as such an extended model should apply to many varieties of human conflict.

The market application can be extended also. In principle, if multilevel securities analysis were permitted, instead of just the two levels used in the illustration here, a fairly realistic depiction of actual asset market operations should be obtained, and it might be tested with data about the distribution of actual expenditures on analysis.

DELACROIX, Jacques (Associates for the Study of Society, Economy and Trade) and Charles C. RAGIN (Indiana) "Structural Blockage: A Cross-national Study of Economic Dependency, State Efficacy, and Underdevelopment". American Journal of Sociology 86 (6): 1311-47, 1981.

This cross-national study of the effects of dependency and state efficacy on development supports the "structural blockage" argument of dependency theory. According to this argument, international economic dependency impedes development in the more advanced countries of the periphery of the work capitalist system. In support of this argument , we show that two forms of participation in the world economy, the export of a small number of commodities and the export of primary products, obstruct development in advanced peripheral countries. The argument that these forms of participation in trade pose internal, structural obstacles to development is supported be evidence showing that state-sponsored institutional transformations outweigh the development-stunting influence of these forms of participation. On the basis of these findings, we argue against the divergent-development thesis implied in some dependency arguments.

DOREIAN, Patrick (Pittsburgh) "Linear Models with Spatially Distributed Data: Spatial Disturbances or Spatial Effects?" Sociological Methods and Research 9 (1): 29-60, 1980.

This article deals with linear models for which data have been aggregated over well-defined geographic areas. Such data may be generated by spatial processes, and these may be represented in the form of spatial autocorrelation in the disturbance term or directly in the form of a spatial effect. This article details the derivation of Ord's (1975) MLE procedure for the spatial disturbances model and contrasts it with this MLE procedure for the spatial effects model. These alternative model specifications and estimation procedures are then illustrated by a variety of examples. These MLE procedures for the spatial models are also contrasted with conventional regression procedures (which ignored geographical space). If there is spatial autocorrelation present, an MLE procedure is preferable.

ENNIS, James G. (SUNY-Plattsburg) "Blockmodels and Spatial Representations of Group Structure: Some Comparisons". 1981.

Demonstrating the systemic properties of groups has been a persistent concern of sociologists. We have sought social structure in fundamental relations underlying observed reality, and have sought to display the pattern of these relations in interpretable and economical form.

Two approaches to these tasks will be reviewed below. The first represents structure in terms of underlying dimensions which are used as axes for geometric representation. The second uses a set of algebraic methods to aggregate individuals and to examine the relations among these aggregates across a range of types of social ties. The complementarity of these approaches will be demonstrated by the analysis of an illustrative small group.

The choice between these methods rests on a judgment of the adequacy of metric distance to represent social distance, or more generally, the features of relations appearing in the original data.

The main weakness of spatial representations is that they do not represent meaningful asymmetries in the data that are of sociolgical interest. In this case, the analogy to physical distance may be misleading. An essential property of metric space is symmetry (McFarland and Brown, 1973), while it is the asymmetries of social distance according to power, status, affect and so on, that are its distinguishing features (Levine, Carter and Gorman, 1976, p. 839). Insofar as relational measures tap these sociological variables, spatial representations will be to some degree inadequate (but see Jones, in press).

For blockmodel analysis, the chief weakness of spatial representations is that the network structure of the original data is not recoverable. Conversely, a major advantage of blockmodel analysis is its ability to demonstrate the specifics of the concrete relations among blocks, across multiple relations. Blockmodel analysts return to the original, nonsymmetric matrices, preserving asymmetries for analysis.

However, detail is also sacrificed in the reduction of the original relational matrices to binary form, and in the discrete assignment of individuals to blocks. It is here that spatial representations provide a useful complement to blockmodels, by demonstrating the marginality or centrality of given individuals to blocks, and the overall spatial configuration of blocks. Nevertheless, the loss of detail in blockmodel representations is offset by the demonstration of an overall pattern of cliques within hierarchy, which would not have been discernable from the spatial representations alone. The key to this result lies in defining a new level of analysis, relations among aggregates, and in seeking regularities at this level.

ERBRING, Lutz (Michigan) and Alice A. YOUNG (Carnegie-Melon) 1979. "Individuals and Social Structure: Contextual Effects as Endogenous Feedback." Sociological Methods and Research 7(4):396-430.

Treatments of contextual effects in the social science literature have traditionally focused on statistical phenomena more than on social processes. Typically, the existence of contextual processes has been inferred on the basis of "group-level" effects (as contrasted with "individual-level" effects). This article seeks to redress that imbalance by focusing on underlying processes through which social structure and social interaction may impinge upon individuals. Four alternative generating mechanisms for contextual effects are discussed, along with their implications for model specifications and estimation: only one of these, however, is found to be compatible with the notion of modeling individual outcomes as a result of group processes (endogenous feedback). Methods for consistent parameter estimation in endogenous feedback models are presented, based on maximum likelihood estimators for models with lattice autoregressive error structures. Moreover, since the latter often arise by failure to specify contextual processes explicitly, conventional statistical definitions of contextual effects are shown to be confounded with the resulting specification bias.

ERICKSON, Bonnie H. (Toronto) 1981. "Measuring Aspects of Network Structure: Resistance Problems in Block-modelling." Paper presented to the Annual Meeting of the Canadian Sociology and Anthropology Association at Halifax, May 28-31.

Current models of network structure have been evaluated in many respects, from their conceptual foundations to the efficiency of their computing algorithms. Yet there has been little work on one topic, resistance, which is a potential problem for network analysis just as for the more well reserached areas such as multiple regression. Here I will point out the importance of resistance by giving some real and hypothetical examples of problems that can arise when non-resistant methods are used for social networks; I will remind the reader that existing methods include some relatively resistant options that have been less often used than they should be; and I will suggest some strategies for checking an analysis for possible problems rooted in non-resistance. For the sake of simplicity I will deal only with blockmodels derived through hierarchical clustering, though similar problems arise when blockmodels are found by other means or when cliques rather than blocks are identified.

FARARO, Thomas J. (Pittsburg). 1981. "Social Activity and Social Structure: A Contribution to the Theory of Social Systems." Cybernetics and Systems: An International Journal, 12:53-81.

This paper shows how recent work on action theory helps to provide a stronger foundation for social system theory. The paper first provides a critical overview of sociological frameworks for developing social systems theory, including one formal theory. Then the notion of a "scheme of activity," appearing in the conceptual framework of that theory, is analyzed from the standpoint of action theory. In particular, recent work using hierarchical production systems is employed to show that a scheme of activity is a formal language of interaction. On this foundation, the logical construction of social structure concepts is shown, using graphs, and a concluding discussion emphasizes the need for further research on institutional systems.

FISCHER, Claude S. (California-Berkeley) 1981. "The Spread of Violent Crime from City to Countryside, 1955 to 1975." Rural Sociology 45(3): 416-434.

This paper addresses the issue of whether cultural differences between communities of varying degrees of urbanism are declining in modern society, taking as a case in point acts of violent crime. I will contend that, contrary to "massification" theories, between 1955 and 1975 differences in rates of criminal behavior between large and small communities actually increased, and furthermore, the pattern of changes in consistent with a specific alternative theory about urban-rural differences. This theory holds that cultural change is continually generated in major urban centers, diffuses to smaller cities and thence to the rural hinterland. Part I of this paper presents the empirical material on criminal behavior, largely consisting of national crime data aggregated to the level of categories of communities and of California crime data aggregated to the level of specific counties. Part 2 of the paper turns to more speculative concerns, discussing the extent to which crime is a cultural phenomenon and presenting more fully a theory of urban-to-rural diffusion, a theory suggesting cyclical patterns that are hinted at – but by no means proven – in the crime data.

FOSTER, Brian L. (Arizona State) and Stephen B. SEIDMAN (George Mason) 1980. "Network Structures Derived from Collections of Overlapping Subsets." Paper presented at the Annual Meeting of the American Anthropological Association, Washington, D.C., December.

Outline of Contents I. Introduction
                         A. The problem with dyadic analysis of urban social structure
                         B. Groups and non-groups in urban areas

          II. A hypergraph approach to collections of subsets
                         A. The distinction between dyadic and subset analysis
                         B. The advantages of hypergraph analysis
                             1. Emergent subsets
                             2. Differentiation of individuals' social potential

         III. Discussion: A hypergraph model of urban structure

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FOX, John (York). 1980. "Effect Analysis in Structural Equation Models: Extensions and Simplified Methods of Computation." Sociological Methods and Research 9(1): 3-28

One of the great virtues of structural equation models is that they permit the quantification of casual and noncasual sources of statistical relationship. The present article discusses efficient matrix methods of computation for effect decomposition and extends these methods to models with unstandardized variables and to nonrecursive models. An appendix includes a computer program, written in APL, which implements the techniques described in the article.

FRANCK, Karen A. (Institute for Community Design Analysis) 1980. "Friends and Strangers: The Social Experience of Living in Urban and Non-urban Settings." Journal of Social Issues 36(3).

Two types of urban social experience are distinguished: contacts with friends and contacts with strangers. Traditional theories of urban life have concentrated on contacts with strangers, which for the most part are impersonal. This has led to the popular view that urban residents are socially isolated even though much of the available evidence on friendship contradicts this. This paper reports a study of new-comers who moved either to New York City or to a town of 31,000. The findings indicate that once the new-comers had lived in the new environment seven or eight months, there were no differences between the two groups with respect to number of friends or frequency of contact with friends. However, the urban group did experience greater difficulty in forming friendships than the non-urban group. It is suggested that the greater feelings of fear and distrust reported by the urban newcomers were the reason for this difficulty. Thus, it is possible that community size affects friendship in a way that has not previously been explored: fear, distrust, and other aspects of encounters between strangers in a city may make the transition from stranger to friend more difficult than in a smaller community.

FRANK, Ove (Lund) 1981. "Random Regions in the Plane." Paper presented at the Graph Theory Conference dedicated to the memory of Professor Kazimierz Kuratowski, Lagow, Poland, February 10-13.

Statistical analysis of empirical regional maps can be based on data on the areas and perimeters of the regions, the number of contiguous regions to each region, the number of points where three different regions meet, and so forth. We investigate a regional map obtained according to the following model. Each square in a regular square lattice is given a color according to a common probability distribution. Contiguous squares of the same color make up the regions. By using results for planar graphs, we estimate the expected number of regions in the random map and some other quantities of statistical interest. We also comment upon how the choice of a probability distrubution can be made to fit the model to an empirical map.

Two papers by FRANK, Ove (Lund) and Frank HARARY (Michigan). "Maximum Triad Counts in Graphs and Digraphs." Journal of Combinatorics, Information & System Sciences 5 (1): 1-9. 1980.

A triad in a given graph or digraph is an induced subgraph of order three, and a triad count is the frequency of a certain triad among all the triads. For each distinct triad, we investigate the maximum triad count in the class of graphs or digraphs of order N. There are four distinct graph triads and for each of them we give the maximum triad count and the corresponding extremal graph. There are sixteen distinct digraph triads, and we show that it is sufficient to consider eight of them. For five of these we give the maximum triad counts and the extremal digraphs. For the other three we give upper and lower bounds to the maximum triad counts.

1981. Unpublished Manuscript. "Cluster Inference by Using Transitivity Indices in Empirical Graphs."

A randon graph model is introduced for similarities observed between the objects sampled from an unknown cluster structure. We investigate this model and show how some common transitivity indices in empirical graphs can be used for making statistical inferences about cluster structures.

FRANK, Ove and Klas AVENSSON (Lund). 1981. "On Probability Distributions of Single-Linkage Dendrograms." Journal of Statistics and Computer Simulation 12:121-31.

There are $\binom{N}{2}$! ways to order the pairwise similarities between N objects, assuming no ties. According to single linkage (SL) clustering, each such order determines a dendrogram for the N objects. We give an algorithm for calculating the number of different SL-dendrograms on N objects. We also give an algorithm for calculating the probability distribution of the SL-dendrograms under pure randomness, i.e. assuming that all the similarity orders are equally probable. The results are used to illustrate the statistical risks for small values of N, when SL-dendrograms are used to test cluster structure hypotheses.

FRANK, Ove. 1981. "Comment on Holland and Leinhardt." Journal of the American Statistical Association 76 (March): 58-59.

One should search for an expotential model for adjacency data in digraphs that is more general than the HL, Bradley/Terry, and Kousgaard models, so that it would be possible to test any of these models against an appropriate specification of a general model. An attempt to link the HL model with the Bradley/Terry and Kousgaard models might also be of some help for the rather frustrating task of trying to find an appropriate Z in formula (61) of HL.

FREEMAN, Linton C. (California-Irvine) "The Gatekeeper, Pair-Dependency and Structural Centrality". *Quality and Quantity* 14: 585-92. 1980.

This is a note to introduce a new measure of a kind of structural centrality called pair-dependency. Pair-dependency explicates the centrality-related notion of the gatekeeper. Moreover, it turns out to be a fundamental structural property of communication networks that provides the basics for the derivation of two standard measures of structural centrality.

GRIFFITH-JONES, Stephany (Institute of Development Studies) 1980. "The Growth of Multinational Banking, the Euro-currency Market and their Effects on Developing Countries." *Journal of Development Studies* 16 (2).

This paper describes the recent rapid growth of transnational banking and lending, as well as its causes. Since the early seventies, a growing proportion of this lending has been oriented towards developing countries. The principal causes for this trend are outlined, and the changes in the mechanisms of the 'Euro-dollar market' which made access to it easier for developing countries are described. The trends prevailing in developing countries' financing throughout the seventies are then examined. Finally, the economic and political effects of the rapid growth in lending by private banks to the Third World are discussed.

GRUENBERG, Barry (U.S. General Accounting Office) 1980. "The Happy Worker: An Analysis of Educational and Occupational Differences in Determinants of Job Satisfaction." *American Journal of Sociology* 86(2)

Two types of explanation for the generally high level of job satisfaction reported by workers holding manual or routine jobs are distinguished on the basis of the degree to which they emphasize the values and needs of such workers as opposed to relying upon the worker's accommodation to limited job opportunities. The former, "dispositional," approach involves theoretical assumptions compatible with a Durkheimian social theory; the "situational" approach is characteristic of a more Marxian set of theoretical assumptions. Data from a national sample of workers are analyzed to show that perceived intrinsic and extrinsic sources of satisfaction have powerful effects on overall job satisfaction irrespective of educational background and that intrinsic satisfaction is a powerful determinant of overall satisfaction among members of all occupational groups, while extrinsic sources of satisfaction vary in importance among different groups. Extrinsic satisfaction is shown to be much more important as a determinant of overall satisfaction among unskilled, semiskilled, and clerical workers than it is among skilled and professional workers, a finding that is interpreted as reflecting the differential in opportunities for intrinsic satisfaction associated with each group. More generally, the findings support the Marxian rather than the Durkheimian model.

HALLINAN, Maureen T. and Edwin E. HUTCHINS, (Wisconsin-Madison) 1980. "Structural Effects on Dyadic Change." *Social Forces* 59 (1)

This paper examines the effects of intransitivity on change in friendship relations. A distinction is made between salient and nonsalient intransitivity; when triplets are used as the unit of analysis, this distinction clarifies the implications of intransitivity effects for balance theory. Longitudinal data from ten classes of fourth, fifth, and sixth grade students are analyzed using a binomial logit model. The results show that salient intransitivity has a strong effect of friendship change; the magnitude of this effect depends on the structure of the friendship dyad. Nonsalient intransitivity has a weaker effect, which is significant only for certain dyad structures. The effects of sex and classroom organization also depend on dyad structure. Hypotheses about the interaction between tendencies toward reciprocity and balance are tested. The results support a balance interpretation of the effect of intransitivity on change in friendship relations, and suggest that this effect involves both intra- and interpersonal mechanisms: a tendency to restore psychological balance and a peer influence process.

HAMMEL, E.A. (California-Berkeley) 1980. "Household Structure in Fourteenth-Century Macedonia." *Journal of Family History* 5(3)

The purpose of this anthropological excursion into the fourteenth century is to analyze the kinship structure of a brief but unusually detailed list of households from that part of medieval Serbia now known as Y goslav Macedonia. The analysis raised interesting methodological questions related to the interpretation of similar data from medieval Serbia, and from other regions and other countries. Further, the results of the analysis contain some surprises, because the households analyzed here are in several ways quite unlike what one might have expected in that time and place. The methodological and substantive issues are intertwined, but both are best approached by considering the background of substantive expectations about the nature of social organization in the Balkans.

HARARY, Frank and Helene J. KOMMEL (Michigan) 1979. "Matrix Measures for Transitivity and Balance." *Journal of Mathematical Sociology, 6: 199-210.*

Our object is to develop matrix formulas for measuring transitivity in digraphs and balance in signed graphs or digraphs. The transitivity ratio is introduced giving the probability that a 2-step path will be completed to a transitive triple. As it is not feasible to enumerate all cycles in a signed graph or digraph, restrictive degrees of balance are considered which involve only small cycles.

Two papers by: HIRSCH, Barton J. (Stanford) 1981. "Coping and Adaptation in High-Risk Populations: Toward an Integrative Model." *Schizophrenia Bulletin 7(1): 164-72*

The identification of factors that promote health in high-risk populations could increase our ability to understand and prevent the development of psychopathology. Although previous studies have suggested several coping variables that affect adaptation, these findings remain fragmentary and in need of integration within a multifactorial model. I propose studying the role of the social network in the coping process as an integrative framework for developing this model and describe two studies using this approach. In the first study of college students during final exams, low-density networks were associated with more satisfying emotional support. In the second study of recent young widows and mature women returning to college, low-density, multidimensional networks were again associated with more satisfying support, as well as better mood, fewer symptoms, and higher self-esteem. A coping strategy based on membership in such networks is described. This strategy integrates resources in several personal and environmental domains. Theoretical and empirical guidelines are suggested for delineating alternative coping strategies of adaptive value.

"Social Networks and the Coping Process: Creating Personal Communities." To appear in B.H. Gottleib (Ed.) *Social Networks and Social Support in Community Mental Health.* Beverly Hills, Sage (in press)

Interest in the health-enhancing potential of social networks has mushroomed among social scientists and mental health professionals. It is presently unknown whether this interest is destined to be merely a fad, or instead to make a serious contribution to our understanding and ability to promote mental health. To prevent the former possibility it is necessary to raise some critical questions regarding the presuppositions and implications of current research. I shall argue that the several research strategies that have been developed differ fundamentally in their capacity to elaborate viable paradigms for this emerging field. In doing so, I argue the value of research which includes the identification of each network member and the use of dyadic and systems analytical categories for network analysis. Several studies which illustrate this approach are discussed. I then sketch the initial formulation of a model that seeks to relate social networks to coping and mental health. The model conceptualizes social networks as personal communities and emphasizes their capability for embedding a repertoire of satisfactory social identities. I conclude by considering implications of this model for the design and evaluation of social-community inverventions.

HOLLAND, Paul W. (Educational Testing Service) and Samuel Leinhardt (Carnegie-Mellon) 1981. "An Exponential Family of Probability Distributions for Directed Graphs." *Journal of the American Statistical Association 76(373)*

Directed graph (or digraph) data arise in many fields, especially in contemporary research on structures of social relationships. We describe an exponential family of distributions that can be used for analyzing such data. A substantive rationale for the general model is presented, and several special cases are discussed along with some possible substantive interpretations. A computational algorithm based on iterative scaling procedures for use in fitting data is described, as are the results of a pilot simulation study. An example using previously reported empirical data is worked out in detail. An extension to multiple relationship data is discussed briefly.

ISAAC, Larry (Florida State) and William R. Kelly (Texas-Austin) 1981. "Racial Insurgency, the State, and Welfare Expansion: Local and National Level Evidence from the Postwar United States." *American Journal of Sociology 86 (6): 1348-86*

This paper addresses systematically the possible nexus between insurgent political action and the state apparatus, concentrating specifically on the relationship between urban riots and welfare or relief-giving activity in the postwar United States. The theoretical warrant for the analysis has its genesis in Piven and Cloward's influential thesis relating insurgency and relief giving in capitalist society. This perspective is juxtaposed with the orthodox developmental perspective of welfare institutions, and the causal processes and underlying images of the state are compared. A critical review of the empirical work on the riot-welfare relationship suggests several deficiencies and questions which we attempt to redress and address, respectively, in a cross-level empirical analysis of (a) changes in welfare expenditures from

1960 to 1970 in a panel of U.S. cities and (b) annual changes in national aggregate relief-program categories for the postwar United States (1947-76). The results of the city-level analysis, parallel to several similar studies, provide extremely weak to no support for the hypothesized riot-welfare relationship. However, the postwar time-series analysis provides consistently strong evidence that the urban riots played an important role nationally in the short-term expansions of the extent of relief giving across several major program categories. The conclusion considers the implications of the findings for theories of (a) welfare institutions in late capitalism, (b) the state in late capitalism, and (c) collective action and insurgency.

KORTE, Charles (North Carolina State) 1980. "Urban-Nonurban Differences in Social Behavior and Social Psychological Models of Urban Impact." Journal of Social Issues 36(3).

An examination of urban-nonurban differences in several aspects of social behavior shows that urbanites are different only in limited ways from their less urban counterparts. In an urban environment, there does appear to be less social contact between neighbors and less helpfulness and consideration shown toward strangers, while social contact between relatives and between friends is no different from what is found in smaller-sized communities. These findings are most consistent with the urban impact models proposed by Milgram and Fischer, while they disconfirm Wirth's model. A fourth model developed by Gans seems also disconfirmed by this pattern of urban-nonurban differences, though the Gans model is less firmly tied to the expectation of overall urban-nonurban differences. A case is made in the paper that the city's influence on social behavior seems mediated by situational forces rather than by alterations of individual personalities. The paper concludes with an account of recent research on urban differences on a number of measures, as well as differences within Turkish cities between an urban sample and a sample of squatter settlement residents, who resembled the town dwellers in their social behavior.

LACY, William B., Kenneth E. PIGG and Lawrence BUSCH (Kentucky) 1980. "Clients, Colleagues, and Colleges: Perceived Influences on Extension Agents." Rural Sociology 45(3): 469-482

This paper focuses on the perceived sources of internal (organizational) and external (environmental) influences on the Agricultural Extension Service Agents and their county programs. Drawing on recent developments in organizational theory relating to organizational-environmental interrelationships, a questionnaire was developed asking agents to rate the relative influence various groups have and ought to have upon their programs. All agents saw their respective client groups as having the most influence upon their programs. County extension councils and college administrations were ranked second and third in importance respectively. However, only agriculture agents say research faculty as having an important influence upon their programs. Significantly, 4-H and home economics agents both felt that research staff should have a greater influence upon their work than is currently the case. Policy implications are discussed.

LORD, George F. III and William W. FALK (Louisiana State) 1980. "An Exploratory Analysis of Individualist Versus Structuralist Explanations of Income." Social Forces, 59(2)

This paper tests two divergent explanations of income: one model based on human capital variables, the other based on neo-Marxian, structural variables. In particular, our paper extends the work of political economists and the very recent work of sociologists (especially, Bibb and Form, Beck et al., and Wright and Perrone). Our sample was a national one drawn from a larger study conducted by the National Opinion Research Center; the final sample consisted of 763 members of the labor force (415 males and 348 females). While the human capital variables produced greater explained variance than the structural variables in a combined model the structural variables increased the explanatory power by 27 percent. The structural model worked better for men; the human capital model worked better for women.

LYON, Larry, Lawrence F. FELICE and M. Ray PERRYMAN (Baylor) and E. Stephen PARKER (Indiana) 1981. "Community Power and Population Increase: An Empirical Test of the Growth Machine Model." American Journal of Sociology 86(6): 1387-1400

Attempts to relate community power to policy outputs have been criticized for lacking theoretical relevance and statistical significance. To overcome these criticisms, this research employs a power-policy model based on a political economy framework which utilizes Molotch's conception of the community as a growth machine. Analysis of the Permanent Community Sample provides strong power-policy relationships that support the major tenets of the growth machine explanation: As members of the business elite gain power, they can successfully promote population growth that provides them with greater profits through higher property values. The most widely cited common good for growth, lower unemployment, does not accrue. This supports the relevance of a political economy approach to community phenomena and suggests different directions for community power research.

MACKINNON, R.D. and P. ROGERSON (SUNY-Buffalo) 1980. "Vacancy chains, information filters, and inter-regional migration." Environment and Planning 12: 649-58

An interregional migration model based on vacancy chains, on an intervening-opportunities interaction hypothesis, and incorporating endogenously generated imperfect information flows is developed. Analytical results are determined for the case of perfect information. Numerical experiments are undertaken for the case of imperfect information. Cyclical behavior in the state variables occurs around the perfect-information equilibrium. Suggestions for extending the modeling framework are identified.

MANCINI, Jay A. and William QUINN (Virginia Polytechnic), Miriam Aberg GAVIGAN (Albright) and Henrietta FRANKLIN (North Carolina-Greensboro) 1980.

In-depth interviews were conducted with older adults to ascertain the importance of social relations for life satisfaction. Probability sampling techniques yielded 74 respondents. The findings indicate that older adults are generally not isolated from others, and that life satisfaction is not necessarily enhanced by interpersonal interaction. Two myths of aging, those concerning alienation and enrichment are thereby not supported.

MARSDEN, Peter V. (North Carolina-Chapel Hill) 1981. "Introducing Influence Processes into a System of Collective Decisions." American Journal of Sociology 86(6):1203-35

This paper modifies and extends the model of collective decision-making processes proposed by Coleman in The Mathematics of Collective Action by introducing a process in which the interests expressed by actors may be influenced by those of other actors. After incorporation of this individual-level process within the framework of Coleman's model, its effects at the system level are explored by comparing results generated by the modified model with those produced by the original model. Analyses of artificial data indicate that the nature and magnitude of system-level effects are contingent on (1) the pattern of interest differentiation in the influence network; and (2) the degree of centralization of the influence network. Depending on these features, the effects of the influence process on collective decision making may be (1) a decline in the system level of resource mobilization; (2) an increase in the level of apparent consensus on collective decisions; and/or (3) a bias in collective decisions toward the interests of the actors centrally located in the influence network.

MARSH, Jeanne C. (Chicago) 1980. "Help Seeking among Addicted and Nonaddicted Women of Low Socioeconomic Status." Social Service Review (June):239-48

Concern with the provision of health and welfare services to underserved or inappropriately served groups has led to numerous studies of patterns of service utilization. This article focuses on the help-seeking patterns of heroin-addicted and nonaddicted women of lower socioeconomic status. The results suggest addicts generally experience more problems than nonaddicts; those with few problems are less likely to use formal support systems; and black respondents, both addicts and nonaddicts, are less likely to use formal support systems. The evidence indicates that while addicts tend to use natural support systems less frequently than nonaddicts, addiction per se does not explain help seeking when race and number of problems are taken into account. The heavy reliance of both addicts and nonaddicts on informal helpers supports the value of professional efforts designed to facilitate or enhance these networks.

MAYHEW, Bruce H. (South Carolina) and Paul T. SCHOLLAERT (Old Dominion). "Social Morphology of Pareto's Economic Elite." Social Forces 59(1)

An a priori model of economic elites – as defined by Pareto – is developed using sociological assumptions from Rousseau and Marx. The model supplies statistical expectations for the probability of an economic elite and the relative size of economic elites. The results of this model have several important implications for the substantive theory of economic inequality.

Three papers by: J. Miller McPHERSON (South Carolina)

"Hypernetwork Sampling: Estimating Parameters Governing the Structure of Voluntary Affiliation".
Unpublished manuscript.

A continuing problem in the study of voluntary organizations is that survey researchers are forced to study individuals, while they are often really interested in structural hypotheses. This paper offers some methods which allow survey researchers to address hypotheses about organizations and the relations among organizations. We develop ways of estimating the number and sizes of voluntary organizations in a community, the number of linkages among organizations, and the amount of membership overlap among organizations, from survey data. Our approach combines the idea of network sampling (Granovetter 1976) with the notion of the duality of persons and groups (Breiger 1974) to produce a quantitative approach to the study of voluntary organizations. We provide an illustration of the methods we develop by testing Blau's (1970) hypothesis that structural differentiation increases with system size.

1981. "A Dynamic Model of Voluntary Affiliation." Social Forces 59: 705-28

This paper develops a dynamic model of voluntary affiliation which describes the flow of individuals into and out of organizations over time. The model is a simple stochastic process model, developed from Coleman, which we use as a baseline generator to produce specific predictions for the distribution of affiliation in cross-section. Incorporating well-known empirical generalizations, the model produces some surprising results for the well-known class differences in the rate of affiliation. The model is fitted in cross-section for six countries, and estimates of the dynamic parameters are produced from a panel study in the United States. We discover some systematic negative consequences for low status individuals and organizations, and some surprisingly strong support for the basic imagery of our model. We conclude with an exploration of several consequences, both substantive and methodological.

1981. "Voluntary Affiliation: A Structural Approach" to appear in Peter Blau and Robert Merton (eds.)
Continuities of Structural Inquiry. Beverly Hills, Sage (in press).

American sociologists have tended to assume that voluntary affiliation has only positive implications for the values of democracy and egalitarianism. At the same time, the recent literature on affiliation has largely consisted of a series of debates about which social aggregates have higher or lower rates of affiliation. This paper is intended to counter both of these trends. Taking a structuralist perspective, we show that the system of affiliation may operate to the clear disadvantage of low status persons, under certain conditions. Taking a mathematico-deductive approach, we use concepts from the network sampling and small world literatures to show the usefulness of our approach. We show how our approach clarifies the issues of inter-individual, inter-organizational, and inter-community structure, and how the almost ignored issue of the size of voluntary organizations can be crucial to an understanding of the voluntary system. We offer many examples of the fruitfulness of our structural approach throughout.

McPHERSON, J. Miller and Lynn SMITH-LOVIN (South Carolina). n.d. "Women and Weak Ties: Sex Differences
in the Size of Voluntary Organizations." to appear in American Journal of Sociology (forthcoming)

This paper explores some network consequences of a dramatic difference in the typical size of voluntary organizations belonged to by men and women. These size differences are greatest in organizations that are most important economically. Furthermore, the differences are remarkably consistent across social categories; men tend to belong to larger organizations whether we compare men and women in similar categories of work status, age, education or marital status. Thus, men are located in core organizations which are large and economically important, while women are located in peripheral organizations, which are smaller, and more focused on domestic or community affairs. Even though men and women have almost exactly the same number of memberships on the average, the dramatic differences in the sizes and types of their organizations expose men to many more potential contacts and other resources than women.

MICHENER, H. Andrew, Kenneth YUEN and Stephen B. GEISHEKER (Wisconsin-Madison) 1980. "Nonsymmetry and
Core Size in N-Person Sidepayment Games." Journal of Conflict Resolution 24 (3): 495-523

This article presents a procedure for indexing n-person cooperative games in terms of *degree of non-symmetry*. This ordinal-level index is limited to sidepayment games, but applies generally to games of three or more players. To validate the index, a laboratory experiment was conducted with four-person games differing in degree of nonsymmetry and in core size. The results show that, while core size had no significant effects, the players' payoffs varied significantly as a function of nonsymmetry. Strong players received

increasingly more and weak players received increasingly less as nonsymmetry increased. Tests for goodness of fit of several prominent solution concepts show that, across experimental treatments, the Shapley value predicts better than other solutions. Shapley is followed in order by the disruption nucleolus, the nucleolus, and finally the equality solution. These tests also show that all of the theories decline in predictive accuracy as the degree of nonsymmetry increases. Reasons for this trend are discussed in terms of predictive patterns and payoff variances.

MOODIE, T. Dunbar (Hobart and William Smith Colleges) 1980. "The Formal and Informal Structure of a South African Gold Mine." Human Relations 33 (8): 555-74.

The primary purpose of this article is to examine the structures of domination in a South African gold mine from the perspective of black migrant miners. The formal management organizational blueprint for mine and compound is compared with the actual social structure of the mine. The article concludes that the black miner's experience of domination in the South African gold mines is a complex combination of management-ordained authority and personal power on the part of a series of overlapping, sometimes conflicting, sometimes complementary, black fiefdoms; namely those of the Team Leader (boss boy), Personnel Assistant, Induna, and the clerks.

MORRISON, Donald G. (Columbia) and David C. SCHMITTLEIN (Pennsylvania) 1981. "A Model of Careers in a Simple Hierarchy: Generalizing the Junior Professional's Decision Rule." Bell Journal of Economics 12: 310-20.

Cooter and Restrepo propose a career path model for junior professionals who can decide to stay and hope for promotion to the senior level or leave to take an outside opportunity. In this article their assumption of a uniform distribution for time to promotion is first changed to the more natural and empirically tested exponential distribution. The resulting decision rule for the junior professional becomes very simple and intuitively appealing and can be applied continuously. Additional generalizations of the exponential distribution are then analyzed. Some very interesting results on the effects of uncertainty are obtained. Myopic decision rules are shown to be nonoptimal in certain situations. However, these changes to the Cooter and Restrepo model are obtained at a cost. The model cannot be closed. The demand for labor is not taken into account. Thus, the supply side is considered in isolation. Nevertheless, the more appealing time to promotion densities used here give better insights into the behavior of junior professionals within the basic Cooter and Restrepo framework.

MURRAY, Colin 1979. "Migrant Labour and Changing Family Structure in the Rural Periphery of Southern Africa." International Review of Modern Sociology 9(2).

My purpose in this paper is firstly to identify some sources of confusion in the analysis of contemporary family structures; secondly to clarify the empirical evidence relating to the structure of small communities and to the validity or otherwise of particular descriptive stereotypes of 'the family'; and thirdly to suggest the possibility of transcending the dualism characteristic of some previous approaches to the study of family life in the labour reserves.

MURRAY, Stephen O. (Toronto), Joseph H. RANKIN, (Purdue) and Dennis W. MAGILL (Toronto) 1981. "Strong Ties and Job Information." Sociology of Work and Occupations 8 (1): 119-36.

Contrary to Granovetter's hypothesis that salient job information derives from "weak ties" (acquaintances), this study of 299 social and physical scientists at one Canadian and one U.S. university reveals that "strong ties" (intimates) were approximately seven times more prevalent than "weak ties." Furthermore, with only one exception (U.S. graduates who obtained Canadian academic positions), the reliance on "weak ties" for job information declined from 1920 to 1978. Although a greater amount of job information can be obtained through weak ties, the problem is to locate only the few openings for which one would be seriously considered and would consider accepting. Long lists of undesirable unobtainable positions are of little interest. Thus, it is more effective to rely on a few initimate colleagues (strong ties) in seeking employment.

PETRAS, James (SUNY-Binghampton) 1980. "Trilateral Commission and Latin American Economic Development." Contemporary Crises 4:367-379.

We will proceed by outlining the material basis for the emergence of the Trilateral Commission by examining the growth of international capital. First, we will detail the global nature of U.S. expansion, as well as its growth in Latin Anerica and secondly, the increasing challenge by European and Japanese capital. We will them examine the structure, function and purpose of the Trilateral Commission, its overall achievements and limitations and the particular impact it has in relation to Latin American development.

PILISUK, Marc (California-Davis) and Meredith MINKLER (California-Berkeley)   1980.   "Supportive Networks: Life Ties for the Elderly." Journal of Social Sciences 36(2).

Recent studies suggest that the increased vulnerability of the older person to physical and/or mental breakdown is related to loss or deficiency in the pattern of supportive ties.

With increases in the geographical separation of adult children from their parents, and with greater longevity, the needs of the elderly are increasingly being transferred from the family either to public service settings or to voluntary associations. The resource needs depend in part on the individual's existing contacts and state of health, as well as upon the psychological history of the person.

Various programs have addressed the differences in social support for older people in markedly different ways. Six different programs are examined to illustrate the importance of attention to health status, ethnicity, and style of life in the provision of social support. By evaluating the offerings of these programs against the concepts of network theory we are able to show how the needs for social support among the elderly are highly differentiated and deserving of equally differentiated forms of response.

POPKIN, Samuel (California-San Deigo) 1980.   "The Rational Peasant: The Political Economy of Peasant Society." Theory and Society, 9 (3).

This essay concerns the impact of colonialism, the expansion of markets, and the formation of central states on peasant society. I shall discuss both the widely-accepted interpretation of this impact, the moral economy approach, and, from different assumptions, an alternative I call the political economy approach.

PORTMANN, Urs (Seminaire d'histoire medievale, Lausanne). 1981.   "The Identification of Persons in the Middle Ages: Results from the First "Freiburger Burgerbuch" (1341-1416)." Quantum 18 (4).

A semi-automized code has been used to identify individuals who are referred to on more than one occasion in the source, the "Freiburger Burgerbuch" (1341-1416). This code is made up of parts of the family and first names. It allows the orthographic and phonetics variants of the same name to be taken into account. The plausibility of the grouped names is then automatically tested. The final decision about the identity of the names has, however, to be taken by the historian.

REINKE, Herbert (Zentrum für historische Sozialforschung, Köln) 1981.   "Towards Standards for the Description of Machine-Readable Historical Data." Quantum 18 (4).

Some years ago, the Center for Historical Social Research had started to archive and to disseminate machine-readable historical data for comparative and for secondary analyses. This work has been accompanied by the development of a specific instrument for describing machine-readable historical data. This instrument has to meet the information needs of users of machine-readable historical data, information needs which are different to those of the users of machine-readable survey data. In this paper, standards for the description of machine-readable historical data are proposed which are also designed to become reporting standards for primary researchers in describing their data.

Comments on the proposals for the description of machine-readable historical data are highly appreciated.

ROY, William (UCLA). "The Vesting of Interests and the Determinants of Political Power: Size, Network Structure, and Mobilization of American Industries, 1886-1905." American Journal of Sociology 86 (May) 1287-1310.

The issue addressed is, What does a social group need to gain political power? Empirical, historical analysis is utilized to explore the relative saliency of three determinants of political power to explain variation in power as defined conceptually and operationally independent from its determinants. The determinants are magnitude, the extend to which the group is tied into economic, political, and social networks, and the degree of mobilization. The aspect of power investigated is the vesting of economic interests, that is, the extent to which the interests of an actor are taken into account by the government in its routine operation. Regression analysis is used to assess the relative explanatory power of the magnitude, network relations, and degree of mobilization of 12 industries on the vesting of economic interests in the U.S. Department of State in the period 1886-1905. Results show that the different components have different explanatory value under varying conditions, depending on the type of interest that is vested. When the State Department was discussing export-related matters the value of exports was the best predictor of vesting, with mobilization having a secondary impact. However, the effect of network relations was notably weak, contrary to predictions of the power-elite perspective. The conclusion stresses the contingent nature of the determinants of political power.

SANDLER, Todd (Wyoming and York, U.K.), Jon CAULEY (Hawaii-Hilo) and John F. FORBES (Glasgow). 1980. "In Defense of a Collective Goods Theory of Alliances." *Journal of Conflict Resolution* 24 (3): 537-47.

This article defends the collective goods theory of alliances by showing that club theory is an appropriate tool for analyzing allocative issues of alliances from a positive prospective. The article concludes with a demonstration that Oppenheimer made an analytical mistake when he questioned the normative importance of Pareto optimality.

SCHOFIELD, Norman (Essex). 1980. "Catastrophe Theory and Dynamic Games." *Quality and Quantity* 14: 519-45.

The concern of this paper is to use the conceptual notions of genericity and structural stability to provide some hints as to the possible structural features of a political economy. The behaviour of a political economic system is the result of optimization by collections, or coalitions, of actors in the society. The emphasis of the theory of dynamic games presented here is on local behaviour rather than the global notions of game theory. In voting games, for example, it is now known that the set of natural equilibria, the core, will generally be empty. Instead we consider the phenomena of cycling. For voting games the cycle set will be dense, and consequently we may regard such games as chaotic.

SCHWEIZER, Thomas (Köln). 1980. "Konsumverhalten im ländlichen Java." *Sociologus* 30: 123-153.

This article analyzes patterns of consumption in a Javanese village. Consumers' choices are interpreted as outcomes of (a) local resources and local preferences and (b) the extra local context which influences local incomes and preferences (e.g. via prices and the supply of consumer goods). Variations in consumption patterns are seen as dependent on variations in occupation and religious orientation. The important mediating element between the village and the extra local marketing system are in this case the local traders. They provide consumer goods and stimulate consumer preferences.

SEIDMAN, Stephen B. (George Mason) n.d. "Structures Induced by Collections of Subsets: A Hypergraph Approach". *Unpublished manuscript.*

During recent years, much attention has been paid by anthropologists and sociologists to the analysis of social networks. These networks arise from dyadic relationships such as kinship or friendship and they have been studied using techniques derived from graph theory. Although the study of such networks can cast much light on the social structure of a population, many important aspects of this structure cannot be addressed using dyadic relationships alone. For example, group membership gives rise to natural non-dyadic relationships which will be distorted if they are forced into a dyadic mold. The purpose of this paper is to propose an analytic scheme which will permit the study of structure induced by non-dyadic relationships. The concepts used derive from the theory of hypergraphs, and it is shown that these concepts permit a wide variety of structural questions to be posted.
Keywords: social network, non-dyadic relationships, collection of subsets, hypergraph.

SEIDMAN, Stephen B. (George Mason) and Brian L. FOSTER (Arizona State). 1981. "An Anthropological Framework for the Analysis of Social Networks." Paper presented at the Annual Meeting of the Society for Applied Anthropology, Edinburgh, Scotland, April.

We have argued in several previous papers (Foster and Seidman n.d.a., n.b.d.,; Foster 1979) that some of the most elegant and substantively productive network analyses have been done by anthropologists using kinship techniques.
Accordingly, we have developed an approach to social network analysis which incorporates many key features of kinship-based methods but whose usefulness is not restricted to situations where kinship is of overriding importance. We focus on individuals' behaviour within the constraints imposed by their social networks, and we insist that our approach be useful cross-culturally. In these regards, our programme is similar to that of earlier anthropological network researchers (see Foster 1979), but in contrast to these researchers, we wish to work with models in which individuals and sets of individuals are the units of analysis. Moreover, we wish to articulate aspects of individual behaviour with our structural analysis far more formally than has been done in the earlier network research and in such a way that it is fully integrated with the method of structural analysis. Each feature of our approach is motivated by a large body of anthropological theory (see Foster 1979; Foster and Seidman 1979).
Our approach is a relational, structural one which takes explicit account of human behaviour. The work that we have done along these lines has led us recently to incorporate a third key feature: handling structure induced by overlapping subsets of a population (Seidman n.d.; Foster and Seidman 1980; Seidman and Foster n.d.) in a way compatible with our general structural analysis method and our treatment of individual behaviour. A full discussion of the articulation of these three aspects of our work can be found elsewhere (Foster and Seidman n.d.b.). This paper illustrates the method with an extended, hypothetical example.

Before proceeding with the example, it should be noted that an integrated system of software has been developed parallel with the theoretical and more general methodological work (Foster and Seidman 1978; Seidman and Foster 1978c, 1979). This software enables researchers to perform the operations described here on data arising from actual populations.

STEIBER, Steven R. (American Medical Association). 1980. "Quantitiative Models and Methods for World-System Analysis." The Sociological Quarterly 21: 295-305.

Many quantitative analysts who have turned their attention to the world-system have developed models of the structural and relational components of that system. These efforts have come under fire, however, from those who claim that statistical techniques, particularly regression, are not suited to analyses of the world-system. This paper presents some of the major criticisms of quantitative efforts, a response to each, and a series of general regression models with applicability to world-system analyses. Discussion of the means by which data may be selected for the proposed analytical models is also offered.

TIENDA, Marta (Wisconsin-Madison). 1980. "Familism and Structural Assimilation of Mexican Immigrants in the United States." International Migration Review 14 (3): 383-408.

The relationship between geographic mobility, kinship ties and social status is examined·in this article using data for a sample of 820 Mexican immigrants aged 18-60 who were interviewed upon legal entry to the U.S. in late 1973-74 and reinterviewed three years later. An attempt is made to determine whether and how the maintenance of kinship ties influences the integration of immigrants during the period immediately following emigration.

USEEM, Michael (Boston). 1980. "The Educational and Military Experience of Young Men During the Vietnam Era: Non-Linear Effects of Parental Social Class." Journal of Political and Military Sociology 8 (Spring): 15-29.

Parental social class is known to have a positive impact on the quality of many experiences of a son or daughter, and studies employing this variable often assume that the impact is linear. This paper argues, however, that failure to consider possible non-linear effects of parental socioeconomic status (SES) on offspring experience can significantly distort interpretation of the impact of social origins. Drawing on data from a nationally representative longitudinal study of 1,922 young men during the 1967-70 period, we examine the form of the relationship between parental SES and two important areas of the sons' experience - continuation of schooling and service in the armed forces during a three year period after the young men reached their eighteenth birthday. Educational and military experience are found to be better predicted as a second degree function of parental SES than as a linear function of parental SES. The evidence also indicates that the curvilinear relationship between social class origins and military experience is partly a product of the non-linear relationship between social origins and education experience, suggesting that if non-linear effects of social origins on sons' experience in one institution are overlooked, the sons' experience in another institution may not be fully interpretable. Finally, a linear assumption is found to system-·atically underestimate the actual degree of inequality in the distribution of access to education.

WOON, Yuen-Fong (Victoria). 1978. "Social Discontinuities in North American Chinese Communities: the Case of the Kwaan in Vancouver and Victoria, 1800-1960." Canadian Review of Sociology and Anthropology 15 (4): 443-51.

Based on the study of in-depth interviews with fourteen members of the Kwaan Lineage residing in Victoria and Vancouver, the author shows that there were important differences in attitudes, social organizations, and behaviour patterns between the Chinese who immigrated to North America before the Second World War and those who came after the war. By comparing with Chinese communities in Southeast Asia, the author concludes that such discontinuities were the result of a complex interplay of the changing patterns of migration, the different economic functions of the Chinese immigrants, as well as the changing sociopolitical milieu of the host and the mother countries.

TEACHING AIDS

Editor's Note: Social Relations 10, "An Introduction to Social Relations", was a year-long course designed
to introduce beginning Harvard and Radcliffe students to social relations. In 1966 the sociology portion
was taught by Harrison White.
   White's lectures and memos for the course were important in developing network analytic thinking,
especially as many of the graduate teaching assistants went on to network careers.
   For your pleasure, INSNA has rescued this exam from its musty archives (those who need help should
consult Linton Freeman's bibliography in this issue):

Instructions (edited)
   Answer 3 questions altogether, 1 from each group, plus 1 individual section question. Each answer
should be less than 500 words. The examination is being given on the honor system. You may use any of the
assigned readings plus lecture notes and homework from the course, but no other references.

I. Do at least one of the following three:
   1. One of the tools for the analysis of social structure that we have discussed is the network.
       a) What exactly is a network?
       b) What kinds of social processes are most amenable to systematization via networks?
       c) Use a network analysis to determine the common elements in funerals, as described in societies
          that we have studied.

   2. One of the tools for the analysis of social structure that we have discussed is the Lorenz curve.
       a) How does the Gini index help you to assess the distribution of wealth in any society?
       b) What other aspects of the Lorenz curve are useful in this assessment?
       c) What further aspects of inequality may be overlooked by the use of Lorenz curves alone?
       d) Suggest another technique that you might want to use to supplement Lorenz curves for this problem.

       (Note: Illustrate your argument in terms of the societies that we have studied.)

   3. Pigovia has three classes of occupations: 1) government officials, 2) mechanics, and 3) pig drovers.
       A census was taken and the total male population (600 men) was asked their present occupations and
       the occupations of their fathers.
       a) The table below presents the column and row totals from this survey. Show what the numbers in
           the various cells would be if the official ideology of Pigovia were true. The ideology is:
           "No pig drover's son should be a pig drover!"

		SONS			
		official	mechanic	drover	
	official				100
FATHERS	mechanic				200
	drover				300
		100	200	300	600

       b) The actual table from the census follows:

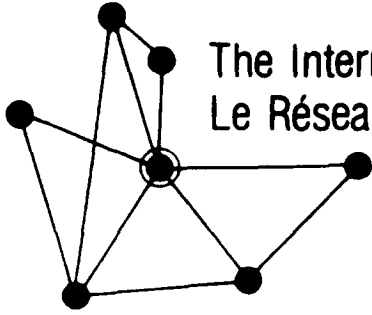|		SONS			
		official	mechanic	drover	
	official	15	34	51	100
FATHERS	mechanic	32	58	110	200
	drover	53	108	139	300
		100	200	300	600

1) Describe in words approximately what is going on in this society, as reported by this table.

2) What kinds of processes might be operative to produce this result?

3) Is this table like or different from tables reporting intergenerational mobility in industrialized societies?

II. Do at least one of the following two:

4. All the societies we have studied (Tiwi, 17th century England, India, modern industrial societies) are stratified in some way, and each has existed over more than one generation; this means that positions in each society, both elite and non-elite, have had to be refilled as the previous occupants have died or retired.

   a) Focusing particularly on the elite positions, describe how this replacement process has worked in each of the four cases. (Be careful to mention all the different ways if there are more than one in a society.)

   b) How many really different processes have you described? (Which one, if any, seems most important?)

   (Methodological caution: "elite positions" need not be considered as individual pigeon-holes; they can also be seen as a functional set of social positions which is contrasted with the non-elite groups.)

5. All of the four societies we have studied (England in the 17th century, the Tiwi, India, modern industrial societies) are clearly stratified. Yet, in none of them apparently has there been any important pressure from those at the bottom to overthrow the system. Can you see any systematic reasons for this, reasons valid in all or several of the societies? Construct a set of propositions which set these reasons out in an orderly, abstract way.

The International Network for Social Network Analysis
Le Réseau International pour l'Analyse des Réseaux Sociaux

Structural Analysis Programme
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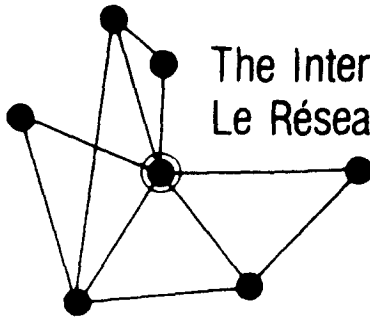
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Dear Colleague,

I am writing to invite you to join the International Network for Social Network Analysis.

INSNA is a clearing house, linking together network analysts and disseminating current information. Formed in 1977, INSNA now has over 400 members from all continents and all social science disciplines, mathematics and statistics.

To link members with each other, INSNA publishes three issues of CONNECTIONS annually. The 60 or so pages of each issue contain research reports, surveys of the field, lots of abstracts, new book announcements, thesis summaries, computer programmes, conference inform-ation, course outlines, research grant announcements, and news items.

We've already published such important new information as William Ratcliffe's review of network/health research, Joel Levine and Nicholas Mullins' assessment of blockmodelling, and Harriet Friedmann asking Max Weber if "distributions are really structures?". This year, we plan to send you the second of John Sonquist (and associates) do-it-yourself guide to computer-ized network analysis, Ron Rice's review of studies of networks over time and Bernard/Killworth/ Sailer's final word on how inaccurately respondents report on their networks.

To keep connected, our Directory gives addresses, telephone numbers, disciplines and descriptions of research interests, all cross-referenced. We will update it frequently from information provided on membership forms.

INSNA also serves as a framework for the organization of conferences: we have met in Toronto (March 1978), and in Uppsala at the World Congress of Sociology (August 1979). Members are now discussing conferences to be held in Europe, Mexico, the U.S., and Canada.

INSNA members may also subscribe to its affiliated journal, SOCIAL NETWORKS, at a special discount. This "International Journal of Structural Analysis", under the direction of an independent editorial board, publishes theoretical, methodological and substantive papers on social structure.
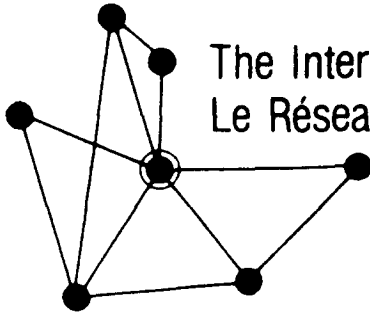
We invite you to join INSNA, using the membership form on the back of this letter. We would also appreciate it if you would pass this invitation along to other interested colleagues. We look forward to receiving your membership and your participation.

Sincerely,

Barry Wellman
Co-ordinator

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