	2001	2002	2003
JAN		Computer Support for Collaborative Learning: Foundations for a CSD Community 1/7-11: Boulder, Colorado	8th Biannual Conference of International Association for the Study of Forced Migration (IASFM) 1/5-9: Chiang Mai, Thailand
FEB	International Conference on Subjects, Actors and Social Movements in the North & South 2/26-27: Rome, Italy	International Social Networks Conference 2/13-17: New Orleans, USA	
MAR	Annual Meeting of the Public Choice Society, Economic Science Association, Society for Social Choice and Welfare 3/9-11: San Antonio, Texas, USA	Transforming Spaces: the Topological Turn in Technology Studies 3/22-24: Darmstadt, Germany R/Évolution An Interdisciplinary Graduate Student Conference 3/23rd: Montréal, Canada	
APRIL	International Social Networks Conference 4/25-29 April: Budapest International conference Comparing Cultures. Dimensions of Culture in a Comparative Perspective 4/ 27: Netherlands	Princeton-Northwestern Junior Scholars' Workshop on Embedded Enterprise in Comparative Perspective 4/11 -14: Princeton University Targeting Mr X - but Is He Mr Right? Sampling, Weighting, Profiling, Segmentation and Modelling 4/17: London	
MAY	Third Annual Graduate Student Conference: "Bridging Divides" 5/16-18: Toronto, Canada Canadian Sociology & Anthropology Ass'n 5/27-30: Laval, Québec, Canada International Communication Ass'n 5/ 24-28: Washington, DC	Shaping the Network Society Patterns for Participation, Action, and Change DIAC-02 Symposium 5/16-19: Seattle, USA Thematic Conference for Network Analysts 5/30-31: Lille, France	International Communication Ass'n
JUNE	6th Workshop on Economics with Heterogeneous Interacting Agents 6/7-9: Maastricht, Netherlands	"Statistical Mechanics of Complex Networks" XVIII Sitges Con-ference on Statistical Mechanics 6/10-14: Sitges, Barcelona, SPAIN Hawaii International Conference on Social Sciences 6/11-15: Honolulu Hawaii, USA CASOS Summer Institute 6/15-20: CMU, Pittsburgh, USA CASOS 2002 6/21-23: CMU, Pittsburgh, USA	
JULY	Global Studies Association: Networks and Transformations 7/ 2-4: Manchester, UK XXV International Congress of Administrative Sciences 7/9-13:Athens, Greece Eight International Facet Theory Conference: Integrating Theory Construction with Data Analysis 7/15-18: Prague	Annual congress of the South African Sociological Ass'n 6/30 - 7/3: East London, South Africa SA Research Committee on Sociology of Sport RC27 XV ISA World Congress of Sociology 7/7-13: Brisbane, Australia Conference on Empowering Humanity. Work in progress 7/8-9: Utrecht, The Netherlands International Communication Ass'n 7/15-19: Seoul, Korea	36th World Congress International Institute of Sociology 7 / 7-11: Beijing, China
AUG	American Sociological Ass'n 8/18-22 Anaheim, USA IJCAI Workshop: Inconsistency in data and knowledge 8/6: Seattle, USA European Sociological Ass'n: Visions and Divisions 8/28 - 9/1: Helsinki, Finland	American Sociological Ass'n 8/16-20: Chicago, USA The International Conference on Improving Surveys ICIS 2002 8/25-28: Copenhagen, Denmark	
SEP	International Conference: Methodology and Statistics 9/17 - 19: Ljubljana, Slovenia SAFECOMP 2001: The 20th International Conference on Computer Safety, Reliability and Security 9/26 - 28: Budapest, Hungary	Communal studies association Twenty-Nineth Annual Conference 9/26-28: Oneida, New York, USA Internet Research 3.0: NET / WORK / THEORY 110/13-16: Maastricht, Netherlands	
OCT	Association of Internet Researchers 10/10-14: Minneapolis-St.Paul, USA	European Symposium on Research in Computer Security 10/14-166: Zurich, Switzerland Mass Media and Communications in the e-Society of the 21st Century: Access and Participation 10/17-20: Moscow, Russia	
NOV	American Anthropological Ass'n 11/28 - 12/2: Washington, DC	International Conference on Questionnaire Development, Evaluation, and Testing 11/14-17: Charleston, S.Carolina, USA American Anthropological Ass'n 11/20-24: New Orleans, USA	
DEC			

Announcements

MEETINGS

Call for Papers

29th Annual Conference of the Communal Studies Association

Oneida, New York
Deadline: 2002-03-15

The COMMUNAL STUDIES ASSOCIATION will hold its Twenty-Nineth Annual Conference at ONEIDA, NEW YORK, SEPTEMBER 26-28, 2002. The CSA Program Committee invites proposals for sessions and individual papers on topics pertinent to all aspects of communal studies with particular attention to methods.

Contact: Rfogarty@university.antioch.edu
http://www.swarthmore.edu/Library/peace/CSA/

CALL FOR PAPERS

8th Biannual Conference of the International Association for the Study of Forced Migration (IASFM)

January 5-9, 2003
Chiang Mai, Thailand

The International Association for the Study of Forced Migration and its local host, the Asian Centre for Research on Migration, Chulalongkorn University, Bangkok, invite paper proposals for its 8th Biannual Conference entitled Forced Migration and Global Processes.

Proposals should be related to one or more of the three sub-themes of the Conference:

- Forced migration and development;
- Forced migration and human rights;
- Forced migration and security

Proposals (maximum 200 words) can be submitted either as:

Individual papers;
- Panel proposals that include three paper presenters, a Chair and eventually a respondent;
- Ideas in progress (which could be innovative ideas without a complete paper)

We invite contributions from all perspectives (anthropological, economic, geographical, health-related, historical, legal, philosophical, political, psychological, sociological, etc.) from academics, governmental or intergovernmental policy-makers, practitioners from NGOs, international organizations or other institutions, and representatives of refugee and migrant organizations.

The deadline for submissions is 31 March, 2002.

For further details and application forms visit http://www.iasfm.org or contact the Programme Committee Chairperson, Prof. Francois Crepeau, at: iasfm8@droit.umontreal.ca

The Stein Rokkan Prize for Comparative Social Science Research

The Stein Rokkan Prize for Comparative Social Science Research was first awarded in 1981 in honor of Professor Rokkan, former President of the International Social Science Council who pioneered this type of research. It was awarded upon the recommendation of an independent jury set up by the European Consortium for Political Research. The Xth Stein Rokkan Prize will be awarded in 2002.

Criteria for 2002 award:

1. Submission must be a very substantial and original contribution in comparative social science research;

2. Submission can be either an unpublished manuscript of book length or a printed book or collected works published after 31 December 2000

3. Candidate must be under forty years of age on December 31, 2002.

Requirements for 2002 award:

1. Four copies of manuscripts typed double space or of printed works should be submitted by 30 April 2002;

2. The above should be accompanied by a formal letter of application with evidence of the candidate's age attached;

3. Submission should be sent directly to the chairman of the jury:

Professor Alfio Mastropaolo, Dipartimento di studi politici, Universita di Torino via Maria Vittoria 19 10123 Torino, Italy

Prize:

The laureate will receive a cash prize of US$ 4,000 jointly awarded by the International Social Science Council and Candido Mendes University of Brazil and a diploma. The laureate will be requested to deliver a public lecture before the ISSC general Assembly, during the celebration of its Fiftieth Anniversary in November 2002.

REQUEST FOR PROPOSAL

The Foundation for the Promotion of Social Science Research on World Society - World Society Foundation ...

... funds selected proposals for research on the structure of and change in world society.

Researchers may submit a short proposal of 2 pages only showing their research intention for which they seek funding until March 31, 2002. These short proposals should be sent either by fax to 41-1-6344989 or by mail to the address below (arriving in Zurich before March 31, 2002). Proposals sent by e-mail may not be accepted.

A small number of the proposals presented will be selected for further elaboration and possible funding which may start, in the affirmative case, in January 2003.

Further information on http://www.wsf.unizh.ch
World Society Foundation
c/o Institute of Sociology
University of Zurich
Ramistrasse 69
8001 Zurich
Switzerland
e-mail: schindle@soziologie.unizh.ch

Joint Princeton-Northwestern Junior Scholars' Workshop on Embedded Enterprise in Comparative Perspective

Princeton University, USA
April 11-14, 2002

We are inviting proposals for participation in a three-day interdisciplinary workshop for young scholars on embedded enterprise in comparative perspective. The workshop will provide an opportunity for intensive exchange among graduate students and recent PhDs, and a select group of faculty mentors. As part of the workshop, we will devote a special, half-day session to the discussion of embedded enterprise in Japan.

Proposals for participation in the workshop are due on December 1, 2001.

For complete submission guidelines, please email embedded@princeton.edu or refer to the workshop's website: www.princeton.edu/~embedded/

CALL FOR PAPERS/ABSTRACTS/PROPOSALS

Hawaii International Conference on Social Sciences

June 11-15, 2002
Sheraton Waikiki Hotel, Honolulu Hawaii, USA
(http://hcsocial.org/hotel_ss.htm)

The number of rooms available at the conference rates are limited. To get the best hotel rates you will need to register early.

Submission Deadline: January 16, 2002
Co-sponsored by the University of Hawaii - West Oahu; and the College of Tropical Agriculture and Human Resources, University of Hawaii

Call for papers, abstracts, student papers, case studies, work-in-progress reports, research proposals, poster sessions, research tables, or reports on issues related to teaching. For more information on the format of submissions see:
http://hcsocial.org/cfp_ss.htm

Workshop proposals for the pre-session workshops on June 11, 2002 are invited. For more information, see: http://hcsocial. org/workshop_info_ss.htm

All areas of Social Sciences are invited: Anthropology, Area Studies, Communication, Economics, Education, Ethnic Studies, Geography, History, International Relations, Journalism, Political Science, Psychology, Public Administration, Sociology, Urban Planning, Women's Studies and other areas related to social sciences. For a complete list of suggested areas of social sciences see http://hcsocial.org/cfp_ss.htm

1. Submissions may be made electronically via

e-mail to social@hcsocial.org or mailed. For more information about submissions see http://hcsocial.org/cfp_ss.htm

2. Registration Information: $390 (U. S. Dollars) includes three breakfasts, two luncheons, mid-morning and afternoon coffee breaks, and admission to sessions.

3. Individuals who wish to assist in organizing a session on a particular topic area or in a language other than English please contact: social@hcsocial.org

If you experience difficulty accessing the website, please try to be patient and try accessing it a couple of hours later. Thank you.

Hawaii International Conferences on Social Sciences
2440 Campus Road, #519
Honolulu, HI 96822
Telephone: 808-947-7187 Fax: 808-947-2420
web address: www.hcsocial.org
e-mail address: social@hcsocial.org

CALL FOR PAPERS

Conference on Empowering Humanity. Work in progress
University for Humanist Studies, Utrecht
The Netherlands
July 8-9, 2002

The University for Humanist Studies was established in 1989 and the aim behind both our teaching and research is to develop 'a science with a human face'; i.e. a science that promotes humanity and human potential. This raises many questions, such as:

- How can academic research be combined with a political, moral and existential programme?
- What does 'humanist inspiration' imply in such research?
- How can humanist studies as an academic discipline be combined with humanist practices?
- Which strategies can be developed for empowering humanity and what role can research play in this?
- How can the principles of equality and diversity be combined in these empowering strategies?
- And, seen from this perspective, how can 'quality of life' be discussed?

The conference on Empowering Humanity marks also the 50th anniversary of the International Humanist and Ethical Union. It will aim to discuss some of the major issues addressed in the Humanism, Meanings of Life, Care and Citizenship research programme.

Academics with an interest in humanist studies are invited to share their insights either by submitting a paper or by participating in the discussions. Empowering Humanity can best be described as a political, moral and existential programme in which humanity is related to meanings of life, human dignity, quality of life and inclusive citizenship.

Presentations and discussions will be given in four workshops:

1. Humanism in local contexts: theories and practices
2. Humanist studies as a new academic discipline
3. Equality and diversity
4. Quality of life and wellbeing

If you want to present a paper, please send your abstract (max 250 words) by email to research@uvh.nl or by regular mail to:

Ms. A. Andeweg
University for Humanist Studies
P.O. Box 797
3500 AT Utrecht, The Netherlands
tel: 31-30-2390162
fax: 31-30-2390170

Deadline for submitting abstracts: January 1, 2002

For more information see: www.uvh.nl/conference/

CALL FOR ABSTRACTS

The International Conference on
Improving Surveys
ICIS 2002
Copenhagen
25-28 August 2002

Preliminary Programme & Call for Abstracts for Contributed Papers on the net We are pleased to announce that the web site of the conference is now ready. Please visit www.icis.dk to find update on the programme, registration and accommodation forms and general information.

We also want to let you know that interest to-date in The International Conference on Improving Surveys - ICIS 2002 has been overwhelming.

Please note that there will not be a printed edition of the preliminary programme of the conference.

Best regards,

The Conference Secretariat

Dr. Edith D. de Leeuw, MethodikA

Plantage Doklaan 40, NL-1018 CN Amsterdam,The Netherlands tel +31.20.3302596 fax + 31.20.3302597 e-mail edithl@xs4all.nl

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CALL FOR PAPERS

ISA Research Committee Community Research RC03
XV ISA World Congress of Sociology
Brisbane, Australia
July 7-13, 2002

ISA Research Committee on Community Research RC03 invites proposals of papers for the sessions at the XV ISA World Congress of Sociology. Sessions descriptions are available at: www.ucm.es/info/isa/congress2002/rc/rc03.htm

Interested scholars, please send an abstract before December 15, 2001, of about 250 words, preferably as a word attachment, to the appropriate session chair and to RC03 Programme Coordinator: Terry Clark, tnclark@uchicago.edu

Session 1. Globalization and urban processes.
Chairs: Alan Harding, University Salford, UK, a.p.harding@salford.ac.uk; Dele Olowu, University of Ife, Nigeria; and Anne Bartlett, University of Chicago, USA, albartle@midway.uchicago.edu.

Session 2. Enhancing urban amenities and environmental preservation: theories and examples that work.
Chairs: Terry Nichols Clark, University Chicago, USA, tnclark@uchicago.edu; Michael Parkinson, John Moores University, UK

Session 3. The politics of urban transitions: Post-communist regimes in comparative perspective.
Chair: Harald Baldersheim, University Oslo, Norway, harald.baldersheim@stv.uio.no; Michael

Illner, Academy Sciences, Czech Republic, illner@mbox.cesnet.cz

Session 4. The new community power. Civic associations, networks, contexts.
Chairs: Robyne Turner, Florida Atlantic University, USA, turner@acc.fau.edu; Angelika Vetter, University Stuttgart, Germany; Michael Goldsmith, Salford University, UK

Session 5. Gender and the city.
Chair: to be announced

Session 6. The progressive city: how do localities frame and provide positive or negative opportunities to new social movements, human rights, and related activities?
Chairs: Dan Chekki, University Winnipeg, Canada, sociology@uwinnipeg.ca; Dominique Joye, Switzerland, dominique.joye@sidos.unine.ch; Anton M. J. Kreukels, University Utrecht, Netherlands, t.kreukels@frw.ruu.nl; Sophie Body-Gendrot, France

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CALL FOR PAPERS/ABSTRACTS/PROPOSALS

Hawaii International Conference on Social Sciences
June 11-15, 2002 Sheraton
Waikiki Hotel, Waikiki, Honolulu Hawaii, USA
(http://hcsocial.org/hotel_ss.htm)

Submission Deadline: January 16, 2002

Call for papers, abstracts, student papers, case studies, work-in-progress reports, research proposals, poster sessions, research tables, or reports on issues related to teaching. For more information on the format of submissions see: http://hcsocial.org/cfp_ss.htm

Workshop proposals for the pre-session workshops on June 11, 2002 are invited. For more information see: http://hcsocial.org/workshop_info_ss.htm

All areas of Social Sciences are invited: Anthropology, Area Studies, Communication, Economics, Education, Ethnic Studies, Geography, History, International Relations, Journalism, Political Science, Psychology, Public Administration, Sociology, Urban Planning, Women's Studies and other areas related to social sciences. For a complete list of suggested areas of social sciences see http://hcsocial.org/cfp_ss.htm

Submissions may be made electronically via e-mail to social@hcsocial.org or mailed. For more information see http://hcsocial.org/cfp_ss.htm

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CALL FOR PAPERS

Internet Research 3.0:
NET / WORK / THEORY
International and Interdisciplinary Conference of the Association of Internet Researchers (AoIR)
International Institute of INFONOMICS and University of Maastricht
Maastricht, The Netherlands
October 13-16 2002
http://www.aoir.org/2002

Deadline for submissions: February 15, 2002.
Submissions: http://www2.cddc.vt.edu/confman/

The Internet has become an integral, ubiquitous part of everyday life in many social domains and international contexts. Yet, most of the public attention on cyberspace remains fueled by utopian or dystopian visions, rather than being informed by the growing body of research on the Internet as a complex fact of modern life. Internet Research (IR) 3.0, an international and interdisciplinary conference, will feature a variety of perspectives on Internet research, in order to develop a better theoretical and pragmatic understanding of the Internet. Building on the previous well-attended international conferences, the IR 3.0 will bring together prominent scholars, researchers, and practitioners from many disciplines, fields and countries for a program of presentations, panel discussions, and informal exchanges.

This year's theme is Net/Work/Theory. Contributors are called to reflect on how to theorize what we know about the Internet and on how to apply what we know theoretically in practice. The conference will be held for the first time in Europe, whose intellectual environments have traditionally been a source of social and cultural theory.

IR 3.0 will be hosted by the International Institute of Infonomics in the beautiful city of Maastricht in the Netherlands. As the city in which one of the key treaties of the European Union was signed, Maastricht also symbolizes a changing Europe in a changing international setting. The conference will provide opportunities to network, learn from other researchers, hear from leading players in Internet development, and enjoy the "art of fine living" of Maastricht, in the south of the Netherlands.

The Association of Internet Researchers invites paper, presentation, and panel proposals from AoIR members and non-members on topics that address social, cultural, political, economic, and aesthetic aspects of the Internet. We welcome interdisciplinary submissions as well as submissions from any discipline. Panel presentations that establish connections across disciplines, institutions, and/or continents are especially encouraged. We also seek presentations that will make creative use of Internet technologies and techniques.

SUGGESTED TOPICS:
- Theoretical and Methodological approaches to Internet Research
- Internet Access, Use and Effects
- Psychology and the Internet
- Individuals, Groups, and Communities Online
- Privacy, Surveillance, and Security on the Internet
- Internet Policy, Ethics, Law, and Politics
- Teaching, Learning and the Internet
- The Internet in Writing and Publishing
- Ethnicity, Race, Identity, Gender, and Sexuality Online
- The Internet in Cultural Contexts
- The Internet in History
- Digital Arts and Aesthetics
- Gaming on the Internet
- E-commerce, E-Business, or Value of Digital Content
- New Technologies and New Media
- E-Sectors (e-health, e-games, e-entertainment, e-other...)

This list is not meant to be exclusive, but to trigger ideas and encourage submissions from a range of disciplines. The organizers will take an active role in generating and joining the various interests in appropriate formats

FORMAT OF PROPOSALS
Proposals can be of three types — papers, presentations, and panels. Each person is entitled to submit 1 paper, 1 presentation, and/or 1 panel proposal.

PAPERS
Proposals for papers: 150-250 word abstract.
CREATIVE PRESENTATIONS/DEMONSTRATIONS
Creative presentations (surprise us!) and Internet-related project demonstrations (including digital arts) are encouraged. The format for these pro-posals is the same as those for regular papers (150-250 word abstract).

PANELS
Panels will generally include three to four papers or presentations. The session organizer should submit a 250-500 word statement describing the session topic, include abstracts of up to 250 words for each paper or presentation, and indicate that each author is willing to participate in the session.

WORKSHOP
We also invite proposals for pre-conference work-shop. These proposals should be submitted as soon as possible (no later than January 15, 2002) so that the workshops can be publicized.

GRADUATE STUDENTS
Graduate students are highly encouraged to submit proposals. They should note their student status with submission for consideration of a special Student Award. If you intend to be a candidate for the Student Award you must also send a final version of your proposal (final paper) by 15th September 2002.

FORMAT OF SUBMISSIONS
Submission will be accepted from 15th December until 15th February 2002.

All proposals should be submitted electronically at: http://www2.cddc.vt.edu/confman/

It is preferred that you use HTML to minimally format your paper. Average time allotted for a paper or presentation will be 15 minutes. Average time allotted for a panel will be 1 hour and 30 minutes, including discussion time. If these time constraints are not appropriate for your panel/ presentation, please include that in your abstract. Please include any equipment or special con-siderations that might affect your presentation.

DEADLINES
Proposal submission: 15th December, 2001-February 15, 2002

Author notification: April 1, 2002
Presenter's Registration to the conference: September 15, 2002

Student Award: Final paper due September 15, 2002

CONTACT INFORMATION
If you have questions about the conference, program, or AoIR, please contact:

Conference Coordinator: Monica Murero, Infonomics and University of Maastricht: Monica.Murero@infonomics.nl

Program Chair: Klaus Bruhn Jensen, University of Copenhagen:
kbj@hum.ku.dk

A(o)IR President: Steve Jones, sjones@uic.edu

More Information about IR 3.0 can be found on the Conference Website: http://www.aoir.org/2002

For more information about the Association of Internet Researchers, including information on joining the Association, visit AoIR's website at http://aoir.org

For more information about the International Institute of Infonomics visit our website at http://www.infonomics.nl

CALL FOR SYNOPSES

TARGETING MR X - BUT IS HE MR RIGHT? SAMPLING, WEIGHTING, PROFILING, SEGMENTATION AND MODELLING
17 April 2002
Imperial College, London

People are always trying to gain an understanding as to why people have taken a certain action or purchased a certain item. Therefore researchers, analysts and people in business try to understand these groups in order to provide them with the services and products they want in the future. There are a number of ways that this can be achieved:

- Sampling techniques - How do you ensure that a sample is reflective and statistically relevant?
- Weighting data techniques - to weight or not to weight - how to get it right?
- Data profiling - Who are our customers, what defines them and what do they like?
- Segmentation and modelling - How do you identify predictive or indicative elements in the data?
- Software for conducting analyses - How can I understand my data more easily and quickly?

Synopses are invited on the above subjects as well as relevant case studies. Synopses highlighting the pitfalls to sampling, weighting and targeting are also welcome.

Synopses should be about 500 words, and submitted by Thursday January 17th 2002 to:

Diana Elder (Admin@asc.org.uk)
Administrator, ASC, PO Box 60, Chesham, Bucks HP5 3QH, UK
Phone & Fax: +44 (0)1494 793033
Web http://www.asc.org.uk

CALL FOR PAPERS

Annual congress of the South African Sociological Association
Theme: Citizenship, living rights and the public intellectual East London, South Africa
30 June - 3 July 2002

The transition to democracy in South Africa has raised a host of questions about the nature and meaning of citizenship. While there has been a dramatic political change towards democracy based on universal franchise, the economic structure, and especially its ownership and property relations, have remained virtually intact. The fact that material inequality still coincides so largely with apartheid-created racial distinctions raises questions about the long- term legitimacy of the state. There are a whole range of other questions in regard to citizenship and the possibility for creating livelihoods, which are enveloped by the basic divide between political equality and economic inequality. The crises of ambiguous citizenship and living rights manifest themselves in diverse forms in the rest of Africa. Class, ethnicity, race, gender, religion; all still play crucial roles in the manner in which different people are viewed.

This congress provides a platform for a deeper discussion about these crucial questions affecting the future of citizenship in South Africa, the rest of Africa and the world. The SASA invites you, whether based in South Africa or not, to participate in the work of the 2002 SASA Congress. Contributions are welcome in any of the following themes: Crime, violence and security; Development; Economic and industrial sociology; Education and teaching sociology; Race and ethnicity; Environment; Rural sociology; Family; Science and tech-

nology; Gender studies; Social demography; Globalization; Social theory; Health; Urban sociology; Media, culture and society; Methodology; Politics and law.

Deadline for submission of abstracts: 28 February 2002.

For more information, see: http://generalupdate. rau.ac.za/sasa/CallForPapers2002.htm

or contact: Ms Namhla Zondani, SASA 2002 Congress Department of Sociology, Rhodes University, P.O. Box 7426, East London 5200, South Africa E-mail: sasa2002@.ru.ac.za

CALL FOR PAPERS

International Conference
Mass Media and Communications in the e-Society of the 21st Century: Access and Participation
Moscow, Russia
October 17-20, 2002

The European Consortium for Communications Research (ECCR) in association with the Faculty of Journalism of Moscow State University invites papers for its International Conference on Mass Media and Communications in the e-Society of the 21st Century: Access and Participation, to be held in Moscow, Russia, on October 17-20, 2002.

Issues related to the development of mass media and telecommunications will be discussed in the framework of the conference. Among key themes for discussion are:

- Convergence: content and industries in the new telecommunications environment

- Network society and mass media and e-society

- Information and communication technologies and globalization: pro and contra

- Open societies and access to e-media

- Does e-society require regulation and media policy?

- Digital divide in economic, social and cultural contexts: measures to prevent exclusion

- Culture in e-society: rise or decrease?

- Use of Internet and consumption of traditional media

- Journalism education and media literacy in the information society

Working languages of the Conference are English and Russian. Deadline for the submission of abstracts: March 1, 2002.

For further information: please contact Natalia Bolotina n_bolotina@journ.msu.ru

ESORICS 2002

European Symposium on Research in Computer Security
Zurich, Switzerland,
October 14 to 16, 2002

Organised in a series of European countries, ESORICS is confirmed as the European research event in computer security. The symposium started in 1990 and is now held every two years in different European countries and attracts audience from both the academic and industrial communities. The Symposium has established itself as one of the premiere, international gatherings on Information Assurance.

ESORICS 2002 will take place in Zurich, Switzerland from October 14 to 16, 2002. It is jointly organized by IBM Research and ETH Zurich, the Swiss Federal Institute of Technology.

More information at: http://www.esorics2002.org/

Graduate Program in Survey Methodology at the University of Michigan

A new interdepartmental degree program is combining the efforts of social, behavioral, and statistical science faculty at the University with the resources and faculty of the Institute for Social Research (ISR). The University of Michigan is offering new degree programs in survey methodology beginning September, 2002. Master of Science, PhD, and Certificate programs are accepting applications for admission. The 15-17 credit hour Certificate program may be completed through Fall and Winter enrollments, or through enrollment in the Summer Institute in Survey Research Techniques during June and July.

Applications for admission to the Masters or Ph.D. program must be received by the Horace H. Rackham School of Graduate Studies (with a copy to the Program) by January 30. Certificate program applications will be accepted during any academic term for admission consideration in the following term.

For details about the Graduate School's admissions process, please visit the School's web site at http://www.rackham.umich.edu/Admis/

or contact:

Office of Graduate Admissions
Rackham Graduate School
915 East Washington
Ann Arbor, MI 48109-1070
Phone: 734-764-8129

For information about the Program, and to request an application packet, please contact:

Dr. James Lepkowski, Acting Director
Michigan Program in Survey Methodology
Institute for Social Research
426 Thompson Street
Ann Arbor, MI 48104
Phone: 734-764-6595
Email: michpsm@isr.umich.edu

CALL FOR PAPERS

R/Évolution
An Interdisciplinary Graduate Student Conference
Hosted by the Ph.D. Humanities Program:
Interdisciplinary Studies in Society and Culture
March 23rd, 2002 at Concordia University

Keynote speaker: Mark Saunders

Graduate students from all disciplines are invited to submit proposals exploring "r/évolution." Proposals should translate into 15 minutes of presentation time (7-8 pages).

We invite proposals for the presentation and discussion of papers, short films, panel presentations, and more around a multifarious, oft-controversial, and timely theme. The goal of this symposium is to integrate theoretical, methodological, and "practical" approaches to the broad theme of "r/evolution." This symposium seeks to address the last century and to create space and possibility for continued praxis and critique of "revolution," "evolution," "progress," and "change." What does "revolution" mean in our historical context? What are (or have been) the vectors of

and for political change? We hope to create a space in which questions can be asked of ideology, language, and discourse, and where dialogue on the past, present, and future can thrive.

Mark Saunders is an acclaimed and award-winning documentary filmmaker whose community-based work is grounded in urbanism and utopianism. His films include the Prix Du Public winning Battle of Trafalgar, 1993's The Truth Lies in Rostock, Exodus Movement of Jah People and Exodus from Babylon, and the Innovations in Communications Award winning A Line in Time in 1999. He has helped to create non-broadcast productions for the World Development Movement, Transport and General Workers Union, New Economic Foundation, and Amnesty International. Resisting, severing, and transcending traditional disciplinary borders, his keynote address "Do Utopians Watch TV?" presents a rapid tour past the landmarks of independent media. Illustrated and contextualized with extracts from his own work, Saunders will discuss the intricacies of these questions from the beginnings of video up to Peter Watkin's La Commune and the new romantic hero, the "Media-Activist".

Presentations may address (but are certainly not limited to):

transition/s, "progress," change: social/political/ cultural/epistomological, revolt v. revolution, continuity/discontinuity, nostalgia, memory, activism, movement/s globalization, revolutionary art, privatization and the academy, the task of history, popular culture, urban spaces, nationalisms, space/time, quiet opposition v. violence, generation/s, sexualities, identity/identity politics, silent revolution/s, collectivity, utopia/s, modernization, labour, HIV/AIDS, displacement, spectacle/s, feminism/s postfeminism/s, alternatives, institutionality, the "right," borders and margins, race, spirituality, morals & ethics, media, voice, myth, legend, folklore...

Presentation Formats: Papers, critical essays, poster presentations, panels, creative writing, and performance art. Non-traditional presentation formats are welcome!

Applicants should submit a title and an abstract of not more than 250 words to "R/Evolution":

Humanities Doctoral Program
School of Graduate Studies and Research
Concordia University
2135 Mackay Street, M-302
MONTRÉAL Quebec H3G 2J2

E-mail: candis.steenbergen@sympatico.ca

SUBMISSION DEADLINE: January 31, 2002.

E-mail submissions encouraged.

Abstracts/presentations will be accepted in both English and French.

SITGES 2002: SITGES CONFERENCE
http://www.ffn.ub.es/sitges/

"Statistical Mechanics of Complex Networks"
XVIII Sitges Conference on Statistical Mechanics
Sitges, Barcelona, SPAIN, 10-14 June 2002

Departament de Fisica Fonamental, UNIVERSITAT DE BARCELONA

Networks provide graphic images of the extent to which population form connections among individuals, and web-like structures describe a large variety of systems in many fields of science. Recently, the growing interest in complex systems has prompted the study of real networks with novel and previously uncharacterized topological properties. As a few examples, we can mention the Internet, a vast network of routers and computers, linked by physical wires; the world-wide-web, a virtual network of web pages connected by hyper-links; social friendship or collaboration networks; protein networks, ecological and food webs, etc. The study of these systems clearly indicates that these complex networks must display some organizing dynamical principles, encoded in their topology as well, for which we need to develop new experimental and theoretical concepts; i.e. a physics of complex networks.

The purpose of this Workshop is to bring together key scientists from the different fields in which complex networks play a major role with a twofold purpose. First of all, the attempt to define a unifying framework, which can be fundamental in order to fully develop a solid theoretical understanding of the physical processes underlying the formation of complex networks. Secondly, the discussion of the possible relevance of the notion of complex networks and the main achievements

developed in this field in a fully interdisciplinary perspective. By allowing the participation of the wide scientific community for which complex networks can become a useful working tool, we hope to favor also the exchange of experiences in the diverse fields of expertise of the key speakers. That will surely lead to fruitful cross-fertilizations of ideas, as well as to communicate to the participants the new and exciting advancements that are made, day by day, in the ambit of complex networks. The presentations will provide an overview of the phenomenology of networks with new findings from different fields and will draw a state-of-the-art picture of theoretical methods and approaches. One important goal of the workshop is also to initiate interdisciplinary exchange between researchers, both experimentalists and theorists.

List of confirmed invited speakers:

- Luis A. Nunes Amaral (Boston University, Boston MA, USA): "Social Networks: Their many guises and structures"
- Albert-Laszlo Barabasi (Notre Dame University, Notre Dame IN, USA): "The Architecture of Complexity: Emergence of scaling in complex networks"
- Guido Caldarelli (Universita di Roma La Sapienza, Rome, Italy): "Stability and Optimization in Food Webs"
- Albert Diaz-Guilera (Universitat de Barcelona, Barcelona, Spain): "Search and congestion in complex communication networks"
- Peter Hanggi (Augsburg University, Augsburg, Germany): "Collective Properties of Ion Channel Clusters: Channel Noise, Synchronization, and Stochastic Resonance"
- Shlomo Havlin (Bar-Ilan University, Ramat Gan, Israel): "The stability of complex networks"
- Jose F.F. Mendes (Universidade do Porto, Porto, Portugal): "Acelerated growth of networks"
- Mark Newman (Santa Fe Institute, Santa Fe NM, USA): "Structure and function in social networks" (tentative)
- Zoltan N. Oltvai (Northwestern University, Chicago IL, USA): To be announced
- Luciano Pietronero (Universita di Roma La Sapienza, Rome, Italy): To be announced
- Sidney Redner (Boston University, Boston MA, USA): "A statistical physics perspective on popularity"

- Ricard V. Sole (Universitat Politecnica de Catalunya, Barcelona, Spain): "Ecology and evolution on complex networks"
- H. Eugene Stanley (Boston University, Boston MA, USA): "Origins of scaling and universality in complex networks"
- Alessandro Vespignani (ICTP Trieste, Italy): "Epidemic spreading and immunization in complex network"
- Duncan J. Watts (Columbia University, New York NY, USA): To be announced
- Yi-Cheng Zhang (Fribourg University, Switzerland): To be announced

A low number of short talks will be offered to selected participants, plus a poster session.

Sponsors: this Conference is financed by DGES of the Spanish Government, CIRIT of the Generalitat de Catalunya, and Universitat de Barcelona.

Scientific Committee:
A.-L. Barabasi (Notre Dame University, USA)
N.V. Brilliantov (Moscow State University, Russia)
P. Hanggi (Augsburg University, Germany)
R. Pastor-Satorras (Univ. Politecnica Catalunya)
J. M. Rubi (Univ. Barcelona)
A. Vespignani (ICTP Trieste, Italy)
Y.-C. Zhang (Fribourg University, Switzerland)

Local Organizing Committee:
J.M. Rubi (Univ. Barcelona)
A. Arenas (Univ. Rovira i Virgili)
A. Diaz-Guilera (Univ. Barcelona)
I. Pagonabarraga (Univ. Barcelona)
R. Pastor-Satorras (Univ. Politecnica Catalunya)
A. Perez-Madrid (Univ. Barcelona)
C.J. Perez (Univ. Barcelona)

Deadlines: Registration: April 26, 2002

Registration fee is 200.00€ and should be paid upon arrival at the Conference site.

Conference Hall: Palau Maricel

Contact address:
Prof. Miguel Rubi
Dept. Fisica Fonamental
Universitat de Barcelona
Av. Diagonal, 647

Barcelona 08028 SPAIN
e-mail: sitges18@precario.ffn.ub.es
Home Page: http://www.ffn.ub.es/sitges

The National Endowment for the Humanities
Presents
eHumanities Lecture Series

The NEH invites you to attend the next installment of the eHumanities Lecture Series. The goal of this series is to bring leading scholars to Washington to discuss the relationship of digital technology and the humanities. Last year, we had a terrific turnout for our free lecture series held here at the Old Post Office in Washington, DC.

Next Lecture: February 13, "After the Internet." JAMES O'DONNELL from UPENN.

See our web page for detailed information and to register:

http://www.neh.gov/news/ehumanities.html

Please feel free to pass this to colleagues.

February 13
Lecture Title: "After the Internet"
JAMES O'DONNELL

The Internet bubble has burst. The Internet is boring. Even The Economist is reduced to devoting a special section to the wireless Internet in order to gain and hold its readers' attention. This is an opportunity for serious thought and action about the integration of information technology and information science in the humanistic organon. How are we different because we live in this wired world? How are we not different? What is reasonable to expect?

James J. O'Donnell is Professor of Classical Studies and Vice Provost for Information Systems and Computing at the University of Pennsylvania. He has published widely on the cultural history of the late antique Mediterranean world and is a recognized innovator in the application of net-worked information technology in higher education. In 1990, he co-founded Bryn Mawr Classical Review, the second on-line scholarly journal in the humanities ever created. In 1994, he taught an Internet-based seminar on the work of Augustine of Hippo that reached 500 students. He also serves as resident Faculty Master of Hill College House at Penn. He is a Trustee of the National Humanities Center, has served as a Director and will become President-Elect in 2002 of the American Philo-logical Association, and served as a Councillor of the Medieval Academy of America.

CALL FOR PATTERNS

SHAPING THE NETWORK SOCIETY
Patterns for Participation, Action, and Change
DIAC-02 Symposium; Seattle, Washington USA.
May 16-19, 2002
http://www.cpsr.org/conferences/diac02

Researchers, community workers, social activists, educators and students, journalists, artists, policy-makers, and citizens are all concerned about the shape that the new information and communica-tion infrastructure will take.

• Will it meet the needs of all people?
• Will it help people address current and future issues?
• Will it promote democracy, social justice, sustainability?
• Will the appropriate research be conducted?
• Will equitable policies be enacted?

The Shaping the Network Society symposium – sponsored by the Public Sphere Project of Computer Professionals for Social Responsibility and the National Communication Association Task Force on the Digital Divide – will provide a forum and a platform for these critical issues. And through the exploration of "patterns" we hope that this symposium will help spur the evolution of an information and communication infrastructure that truly meets today's urgent needs.

Please join us in Seattle in May 2002 for this exceptional event!

To promote bridge-building between theory and practice, across economic, cultural, geographical, and disciplinary chasms, we are soliciting "pat-terns," instead of abstracts, and accepted patterns will be developed into full papers for this sym-posium.

Based on the insights of Christopher Alexander and his colleagues, a "pattern" is a careful description of

a solution or suggestion for remedying an identified problem in a given context that can be used to help develop and harness communication and information technology in ways that affirm human values.

The information contained in patterns is similar to that in traditional abstracts or papers, but it is arranged in a common structure in order to inspire scholars and practitioners to think about their work in terms of social implications and actual social engagement and to build networks that include research, practice, and advocacy. The most important outcome may be allowing people to see their patterns in a large yet coherent network of patterns, a "pattern language."

+ Patterns are SOLUTIONS to PROBLEMS in a given CONTEXT
+ Patterns can be observable actions, empirical findings, hypotheses, theories, or "best practices"
+ Patterns exist at all levels; they can be "global" as well as "local;" theoretical as well as practical.
+ Patterns are the springboard for discussion, research, and activism

Patterns can be submitted for consideration for presentation at the symposium and/or published on the web site as a contribution to the evolving pattern language. (The submitted patterns will be made public in early 2002.) Patterns accepted for presentation will be developed into full papers and will appear in the Conference Proceedings. The best papers will be selected for an edited book. A pattern language book / web site is also planned.

We believe that the "pattern" orientation will be useful and inspiring for all participants. If you're tempted to submit a pattern (or multiple patterns!) we encourage you to do so. Although this approach may require slightly different thinking we believe that it will be worth the extra effort. Remember: you can submit patterns whether or not you come to the symposium.

Complete details on pattern submission, including example patterns, are available at the web site: http://www.cpsr.org/conferences/diac02/.

The preferred way to submit patterns is through the pattern intake site (http://www.cpsr.org/conferences/diac02/pattern.cgi). If you cannot access the site, please send your pattern(s) as email text (no attachments) to docrod99@hotmail.com. If you lack email access, you may submit your pattern(s) via surface mail to be received by December 1, 2001 to: Rod Carveth, School of Mass Communications, Texas Tech University, P.O. Box 43082, Lubbock, TX 79409, USA.

Please see the patterns page for more explanation about patterns (including examples) and the author's advice page to assist potential contributors.

Important Dates

• August 1, 2001: Patterns can be entered via web page
• November 15, 2001: Web registration available
• December 1, 2001: Patterns due for conference consideration
• January 15, 2002: Feedback to conference pattern submitters (accept/reject decision)
• March 15, 2002: Full papers (based on accepted patterns) due
• April 15, 2002: Last day to submit pattern abstracts for database inclusion only
• May 16 - 19, 2002: Shaping the Network Society Symposium; Seattle, Washington US

Program Committee

Abdul Alkalimet (US), Alain Ambrosi (Canada), Ann Bishop (US), Kwasi Boakye-Akyeampong (Ghana), Rod Carveth (US), Andrew Clement (Canada), Fiorella de Cindio (Italy), Peter Day (UK), Susana Finquelievich (Argentina), Mike Gurstein (Canada), Harry Hochheiser (US), Toru Ishida (Japan), Susan Kretchmer (US), Brian Loader (UK), Geert Lovink (Netherlands, Australia), Richard Lowenberg (US), Peter Mambrey (Germany), Peter Miller (US), Kenneth Pigg (US), Scott Robinson (Mexico), Partha Pratim Sarker (Bangladesh), Doug Schuler (US), David Silver (US), Sergei Stafeev (Russia), Erik Stolterman (Sweden) and Peter Van den Besselaar (Netherlands).

Other invaluable assistance:

Christopher Alexander (inspiration and advice), Steve Berczuk (patterns), Susan Kretchmer and Rod Carveth (NCA Task Force on the Digital Divide liaisons), Noriko Okazaki (graphics), Robin Oppenheimer (advisor), Lorraine Pozzi (communi-

cations), Scott Rose (web technology). Nancy White (advisor).

For more information please contact symposium coordinator Doug Schuler, douglas@scn.org.

Séminaire « Jeunes : gestion des diversités et cohésion sociale »
organisé par l IRESCO et l INJEP
Seminaire Jeune 13 décembre 2001

59-61 rue Pouchet
75849 Paris cedex 17
métro Brochant ou Guy Moquet (ligne 13)
bus : n° 66 arrêt Jonquière.

de 14h. à 17h.30 salle de Conférence au rez-de-chaussée

Jeudi 13 Décembre 2001 : Jeunes, exclusion sociale, citoyenneté.

Intervenants :

Serge Paugam (Lasmas)

Jean Manuel de Queiroz (Université Rennes II)

Paola Rebughini (Université de Milan)

Marc Molgat (Université d Ottawa)

Les conceptions de la citoyenneté sont diverses car ancrées dans des traditions culturelles et dans des configurations nationales spécifiques. Le séminaire du 20 septembre 2001 avait permis de rappeler avec insistance, ce point. D une rive à l autre de l Atlantique les différences sont patentes. Ici la citoyenneté opère par abstraction, extraction, négation des particularismes, et là au contraire par la reconnaissance des différences et la délivrance de droits. Ici elle se réalise sur une base purement individuelle l individu face à l état ; là elle Suvre sur une base communautaire. Différentes conceptions co-existent donc, qui se trouvent remises en question et appelées à de sévères révisions en fonction des enjeux auxquels nos sociétés modernes se trouvent confrontées. Le premier d entre eux est sans nul doute l exclusion sociale et économique, qui frappe les jeunes au premier chef. Quelles que soient ses formes et sa définition, la première finalité de la citoyenneté est d assurer l intégration politique de la cité. L exclusion est la limite, voire la négation de cette capacité. Elle est privation des droits qui sont dévolus à toute personne qui fait acte d adhésion. Or l exclusion,

même avec la relance économique, n a guère été maîtrisée. L exclusion s est maintenue, au sein même de sociétés qui, au cours de ces dernières années, n ont jamais été aussi prospères. Pour les uns, c est donc le contrat social qui se trouve remis en question, pour les autres c est aux droits de créances que l on sattaque remettant en question ce qui dans la typologie de Thomas Humphrey Marshall représentait le troisième niveau de la citoyenneté, à savoir la citoyenneté sociale. L exclusion, et d une manière plus générale, l émiettement du travail et la réévaluation de son rôle et de sa place comme vecteur d intégration apparaissent donc comme la première menace qui pèse sur la citoyenneté.

C est en nous focalisant sur les jeunes que nous engagerons la réflexion sur ces points.

REMINDER AND CALL FOR PAPERS

Second European Thematic Conference of Network Analysts
University of Lille I, France, May 30-31, 2002

MICRO-MACRO RELATIONS :
ADVANCES IN THE CONTRIBUTION OF STRUCTURAL ANALYSIS

Keynote speaker: Tom SNIJDERS, University of Groningen

Dear Colleagues,
The deadline for sending a title/abstract and for registration has been extended to March 31, 2002.

Suggestions for sessions and contributions made up to now can be sorted out as follows :

- Statistical models, simulation
- Diffusion processes (in health (disease); in business (innovation))
- Theory: What is the meso level?
- Political process (policy networks, multilevel bargaining)
- Micro conditions for macro change, and the other way around (civic participation)
- Social capital: individual or collective asset ?
- Social mobility and social networks
- Effects of ecological conditions on ego nets
- Local redefinition of collective norms
- From intra- to inter-organizational networks

Additional suggestions most welcome.
For more information, visit our website:
http://www.univ-lille1.fr/lilnet/

Organization: Alexis Ferrand, Emmanuel Lazega

INVITATION

CASOS SUMMER INSTITUTE
June 15-20, 2002
Location: CMU, Pittsburgh, PA

The CASOS summer institute provides an intense and hands-on introduction to computational analysis of social and organizational systems. The focus is on social network analysis, complex adaptive systems, designing and evaluating computational models, multi-agent systems, virtual experiments, and docking. Illustrative models such as VDT, ORGAHEAD, CONSTRUCT, and ORGCON will be discussed. Network tools such as NETSTAT and UCINET will be used. Sessions will be split between lectures and labs. No prior programming experience is assumed. Attendees will be given readings and selected software. This institute is supported in part by the National Science Foundation, IGERT program. Ph.D. students who are US residents can apply to the CMU IGERT program for scholarships to help cover part of the cost of attending this workshop. Simply mark on the application that you are interested in a scholarship and send email to: kathleen.carley@cmu.edu

Additional information is available on: www.casos.ece.cmu.edu/ Go to "upcoming events" then to "summer institute". Registration forms are available on line.

Costs:
Ph.D. Student - $650 (includes breakfast and lunch each day, and reception)
Faculty - $950 (includes breakfast and lunch each day, and reception)
Industrial participant - $1300 (includes breakfast and lunch each day, and reception)

Housing - These are the costs for Mudge Dorms
Single - 24.00/night per person
Double 17.50/night per person

CALL FOR ARTICLES

Studies in Ethnicity and Nationalism is a biannual academic journal of the Association for the Study of Ethnicity and Nationalism (ASEN). It contains fully refereed short articles on ethnicity, nationalism, identity and related topics. It also contains information on forthcoming conferences, seminars, courses and general information for society members and other scholars in the field.

The Editors welcome the submission of high quality, 4,000-5,000 word articles, particularly those which represent new ideas, work in progress or analysis of key debates and issues. The Editors encourage submissions from both postgraduate students as well as new and established academics. Submission deadline for the next issue: 15 of December 2001.

For a copy of the journal and the Guidelines for Contributors please contact:

Mansoor Mirza or Diego Muro-Ruiz
Studies in Ethnicity and Nationalism,
European Institute
London School of Economics
Houghton Street
London WC2A 2AE, UK
e-mail: sen@lse.ac.uk

CASOS 2002
June 21-23, 2002
Location: CMU, Pittsburgh, PA
KeyNote: TBA

This international conference explores advances in computational social and organizational science. The purpose of this conference is to explore advances in computational social and organizational science. Of particular interest is recent work in any of the following areas:

1. computational theorizing about complex social systems including small groups, political systems, organizations, societies, institutions and technology enhanced environments

2. new computational or network based analysis tools for studying complex social or organizational systems, social-psychological, social, organizational, political and technological systems

3. empirical tests of computational, mathematical, or logical models

4. formal complex systems models

5. computational models of impact of new technologies

6.   multi-agent network models

Presentations are from a combination of invited and submitted papers. Participants need not present a paper. Individuals interested in presenting a paper must submit an extended abstract.

There will be a Ph.D. student paper competition. The winner of this competition will have their extended abstract published in CMOT.

Additional information as it becomes available will be posted to www.casos.ece.cmu.edu. Go to CASOS 2002 conference (or go to Upcoming events then to the conference).

The registration is on line.

Submitted Papers - Guidelines

If you are interested in presenting a paper you must submit an extended abstract by March 5, 2002 to Kathleen M. Carley - kathleen.carley@cmu.edu.

The extended abstract must have this format:

1.   Length 3-5 pages
2.   Margins 1 inch – all sides
3.   Font – Times-New-Roman 10 for body
4.   Paragraphs - .25 indent
5.   Spacing – single
6.   Headers – Times-New-Roman 12 point bold - centered
7.   References – hanging indent Times-New-Roman 10
8.   Do not number pages
9.   All papers must be either msword files or PDF files. See attached file for sample format.
10.   Abstract should include – topic, background, illustrative results, references. Abstract may include figures or tables.
11.   Do NOT use macros or non English fonts.

See attached msword file for title page format.
If this paper should be considered for the Ph.D. paper competition – then please state that in the email note when the paper is submitted, along with the name of the institution, and the name of the student's advisor. All papers where a Ph.D. student is the primary or sole author are eligible. Accepted abstracts will appear in the conference proceedings and be published on the CASOS web pages.

Papers will be refereed and those accepted for presentation will be notified in mid April.

Submitted Laptop Demos - Guidelines
Laptop demos – June 21,22 and 23. Anyone with a laptop is invited to provide a real time demo after the talks, in the main conference room. Please send title of demo, abstract of what will be covered (1 paragraph) and name of person who will be doing the demo to Kathleen Carley (kathleen.carley @cmu.edu). The only requirement is that you must provide your own laptop. There will not be connection to the internet for these demos.

All demo information should be sent by April 30th so that it can be published in the proceedings.

Where to Stay
Limited space is available in CMU 's Mudge dorm at a reduced rate, if you would prefer that to a hotel.

If interested contact Cari Taylor: carie@andrew.cmu.edu.

Hotels in the Oakland area:
Wyndham Gardens Hotel
University Place
3454 Forbes Ave.
Pgh. Pa 15213
412-683-2040
877-622-6242 (toll free)
412-683-3934 (fax)

Holiday Inn, University Center
100 Lytton Avenue
Pittsburgh, PA 15213
412-682-6200
1-800Holiday, Reservations

Costs
CASOS Conference
Graduate Student - $180.00
Faculty   - $350.00
Industrial or
Government Participant - $500.00
Note: Costs include keynote dinner, reception and lunch each day and breakfast when morning sessions.

Late and on-site registration fee – add an additional $25.00

Housing - These are the costs for Mudge Dorms
         Single - 24.00/night per person
         Double 17.50/night per person

Payment
Payment is by check or credit card in advance of the conference
• please contact Cari Bruggeman at carie@andrew.cmu.edu

Background
Conference typically has 80 to 100 people who register, drawn internationally. The mixture is interdisciplinary. Faculty, advanced Ph.D. students, government and industry personnel are speakers.

SPECIAL ISSUES

Social Science Computer Review
Volume20, No. 2
Summer, 2002

SocialCapital and the Equalizing Potential of the Internet / Hans Pruijt

Perceptions of University Students Regarding the Digital Divide / Mike Crews and Martin Feinberg

CitizenSurveys on the Web: General Population Surveys of Community Opinion / Thomas I. Miller, Michelle Miller Kobayashi, Erin Caldwell, Sarah Thurston, and Ben Collett Computer Application for Research on Gender: Using Online Context as a Mediating Variable in the Investigation of Sex-Role Orientation and Care-Oriented Moral Reasoning / Lynn M. Mulkey and Tasha D. Anderson

*MotivatingOnline P*erformance: The Influences of Goal Setting and Internet Self-Efficacy / Lori Foster Thompson, John P. Meriac, and John G. Cope

*ComputerMo*deling and the Politics of Greenhouse Gas Policy in Australia / Paul Henman

*Agent-Based*Modeling: What I Learned from the Artificial Stock Market / Paul E. Johnson

Reports and Communications Comparing Trade Instruments Using Spreadsheets / Souomaya M. Tohamy and J. Wilson Mixon, Jr.

*Lessons for M*anaging Information Technology in the Public Sector / Alana Northrop

News and Notes / G. David Garson

*BookR*eviews

*ReviewE*ssay: The Human-Machine Interface, by

Joseph Behar, treating Evan J. Bibbee and Olliver Dyens, Metal and Flesh: The Evolution of Man - Technology Takes Over; Paul Dourish, Where the Action Is: The Foundations of Embodied Action; and Cynthia K. West, Techno-Human Mesh: The Growing Power of Information Technologies.

*Reinventi*ng Government in the Information Age: International Practice in IT-Enabled Public Sector Reform, by Richard Heeks, ed. / reviewed by Amy L. Fletcher

*BeyondOur Con*trol? Confronting the Limits of Our Legal System in the Age of Cyberspace, by Stuart Biegel / reviewed by Carl Grafton

*The Digital Dial*ectic: New Essays on New Media, by Peter Lumenfeld, ed. / reviewed by Ted Goertzel

*e-Sphere:Th*e Rise of the World-Wide Mind, by Joseph N. Pelton / reviewed by Ted Goertzel

Articles on similar topics relating to social impacts of information technology and computer applications in social science are welcomed for consideration for future issues.

Contact the editor at David_Garson@ncsu,edu

Sample issues available by request from: jsamples@sagepub.com.

Information: http://www.sagepub.com/shopping/ Journal.asp?id=32

Concurrent Engineering: Research and Application (CERA) Journal

'A Complex Systems Perspective on Concurrent Engineering'

Why can concurrent engineering projects take so long and cost so much, despite our best efforts to use such apparently sensible techniques as multi-functional design teams, set-based design, and computer-aided collaborative design tools? How can we cope with the increasing scale and complexity of such projects? The emerging discipline of complex systems research offers a new and potentially powerful perspective on these problems, by attempting to understand the dynamics of distributed systems using such concepts as chaos, power laws, self-similarity, emergence, self-organization, networks, adaptation, evolution, etc.

This special issue solicits papers that apply the complex systems perspective to understanding and improving the dynamics of the concurrent engineering process. Topics of interest include but are not limited to:

- Emergent behavior in collaborative design
- Non-linear and chaotic dynamics of collaborative design
- Interaction between technical, environmental and socio-economic factors
- Evidence of chaos and nonlinear phenomena in product development
- Network dynamics in concurrent engineering
- Distributed structures of workgroups in collaborative design
- Pattern formation in workgroups and cooperative teamwork
- Critical connectivity effect on product development performance
- Classification of complex collaborative design
- Complexity measures in collaborative design
- Characterizing and controlling product development dynamics
- Multi-scale descriptions of collaborative design
- Modeling and simulation of complex manufacturing and product development environments
- Computer-aided complex concurrent engineering
- Complexity related methodologies in product development monitoring
- Game theory, strategic planning and collaborative design
- Concurrent engineering as self-adaptive systems
- Evolutionary perspectives to concurrent engineering
- Adaptability of collaborative design processes
- Vulnerability of collaborative design processes

Authors should email electronic copies (PDF format) of their full-length papers to ALL the guest editors listed below. See http://www.ceraj.com/ for formatting guidelines.

Important dates:

Electronic abstract (optional)

February 1, 2002 *EXTENDED*
Papers due
    March 15, 2002
Reviews to authors
    June 15, 2002
Revised papers due to guest editor
    August 15, 2002
Planned publication date
    March, 2003

Guest editors:

Dan Braha
Massachusetts Institute of Technology
braha@mit.edu

Mark Klein
Massachusetts Institute of Technology
m_klein@mit.edu

Yaneer Bar-Yam
New England Complex Systems Institute
yaneer@necsi.org

Hiroki Sayama
New England Complex Systems Institute
sayama@necsi.org

JOB OPENINGS

POSITION AVAILABLE

Senior Lecturer in Sociology of Health
Faculty of Human Sciences
University of Natal, Durban
South Africa

Applications for the post Senior Lecturer in Sociology of Health at the University of Natal (Durban campus), starting January 1, 2002 or as soon as possible thereafter, are invited from suitably qualified and experienced persons. (Reference No: D 104/2001)

The Sociology and the Industrial, Organisational and Labour Studies (IOLS) Programmes operate separately although some staff teach in both. The prevalence of HIV/AIDS in the southern African region and in this province, as well as other health-related matters, makes it essential that we introduce courses in the broad field of the Sociology of Health. As this is a field at present not

covered within IOLS or Sociology, skills in curriculum development will also be necessary. IOLS specifically requires the development and teaching of course(s) in industrial/occupational health. This post offers the incumbent opportunities for career development and extensive practical and research experience in the field.

For this career position you will need: At least an appropriate Masters degree, but clear preference will be given to candidates with an appropriate PhD for reasons of effective supervision of graduate students at all levels. University teaching experience of at least five years and a sound record of publications and research in this field.

You will be required: to teach at undergraduate level, such as Social Issues (in the Sociology Programme), and Industrial Health (in IOLS); to provide a graduate course on some aspect of the Sociology of Health; to supervise research projects at all levels for which you are qualified; to have the ability to work in a team as shared responsibilities will be required of this appointee; to develop links with other programmes, both within the Faculty of Human Sciences and within other Faculties and off-campus projects; to assume course co-ordinating and administrative responsibilities as expected of a senior appointee.

The package offered will be dependent on the qualifications and experience of the successful candidate. Applicants are required to submit a curriculum vitae, together with the name, telephone no. and fax no. or e-mail address of three referees, to Human Resources Administration, University of Natal, Durban 4041, South Africa, Fax: 27 (0)31 260 2139 or e-mail:

moodleys60@nu.ac.za

For further information contact:
Director tel: 27 (0)31- 260-2442
Administrative Assistant tel: 27 (0)31- 260-2302 or e-mail sociology@nu.ac.za

POSITION AVAILABLE

Assistant Professor
Department of Sociology
University of North Carolina
Greensboro, USA

The University of North Carolina at Greensboro's

Department of Sociology invites applications for a tenure-track Assistant Professor position effective August 2002.

Candidates should be able to teach and conduct research in at least two of the following three areas: race and ethnicity, quantitative methods and social change. Persons with a substantive interest in Latin or Asian studies are encouraged to apply. We seek a person with high promise in both teaching and research.

The UNC Greensboro is a growing campus with over 13,000 students. Ethnic migration to North Carolina's piedmont region makes the greater Greensboro area an attractive location for a variety of research interests. Applications will be accepted until November 15, 2001, or until the position is filled.

Please forward a letter of introduction, three letters of reference, a vita, an example of written work, and sample teaching evaluations to:

Ken Allan, Chair Search Committee
Department of Sociology, UNC Greensboro
Greensboro, NC 27402-6170, USA
E-mail: kdallan@uncg.edu

FELLOWSHIPS

Research Fellowships
University of Essex

Readers of this list may be interested in the availability of fellowships to support research visits to the European Centre for Analysis in the Social Sciences (ECASS), located within the Institute for Social and Economic Research at the UK University of Essex. These awards allow researchers to visit Essex for periods of up to three months and to spend time carrying out their own research, making useof Essex facilities and data collections and up-grade their analytical skills.

ECASS is a major infrastructure for European research and data analysis, supported by the Improving Human Potential - Enhancing Access to Research Infrastructures Programme of the European Commission. Now in its fourth year, it was set up to help researchers gain access to existing ISER and Data Archive facilities by providing travel and subsistence support for short-term visitors. More information on ECASS, ISER, the Data Archive

and the Essex Summer School can be found at the web at the address below.

ECASS is interdisciplinary specialising in the empirical study of social and economic change in a comparative context. It integrates longitudinal and cross-sectional European datasets, provides technical and intellectual support services required for their analyses and acts as the host for major substantive research programmes - primary among them being longitudinal household panel studies and time budget studies.

Researchers visiting ECASS will be able to:

collaborate with researchers producing the British Household Panel Study and the European Community Household Panel Study within the Institute for Social and Economic Research, and in comparative longitudinal research on a variety of social and economic topics, and take advantage of the resources of the national Data Archive with over 4,000 significant social indicators datasets - both quantitative and qualitative, and participate in the Essex Summer School in Social Science Data Analysis and Collection (through ECASS bursaries),

Interested researchers (postgraduate or postdoctoral) are invited to submit individual or joint, comparative research proposals to ECASS. Only those who are employed in European Union and Associated countries (Iceland, Norway, Liechtenstein, Israel, Bulgaria, Republic of Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia) and excluding the United Kingdom are eligible.

Applications are considered at any time. Early application is advisable.

For more information, contact:

ECASS,
Institute for Social and Economic Research,
University of Essex,
Colchester, Essex, CO4 3SQ,
England

Tel: +44 (0)1206 873087

Fax: +44 (0)1206 872403

Email: ecass@essex.ac.uk

Or

See the ECASS Home Page at
http://www.iser.essex.ac.uk/ecass

UNIVERSITY RESEARCH FELLOWSHIP

School of Computing,
University of Leeds, England
URF/02/2 Computational Modelling of Complex
Adaptive Systems

Closing date: by noon, 1 March 2002.

University Research Fellowships:

• are normally offered on Research Grade II (£24,435 - £32,537 p.a), but may be more senior for particularly outstanding applicants;

• will concentrate on research for three to five years, normally leading to a permanent academic appointment;

• are exempt from teaching and administrative duties in the early stages.

• may be supported by development grants of up to £30,000

Appointees will have an excellent record of research achievement and will be expected to make a significant contribution to the research profile of their department and the University. Full support for career development will be provided.

Closing date for applications is noon on 1st March 2002. For further information and details of how to apply please contact:

Human Resources (Research Fellows),
University of Leeds, Leeds LS2 9JT, UK
telephone: 0113 233 4153
e-mail: urf@leeds.ac.uk
http://www.leeds.ac.uk/jobadverts

Please quote the reference number URF/02/2.

NSF SCHOLARSHIPS FOR ONE WEEK
COURSE ON COMPLEX SYSTEMS

ComplexPhysical, Biological and Social Systems
January 7-11, 2002
Cambridge, MA (at MIT)
http://necsi.org/education/oneweek/
winter01.html
We have just received a special grant from the National Science Foundation providing support for a limited number of partial scholarships for the One-Week Intensive Course on complex systems concepts and methods.

Members of underrepresented groups are especially encouraged to apply.

Applications should be sent to office@necsi.org We will provide these scholarships on a first come first served and need basis.

POSTDOC TRAINEESHIPS

Postdoctoral traineeship in quantitative methods:
University of illinois at
Urbana-champaign

NIMH funded training in quantitative methods for behavioral and social science. Appointment commences July or August 2002. Seminars on advanced topics including multivariate analysis, multi-dimensional scaling, decision theory, social choice modeling, combinatorial methods for data analysis, and social network analysis. Opportunities for both methodological and applications research. Faculty includes: C. Anderson, D. Budescu, L. Hubert, L. Jones, R. McDonald, J. Meulman, G. Miller, M. Regenwetter and S. Wasserman. Stipend range: $28,260 to $36,996. Applicants should be US citizens or have been admitted for permanent residence. Funding limits appointments to individuals who are no more than two years post-PhD. Curriculum Vitae, statement of research interests, reprints, and three letters recommendation should be sent to: Stanley Wasserman, Coordinator, NIMH Training Program in Quantitative Psychology, Department of Psychology, University of Illinois, 603 E. Daniel, Champaign, Illinois 61820.

e-mail:stanwass@uiuc.edu   Deadline is February 28, 2002.

POSITION AVAILABLE

The Department of Systems Analysis, Integrated Assessment and Modelling (SIAM) of the Swiss Federal Institute of Environmental Science and Technology (EAWAG) is seeking applications for a Tenure Track Position in Modelling of Socio-Technic-Economic Systems

The Swiss Federal Institute for Environmental Science and Technology, 8600 Düben-dorf, Switzerland (http://www.eawag.ch) is a federal institute for water research and protection with close ties to the Swiss Federal Institute of Techno-lo-gy (ETH; http://www.ethz.ch). The

Department of Systems Analysis, Integrated Assess-ment and Modelling (SIAM; http://www. eawag.ch/research_e/siam) is concerned with modelling aquatic environmental systems and integrated modelling of environmental, technical and socioeconomic systems.

The candidate should build up a research group that develops simulation models for socio-technic-economic systems and applies them to actors and institutions involved in environmental decision making and material flux management. Of special interest to our department is the development of innovative models, such as agent-based social simulation models, that go beyond standard modeling practice in this field. The activity of the new group should strengthen the ongoing research in our department on integrated modelling for improving understanding and support of environmental decision making. It should complement the natural science and environmental engineering experience in our department and at EAWAG by knowledge of social systems. In addition to conceptual and theoretical work, the new group should be engaged in applications of the models to decision makers involved in water use (such as farmers and consumers) and together with decision makers relevant for water ressources management (such as governmental authorities). This is intended to be done in collaborations with other departments of EAWAG e.g. in the fields of the development and dissemination of sustainable urban drainage techniques (Departments of Environmental Engineering and Urban Water Management), of management of rivers and reservoirs (Department of Applied Aquatic Ecology) and in projects in the planned new Depart-ment of Socio-Economics of Water.

Requirements for the position are

• a PhD degree in Decision Sciences, Environmental Engineering, Economics, Computer Science, or Environmental Sciences,

• research experience in the development and application of novel socio-economic models such as agent-based models,

• a profound knowledge of statistics and experience in data analysis,

• a strong interest in interdisciplinary collaboration.

Please send your CV and an outline of research

interests to Ms. Karin Ghilardi, EAWAG, POB 611, 8600 Düben-dorf, Switzerland. Further information is available from PD Dr. Peter Reichert at reichert@eawag.ch.

POSITION AVAILABLE

Assistant or Associate Professor
Quantitative Methodologies Position
Department of Sociology
University of Texas at San Antonio, USA

The Department of Sociology at the University of Texas at San Antonio, USA, invites applications for a tenure-track position as Assistant or Associate Professor Sociology, at the beginning or advanced level, beginning September 1, 2002, pending budget approval. Responsibilities: pursuing an active research and publishing agenda; reaching, advising, and mentoring undergraduate and graduate students at the campus; serving the university, profession, and community.

Required qualifications: Candidates must demonstrate potential for and commitment to scholarly research and quality teaching in quantitative methodologies. Applicants in any substantive field are welcomed. Courses include: Conceptualization and Measurement, Research Design and Application, Survey Research Methods, Evaluation Research. The PhD is required by August 31, 2002, for appointment at the Assistant Professor Rank; ABD candidates close to completion (less than one year remaining towards the degree) may be considered for appointment at the Instructor Rank. Preferred qualification: The ability to teach Comparative/Historical Sociology is helpful.

Applicants must submit a letter of application, a current curriculum vita, writing samples, a copy of official transcripts, teaching evaluations (if available) and three letters of reference to:

Prof. Richard Lewis, Chair
Quantitative Methodologies Search Committee
Department of Sociology
The University of Texas at San Antonio
6900 N. Loop 1604 West
San Antonio, Texas 78249-0655, USA

Review of complete applications will begin on February 11, 2002 and continue until the position is filled. Applicants who are not US citizens must state their current visa and residency status.

POSITION AVAILABLE

Chair in social statistics
Departments of sociology and demography
University of Montreal, Canada

Applications are invited for the full-time posts of lecturer at the rank of full professor in the Departments of Sociology and Demography. The successful candidate's dossier will be entered for the Canadian Research Chairs Competition (senior level).

Duties:
To teach undergraduate and graduate students, carry out research and supervise graduate students, as well as participate in University operations.

Requirements:
Ph.D. in Sociology, in Demography or a related field. Demonstrated excellence in research as well as aptitude for teaching. Expertise in Social Statistics and Comparative Studies. Excellent proficiency of advanced longitudinal and multilevel analysis methods. Internationally recognized publication dossier.

Remuneration:
The University of Montreal offers a competitive salary package tied to a complete range of social benefits.

Contract Date: 1 June 2002

Interested persons should send their applications along with their curriculum vitae, formal description of their research programme, one recent publication or research project and three letters of recommendation to:

Chair, Department of Sociology
Universite de Montr al
C.P. 6128, succursale Centre-ville,
Montreal, Que H3C 3J7 , Canada
Arnaud.Sales@umontreal.ca

Upon receipt, applications will be studied and a final decision rendered by the latest 7 January 2002.

In keeping with Canadian immigration regulations, priority will be given to citizens or permanent residents of Canada. The University of Montreal practises a policy of equal employment for women and is guided by the principle of employment equity.

POSITION AVAILABLE

Centre for Addiction and Mental Health
Department of Psychiatry
University of Toronto, Canada

The Centre for Addiction and Mental Health has an exciting opportunity for a suitable candidate for the combined positions of Head of the Culture, Community and Health Studies (CCHS) Research Section at the Centre, Head of the University of Toronto Department of Psychiatry CCHS Program and the David Crombie Professorship in Cultural Pluralism and Health.

CAMH is dedicated to improving the quality of life for people affected by addiction or mental illness through prevention, clinical care, research, and education. Recognized by the World Health Organization as a Centre of Excellence. The team, which includes scholars from a variety of academic disciplines, including psychiatry, sociology, clinical and developmental psychology, social epidemiology, anthropology, demography, medicine, nursing, and public health, has been very successful in attracting external funding in support of its research programs, from a variety of sources in Canada. Areas of expertise which are essential for this position include: cultural factors affecting mental health and/or addiction; immigration and settlement issues affecting mental health and/or addiction; incorporation of cultural factors into clinical and community care.

The successful candidate is a senior mental health professional (MD or PhD) with a minimum of 10 years of related experience. The ability to build a team and this program is essential. In addition to scientific excellence, the candidate will have the ability to demonstrate direct involvement in knowledge transfer, and the ability to integrate a research program with clinical and community care. We are seeking a senior academic with an established track record of scientific excellence at the local, national and international levels. The incumbent must be eligible to be the Head of the Program at the University of Toronto. The successful candidate will have a solid track record of scholarship in the field of culture and mental health and/or addictions, significant administrative experience and the ability to mentor and inspire junior colleagues from several key disciplines.

Please forward your application package, including a curriculum vitae, a cover letter, and three letters of reference. The package should be sent by February 28, 2002, quoting file #525E, to:

Rachael Jensen, Human Resources Officer
Human Resources Department
Centre for Addiction and Mental Health
1001 Queen Street West
Toronto, Ontario M6J 1H4, Canada
E-mail: Rachael_Jensen@camh.net
Fax: 1-416- 583-4316

POSITION AVAILABLE

Full Professor in Sociology, in particular empirical research (full time, tenured) Department of Sociology / ICS Utrecht University Netherlands

The Department is part of the Faculty of Social Sciences of Utrecht University. The Department of Sociology is responsible for teaching sociology at the undergraduate and graduate level (Bachelor's, Master's, and Ph.D. degrees). The research of the Department is part of the Interuniversity Center for Social Science Theory and Methodology (ICS).

The ICS is a research and graduate school recognized by the Royal Netherlands Academy of Arts and Sciences (KNAW) at the Universities of Groningen, Utrecht, and Nijmegen. The Utrecht Department of Sociology and the ICS are oriented toward problem-guided and systematic theory elaboration, the integration of theory and empirical research using advanced statistical models, and an interdisciplinary approach. In Utrecht, this research strategy is developed and applied in fields such as social inequality, problems of coordination and cooperation, households and the labor market, social networks and social capital, and policy studies. External evaluations of the teaching and research program of the Department such as the major evaluations by the Association of the Universities in the Netherlands (VSNU) have consistently produced very favourable results. The Department hosts numerous research projects and programs with funding from the Dutch Science Foundation (NWO) and the Royal Netherlands Academy of Arts and Sciences (KNAW).

The vacancy
The new full professor should be an excellent sociologist who is able to contribute to maintaining and further developing the high quality of teaching

and research of the Department and the ICS. His/her profile includes:

- Ph.D. degree in one of the social sciences, preferably sociology,
- broad experience in teaching and research,
- strong publication record with contributions to major journals in sociology and social research,
- broad expertise with empirical research in sociology, including the analysis of quantitative data using advanced statistical models,
- broad expertise in one or more special fields of sociology,
- able to initiate innovative, large scale research programs,
- good record in generating external research funding,
- strong network of contacts,
- able and willing to contribute to the management of the Department as well as the ICS.

Teaching obligations of the new full professor are in undergraduate and graduate programs (Bachelor's, Master's, and Ph.D. degrees) in sociology and the social sciences at Utrecht University and the ICS, including supervision of individual Ph.D. students.

The research of the new full professor focuses on the application and testing of sociological and social science theories and hypotheses in empirical research. He/she will be responsible for the design and execution of innovative empirical research in sociology as well as the analysis of social science data, preferably with an emphasis on survey research and the analysis of survey data using advanced statistical models. He/she contributes to the integration of theory, empirical research and data analysis. He/she stimulates collection, analysis, and documentation of social science data by other ICS researchers. He/she will be responsible for generating external research funding. The new full professor specializes in one or more fields of sociology that fit with and complement the available expertise of the Utrecht Department of Sociology. The research initiated by the new full professor will provide a context for research by Ph.D. students and postdocs.

Management responsibilities of the new professor include contributions to the management of the Department, various undergraduate and graduate teaching programs, and the ICS graduate and research school.

The appointment should take place as soon as possible.

Additional information: prof. dr. Werner Raub, phone +31-30-253 19 67 and +31-70-512 27 00, email w.raub@fss.uu.nl.

A more detailed description of the vacancy (in Dutch) is available at Ms. D. van Ginkel, afdeling Personeel & Organisatie van de Faculteit Sociale Wetenschappen, phone +31-30-253, email D.vanGinkel@fss.uu.nl.

More information about the Utrecht Department of Sociology (partly in Dutch) can be found at:

http://www.fss.uu.nl/soc/index.htm

POSITIONS AVAILABLE

Department of Sociology, Western Washington University at Bellingham, USA, invites applications for our vacancy pool from which candidates to fill two full-time, non-tenure track positions at the lecturer or Visiting Assistant Professor level will be selected. These are one-year appointments for the 2002-2003 academic year with an expectation of a six or seven course-teaching load.

Areas of specialization are open, but first consideration will be given to candidates in Law/Crime/Deviance, Race and Ethnicity and Statistics. Salary commensurate with qualifications and course load. Ph.D. preferred, but applicants should be ABD at minimum. The Department maintains a computer laboratory for undergraduate instruction, social and demographic data resources and a Center for Survey Research.

Review of applications begins March 11, 2002 and continues till the positions are filled. A vita with names of references (not letters) and evidence of successful teaching should accompany the letter of application. Send to:

James Inverarity
Chair of the Search Committee
Department of Sociology
Western Washington University
516 High Street
Bellingham, WA 98225-9081, USA
Tel: 1-360-650-3006
Fax: 1-360-650-7295
e-mail: jimi@cc.wwu.edu
http://www.wwu.edu/

MA PROGRAM SPACES AVAILABLE

Specialization in Survey Methodology
Department of Sociology
University of Waterloo, Canada

The Department of Sociology at the University of Waterloo offers a Specialization in Survey Methodology as part of its Master of Arts program. Approved by the Ontario Council of Graduate Studies to commence as of Fall 2001, the Specialization comprises six courses plus a research paper (i.e., short thesis). Two of the courses are interdisciplinary, and one is offered in association with the Department of Statistics and Actuarial Science. There are good opportunities for first-hand involvement in survey projects through the University of Waterloo Survey Research Centre. The program liaises with the commercial survey research industry and with government agencies such as Statistics Canada through an advisory board. Completion of the course of study for the Specialization is designated on the Master's degree.

For application details, contact:

Ilona Kosa
Department of Sociology
University of Waterloo
Waterloo, Ontario, Canada
N2L 3G1

Telephone 519-888-4567, extension 2606

or visit the Department of Sociology website at: http://arts.uwaterloo.ca/ARTSZONE/Grad-Prgms.htm

NEW!

The StOCNET team (Peter Boer, Mark Huisman, and myself) has put the new version (1.1) of StOCNET on the web. It is a freeware Windows program which can be downloaded from: http://stat.gamma.rug.nl/stocnet/

The new release features:

★ a new version of SIENA, the method for the statistical analysis of the evolution of networks according to Tom A.B. Snijders, The Statistical Evaluation of Social Network Dynamics. Sociological Methodology -2001, in press. The new version allows up to 99 repeated measurements on the network, and also allows changing covariates. It also includes an MCMC estimation method for the $p*$ model, but this is a tricky method, included only for research purposes.

★ The new program BLOCKS for the MCMC estimation of stochastic blockmodels according to Krzysztof Nowicki and Tom A.B. Snijders, Estimation and prediction for stochastic block-structures. Journal of the American Statistical Association, 96 (2001), 1077-1087.

We hope that some of you will find this useful!

Cheerio,

Tom
t.a.b.snijders@ppsw.rug.nl

September 11, 2001

As we go to press with this issue of Connections, we do so at a time when the majority of the world seems to have aligned itself behind the United States in the so-called war against terrorism. Many of us are still in shock at what we witnessed and wish to extend our sympathy and support to all those affected. Following the outrages on the world trade center and in Washington there was a spate of activity on SOCNET. In the first instance giving assurances to our community about members who could have been victims and then latterly about the role of SNA in the fight against terrorism. This was further triggered by the article that appeared in the Washington Post that highlighted how network methods could be used to combat underground organisations. It would be naïve of our community to think that this is in some way new. Here in the United Kingdom we have lived with terrorism from Irish paramilitary organisations for a long time. It seems to be well known that the security services here are very familiar with all the techniques that we believe to be our own, and have probably developed many others which are not in the public domain. As a community we need to continue to develop tools that we believe will help us understand the society we live in. It is up to individuals to decide whether they wish to apply these methods to terrorist groups or understanding aids. The problem I have with the ethical discussions contained on SOCNET is they asked questions such as: Can you be certain your methods are robust enough to decide whether someone will live or die? On their own clearly the answer is no, but as part of a larger collection of evidence, perhaps it is yes or at least yes to the fact that the individual may need to account for themselves. We are back to the old adage if it looks like a rose, and smells like a rose, then the chances are it is a rose.

On reflecting about what has happened I wondered about other areas in which networks may assist. As mentioned by others the situation is brought about often by an inherited political situation. Networks have been used for conflict resolution and perhaps this is the area in which we should be more forthcoming. In addition it is clear that the two (or more) sides involved in conflicts such as this have no understanding of the other. We are in the situation in which inbred dogma fuelled by propaganda leads to a vicious cycle of hatred and the hardening of ideas. But we claim to know about diffusion of ideas. Can we not use this to help combat terrorism? Does our research not provide an insight into how we can help both sides at least adopt some empathy for the other? Not easy I know but possibly an area in which we can help. Members that are involved in social support clearly can contribute to those directly affected. I realise this does not move us towards curing the problem, but it is a positive outcome from network studies from an area that is too often seen as the poor relation within our field. Finally, I was struck by something I read in a PhD submission, and I quote "I would like to thank….members of INSNA who provided comments and advice by e-mail from all over the world…..the informal, non-hierarchical, highly supportive network based organisation must surely provide a model for other learned societies to follow in the third millennium." Perhaps we have a model that should not only inform other learned societies but larger organisations and regimes as well.

<div align="right">

Martin Everett
26 September

</div>

The Rise (and Possible Fall) of Networked Individualism

TOWARDS A NETWORKED SOCIETY

I have been writing in recent years about the transformation from a group-based to a networked society. Probably the most coherent text version to date is in Wellman 2001, although I expect to write more fully about this soon. I summarize matters here, and why the events of September 11 2001 and afterwards may have reversed the trend (see also Table 1).

1. Community is rarely a neighborhood phenomenon. Even before the Internet, community ties were predominantly non-local. Now, the Internet not only supports online-only communities, but more predominantly, it facilitates the maintenance of far-flung communities that interact both online and offline. Caroline Haythornthwaite and I have just edited *The Internet in Everyday Life* which documents this. The preliminary version is in the *American Behavioral Scientist* (Nov 2001); the expanded version will be published by Blackwells 2002. Keith Hampton and I argue that the predominant mode now is probably "glocalization" – far-flung networks with household and worksite home bases continuing to be important. I suspect that the trend has been moving to "networked individualism," in which the individual operator of his/her network is important, rather than the household or work unit.

2. Workers have more discretion about how they do their job. The report to multiple peers and superiors instead of staying solely within one work unit. Management by network is replacing management by hierarchal tree or matrix Participants inherently have multiple loyalties and partial commitments. They have other projects and task groups in which they are involved.

2. Corporations are less apt to be autarkic enterprises. They often link in complex networks of alliance and exchange with putative competitors. At times, members of different organizations come together in temporary virtual organizations to deal with specific problems or markets, while retaining their membership in (and loyalty to) their home organization.

3. Trading and political blocs lost their monolithic character in the world system. In the 1990s, with the end of the Cold War, more complex network structures linked and cleaved nations (Snyder and Kick 1979; Kick and Davis 2001; Sacks, Ventrresca and Uzzi 2001; Barnett 2001; Bergesen and Sonnett 2001; Smith and Timberlake 2001).

BACK TO LITTLE BOXES

Veterans of the 1960s may remember Malvena Reynolds' wonderful "Little Boxes" song which saw endless arrays of identical suburban homes as a metaphor for a conformity society. My fear is that reaction to the events of September 11 2001, and continuing social and physical uncertainty since then, may lead to a move back from open, permeable, flexible networks, to closed, bounded, rigid little boxes – a group based society:

1. Fear of strangers can lead to negative stereotyping, and a drawing back within bounded, gated communities. This might entail more socially homogeneous friendship (and kinship) networks – wherever network members are physically located – as well as more physically-local, guarded communities.

2. Security-induced difficulties in travel can lead to more local involvement. There already are numerous often-unpublicized closures of expressways, bridges and tunnels in American metropolitan areas.

3. Even greater difficulties in flying has cut back on inter-metropolitan and inter-national travel. Until recently, a significant part of the economy has been based on air travel connectivity of knowledge workers, managers, and technicians. Many travelled on a more-than-weekly basis. Security delays make such travel more difficulty, and adoption of a thorough-going Israeli model will cause further delays. (Remember, that almost all trips through Israeli airports are relatively infrequent international trips.)

4. Security concerns have also slowed the flow of goods, internationally and to some extent internally. For example, the relatively open US-Canadian border had evolved towards just-in-time manufacturing divisions of labor. When the free flow of goods was greatly slowed post-September 11, many enterprises were without parts and materials.

5. Security issues and lack of international trust may lead to the reformation of inter-state blocs. In the post-Cold War period, international networks were fluid and un-blocked, with even Russia discussing joining NATO. Unlike the East-West Cold War, these are more apt to be more North-South.

What will this world look like? One possibility is to take Table 1 and reverse the arrows. Are we leaving our networks and retreating to the cocoons of little boxes?

Table 1: Comparing Group-Based and Networked Societies

GROUP-BASED SOCIETY	NETWORKED SOCIETY
United Family	Serial Marriage, Mixed Custody
Shared Community	Multiple, Partial Personal Nets
Neighborhoods	Dispersed Networks
Voluntary Organizations	Informal Leisure
Face-to-Face	Computer-Mediated Communication
Spaces	Public Private Spaces
Focused Work Unit	Networked Organizations
Job in a Company	Career in a Profession
Autarky	Outsourcing
Office, Factory	Airplane, Internet, Cellphone
Ascription	Achievement
Hierarchies	Matrix Management
Conglomerates	Virtual Organizations/Alliances
Cold War Blocs	Fluid, Transitory Alliances

References

Barnett, George A. 2001. "A Longitudinal Analysis of the International Telecommunication Network, 1978-1996." *American Behavioral Scientist* 44 (10): 1638-1655.

Bergesen, Albert and John Sonnett. 2001. "The Global 500: Mapping the World Economy at Century's End." *American Behavioral Scientist* 44 (10): 1602-1615.

Haythornthwaite, Caroline and Barry Wellman (ed.). 2001. *The Internet in Everyday Life.* Special Issue of the *American Behavioral Scientist* (45, 3; November).

Kick, Edward and Byron L. Davis. 2001. "World-System Structure and Change: An Analysis of Global Networks and Economic Growth Across Two Time Periods." *American Behavioral Scientist* 44 (10): 1561-1578.

Sacks, Michael Alan, Marc J. Ventresca and Brian Uzzi. 2001. "Global Institutions and Networks: Contingent Change in the Structure of World Trade Advantage, 1965-1980." *American Behavioral Scientist* 44 (10): 1579-1601.

Smith, David A. and Michael F. Timberlake. 2001. "World City Networks and Hierarchies, 1977-1997." *American Behavioral Scientist* 44 (10): 1656-1678.

Snyder, David and Edward Kick. 1979. "Structural Position in the World System and Economic Growth, 1955-1970: A Multiple-Network Analysis of Transnational Interactions." *American Journal of Sociology* 84: 1096-1126.

Wellman, Barry. 2001. "The Rise of Networked Individualism." in *Community Networks Online*, edited by Leigh Keeble. London: Taylor & Francis.

I decided to go anyway

Dear Bill,

The best mailing address for me, Peter, and Alan is now at our new offices:
National Development and Research Institutes
71 West 23d Street
New York, NY 10010
Tuesday, November 20

. . . we have been working very hard trying to re-locate to our new offices. (By Dec 1, we hope!)
And keeping things going otherwise. Most people have already moved into them. Those of us in
AIDS Research will do so about Dec. 1.   . . .   On September 29, I began a long journey to
Australia for a couple of AIDS conferences. My wife and friends suggested that it was too
dangerous to go, and too iffy. I decided to go anyway, both because the AIDS work is too
important to be put aside and because I thought I needed some time away for healing. "AIDS
Conference round-up" was written during the closing morning of the International Conference on
AIDS in Asia and the Pacific. . . .

best,
sam friedman

AIDS Conference round-up

As I sit in a Melbourne lecture hall
hearing yet another Manifesto against HIV
and the actions of the powerful
that empower this virus, that encourage its spread,
Annie and Nickie confer quietly beside me
as Alex walks to leave the hall,

and I sit stricken with awe
at our human race,
that we could, in spite of it all
produce a roomful of Angels,
of Annies, of Nickies, of Alexes
and hundreds besides,

and peace washes over my soul
solacing my memories of burning Towers,
of data destroyed by vengeful airplanes,
as I bask in a sunlight of joy
at my wondrous good fortune,
at the privilege of friendship
with angels like these,
at sitting in this roomful of saviors,
these foes of the plague.

Instant connection

As our offices burned,
our towers collapsed,
the TVs roared their anger,
the politicians their hate.

Our first actions
when we at last reached our homes
were to call one another
to be sure the other was there,
that each had survived,
and to e-mail the world
with the words, "We're alive,"

and to process our losses,
the destruction of place,
the erasure of sites
now gaps in our lives,

and our new disconnection
from a nation enraged,
from politicians and TVs
who evoked vengeance and blood-debt
and stoked flame-fed mass hatred

while we responded with horror
at their plans for more violence,
of spreading destruction
like that we had suffered,
rejecting connection
with those who sought blood,
while seeking connection
with workmates and strangers,
forging empathetic connection
with those who faced bombs.

Rejoicing in living,
while mourning all dead,
we build empathetic connection
against blood-spilling's spread.

Terrorism

As I ride my daily train from Jersey 'burbs to metropolis,
I muse about Madame Nhu's ride to America,
about a younger me marching brick sidewalks in innocent outrage,
protesting dictatorship backed by Old Glory,
knowing not, as Madame Nhu knew not,
for neither knew, knew not yet,
that Old Glory would ravage the treetops of 'Nam,
savage her peoples
in an act of power that baffled my generation,
we who did not understand terror,
who knew not that the phrase "balance of terror"
meant only that one tiny facet balanced,
but terrorism was policy, was values
lodged deep in the bomb-bursting stars of Old Glory,
in stars and stripes that grew as a symbol of freedom
from imperial tyranny,
stars and stripes viewed by Shelley and by Asian generations
as a symbol of a glory that could be,
but viewed by generations who knew in the American forests and plains
as a symbol of terrorism set free
to savage Iroquois, Cherokee, Apache, Navaho, Mexico,
and far beyond,
bringers of death and homilies of freedom for 200 years,
so as we protest the starvation of Iraqi children
or devastations yet to come,
or as we watch the talking dreads
seize upon a plane crash that killed my friends
off the coast of Nova Scotia
to tighten the regulation of Americans,
to outlaw the right to organize
in the name of fighting "terror,"
our intestines should indeed turn acid in fear,
in an act of recognition of professionalism in action,
at terrorism incorporate and elected,
but a terrorism in our power
to doom.

From Whole Cloth: Making up the terrorist network

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Little firm information exists about the global terrorist network, and the type of data used by network analysts—testimony of participants—is not available. Relying on newspaper and other media reports, some general conjectures about the network features of the terrorist organization can be offered: It may well be characterized by a high degree of connectivity and considerable redundancy. The dynamic units are probably small, with high personnel turnover and considerable structural equivalence. The network is not 'managed' in the strict hierarchical sense, but a central leadership appears to plan major moves, to provide training, finance and logistical support, but to permit considerable autonomy at the local level. Such structure contrasts markedly with typical governmental hierarchies. Success against terrorism may be contingent, in part, on governments' ability to set aside formal structure and match the fluidity and nimbleness of terrorist networks.

Social network analysts know something about social networks, and some may know something about terrorism, but it is highly unlikely that any of us knows anything about terrorist networks. Some interesting guesses have appeared, but the very methods that are used to investigate networks are not available to researchers, except perhaps long after the fact. And, in the current circumstances, we seem unhappily far from long after. To understand networks, one has to interview people; learn about their friends, relations and contacts; describe the relationships; deduplicate so that everyone is represented only once in the network, albeit in multiple roles; describe their movements; determine the processes of fission and fusion that create their particular dynamics; and connect the dots. An alternative is to be a participant-observer, but in either case, the fundamental data set that permits network analysis is simply not available.

The only information to go on, at the moment, is "what you read in the papers," (though the real investigators likely have more). The literature available to try to piece together some concept of the shape, size, composition, and dynamics of a network is less than spotty, and only available through clues in newspaper reports. A review of the New York Times archive from September 11, 2000 to October 31, 2001 uncovered about two dozen articles that mentioned "terrorists," "networks," together with "chronology," "movement," and "activity," from well over 500 articles that dealt with the terrorist aspect of the events directly.

The articles mention about 25-30 persons by name who appeared to play some role in the events of September 11, 2001 (there is some overlap with 22 persons made public as most wanted[1]). The major relationship described was that of a small group, referred to as the Hamburg cell, that had close ties to at least three of the men who were pilots on the suicide flights. A wedding of one of them was attended

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[1]Anon. A Nation Challenged: The Hunted: The 22 most wanted suspects, in a five-act drama of global terror. New York Times. October 14, 2001

by most of these actors, including a person with presumed direct and indirect contact to bin Laden. The articles also describe activities in Malaysia and the Philippines that involved persons associated with the hijackers and with others who had been implicated in previous terrorist acts. A Turkish connection is also described. The reports are peppered with specific moments of connection (like the wedding), and with discussions of how money is exchanged over long distances (*hawala)*[2] and how a string of honey stores were a front for transactions.[3] There are occasional insights offered in a way that is certainly believable, but without real documentation. The group is described as "a loose organization of terrorists who may have no idea who the leader is or where the plans come from."[4] Alternatively, a picture is described of "an underground army so scattered and self-sustaining that even the elimination of Mr. Bin Laden and his closest deputies might not eradicate the threat they have created."[5] Weiser and Golden quote Juliette Kayyem of the Harvard University Kennedy School of Government: "Bin Laden is the leader of a movement that doesn't necessarily need a leader to function and be effective…This is such a diffuse structure that it can survive without him." In a description of the European dragnet that has picked up a number of suspects, a European intelligence official is quoted as saying: "We don't think there is a structured network, perfectly organized into cells or groups."[6]

What the reports do describe is a loose association of two types of persons, planners and doers. The former gather intelligence, pick targets, and provide the materiel.[5] The latter are "expendable," persons whose commitment to the cause, but lack of special training, places them in such a role. Interestingly, testimony to the FBI from one of the participants suggests that nationality matters less than the commitment. The force is composed of a variety of ethnic and national groups, whose belief presumably binds them to the cause, and not necessarily to a given organization or leader. Chris Hedges, in a radio interview, noted that the tie that may bind the diverse ethnic groups is their common experience fighting the Serbs in Bosnia.[7] Wieser and Golden provide one more 'solid' network fact. In describing one of the doers: "He was then placed with five other Algerians in a cell led by a contact who kept in touch with al Qaeda operatives in Europe."

There is, however, another level of network association, which might be viewed as the command structure. This appears to resemble the more traditional hierarchy—a leader (the *emir*, who is bin Laden), a council of about a dozen advisers (the *shura*) and committees responsible for "military operations, religious affairs, finances, and the production of false travel and identity documents."[5]

Thus, the incomplete picture conjures up a highly dynamic group, with some semblance of leadership structure that may be important for the large efforts, but may not be critical for the maintenance of the terrorist activity. The group is financed by large amounts of money that bin Laden has brought to the process, but has been augmented by significant contributions and, probably, considerable entrepreneurial activity. Rothstein, in a commentary, hypothesized that the model for the overall network process is the Internet, a decentralized, highly interactive but highly flexible network with no

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[2] Frantz D. A Nation Challenged: The Finanacing; Ancient secret system moves money globally. New York Times. October 3, 2001

[3] Miller J and Gerth J. A Nation Challenged: Al Qaeda; Honey trade said to provide funds and cover to bin Laden. New York Times. October 11, 2001

[4] McFadden RD. A Nation Challenged: In Profile; Bin Laden's journal from rich, pious boy to the mask of evil. New York Times, September 30, 2001

[5] Weiser B. and Golder T. A Nation Challenged: bin Laden's network; Al Qaeda: sprawling, hard-to-spot web of terrorists-in-waiting. New York Times, September 30, 2001

[6] Hedges C. A Nation Challenged: The search: A European dragnet captures new clues to bin Laden's network. New York Times. October 12, 2001

[7] Hedges C. Radio interview on Fresh Air. National Public Radio, October 30, 2001.
http://freshair.npr.org/dayFA.cfm?todayDate=archive

nodes so central that their loss would interrupt transmission.[8] The Japanese author, Haruki Murakami, is quoted as describing the process as one of a clash of networks (which he calls "circuits")—open vs. closed. He states that the open circuit is our society, and the closed one is the world of religious fanatacism.[9]

In sum, not much to work with. This leaves the field safe for conjecture.

With the appropriate caveats—none of this is known to be true—presented here are some possibilities about what a terrorist network, either local or global, might look like, and the characteristics that define it. It should be noted at the outset that this approach is really an invitation to others to use their powers of conjecture and add to the discussion, since it is hard to know what else to do.

- The entire global network is a connected component.

Estimates of the size of this network are as varied as estimates of the size of personal networks. If it numbers in the thousands, as the information on training camp attendees suggests, then it is unlikely that everyone knows everyone else. It is, however, likely that anyone in the network can be reached in some way by anyone else (not that they would necessarily want to do that). Moreover, it is likely that on the local level, individual ties are very strong: the two persons know each other very well and they know dozens or even scores of persons in common. On a higher level (regional, national, international), individual ties are likely to be weaker but the strength of association (the people that are known in common) is likely to remain high. It is such an arrangement that permits extensive use of the Internet and telephone (a petard by which at least some appear to have been hoist). (Note that postulating a path of some length from everyone in the global network to everyone else runs counter to the instructions from a recently uncovered 'handbook' for terrorist activity [see below][10]).

- The network is redundant on every level.

Each person can reach other people by a multiplicity of routes. Information and material can travel along multiple routes with the same destination. Though there will be some variation in degree centrality (the number of persons with whom an individual is in active contact), this variation will be small, so that the loss of no one person can interrupt transmission. Comparing small units (say 4-6 people), there will be considerable, though approximate, structural equivalence, so that the loss of a unit will not be deleterious. The redundancy in communication channels will be mirrored in the redundance of active groups (provide for many so that a few make it through to the end). Finally, there is a redundancy in the leadership, that is, numerous persons who can play a pivotal role. (In the current arena, several persons have been informally designated as "central," and it remains to be seen whether their presence is critical to the life of the organization. As the situation unfolds, it is likely that key figures will emerge, but the network's dependency on them remains to be determined.)

- On the local level, the network is small and dynamic.

It is likely that small cells (say, 4-6 people) operate with relative independence and little oversight in the intermediate term. Since the glue that binds this small unit to others and to the global whole are money, moral certitude, and an unrelenting faith worth dying for, and since human beings vary in their capacities, it is likely that there is some turnover in personnel, particularly in light of a long leadup time. Such dynamics are aided by the considerable structural equivalence of roles in the network (see Figure 1 for a primitive example), so that persons can be deployed in different locations with ease, or can be

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[8]Rothstein E. Lacking a center, terrorist networks are hard to find, let alone fight. New York Times, October 20, 2001

[9]French HW. Seeing a clash of social networks; a Japanese writer analyzes terrorist and their victims. New York Times october 15, 2001

[10]Weiser B. Captured terrorist manual suggests hijackers did a lot by the Book. New York Times October 28, 2001.

eliminated if need be. (Has anyone thought to look into unsolved murders of young men of Middle Eastern origin over the past 5 years in the United States or Europe?)

- The network has formidable barriers to entry and exit.

Exit, as noted, is not tolerated, though a few examples are documented in press reports. Entry is only possible through having led an entire life that becomes the individual's credential. New recruits are sought, but the screening process is arduous, training interminable, selectivity high, and the waiting process after training can be long. Entry is a process that takes years, so that rapid penetration of the network is impossible. Perhaps the most important attribute of the network is its impenetrability, but it is not clear that there have as yet been serious attempts.

- The network is not managed.

First intimations were of a highly organized, managed and disciplined network. But such operations, if covert, can be fragile. The network instead has fuzzy organization (that is, considerable room for maneuvering on the part of individual actors), minimal moment-to-moment top-down management, and little overt discipline. Rather, during most of its existence, the purpose of such network units is to be, not to do. Though some persons occupy positions of authority, on the ground there is dependence on local decisions. The discipline is internal, in the beliefs and loyalty of the participants, rather than in a command structure. For much of its existence, such a small group's major problem with discipline probably involves the forces for and against a strict adherence to a Western life style, and the maintenance of intensity in the face of waiting.

Management implies record keeping. The most mysterious aspect of this network is the way it keeps track of people, of money, or of activities. Perhaps it does not. Based on the system of *hawala*, there are no computers, no paper, no records, no remains. A system built on trust is untraceable. Such trust is built on the beliefs and loyalty, the shared experience of living and training in a world of no prospects, and a shared language (Arabic, for the most part) plus many other dialects that provide inidividuals with an almost unbreakable code as well as evidence of their trustworthiness. (Didn't we once have an unbreakable code, during World War II?)

- These structural characteristics of the network give it operational flexibility.

Compare the terrorist acts to the response of American bureaucracy. The terrorist network(s) had the option to use postal conveyance of anthrax and it is assumed to have done so, to an extent currently unknown, by a number of operatives currently unknown, at a multiplicity of sites (currently unknown), with or without advance planning (currently unknown), and with or without the foreknowledge of the amplifier effect of central postal handling. Thus, small, multipotential groups, with considerable internal discipline but considerable local decision making, adherence to a common cause, few direct contacts but a connection to a larger whole, and an unshakable belief structure has shown itself capable of performing multiple tasks with agility and audacity. Even in the face of some individual bungling that has become evident, the operation can rest its successes on its network characteristics. In response, we have witnessed the mobilization of large hierarchies at the federal, state, and local level, internal dissension, a top-down discipline, a highly documented audit trail, secrecy and a cultural of noncollaboration, and recrimination at all levels (failure is not an option). This is perhaps an object demonstration of the clash of of Murikami's circuits. Our power dwarfs theirs, but our network is no match.

- The network didn't 'just happen' but its construction was not planned.

The network was unlikely to have been mapped ahead of time. Organizers realize the fruitlessness of planning on behalf of those on the ground, and the considerable leeway in local decision making permits organic growth, a far preferable outcome than hierarchical imposition. Such a network has the dual features of local control and responsiveness to outside mandates. It is thus likely that the specific features of the network differ in different places, and may in fact change at any given site, but

the general structure, devolved upon by those in the field, probably looked approximately like that depicted in Figure 1.
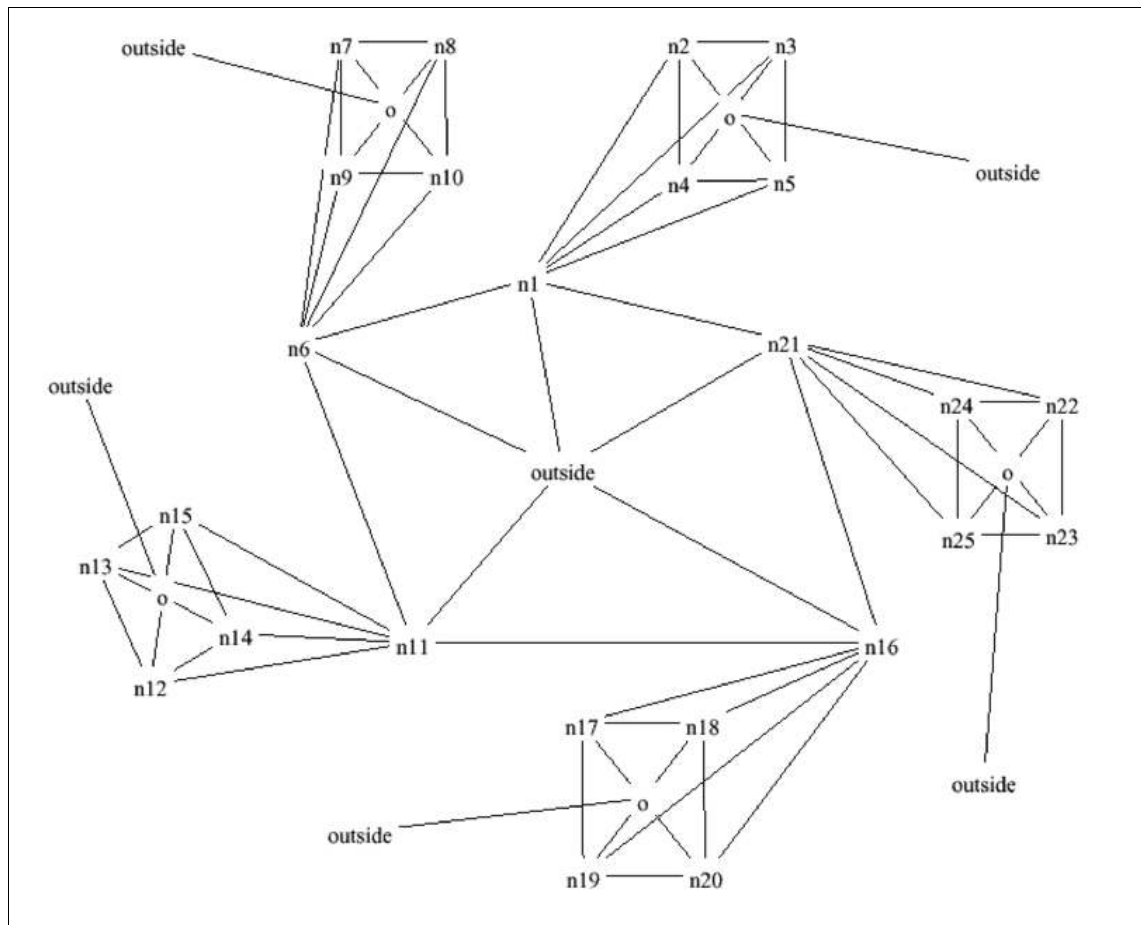

Figure 1. Simplified depiction of terrorist network

The graph incorporates the elements of redundancy, relative lack of centrality, multiplicity of communication channels, structural equivalence of certain roles, and manageable size. What cannot be easily communicated visually is the structural relationship of this group of 'cells,' which might be thought of as a 'pod,' to other such pods operating in the same area, in different areas, or in different countries. It is likely that the channels of communication and conveyance among the pods will mimic the channels among cells—multiple and redundant. As noted, the specifics of this general pattern are likely to differ with time and place, and it may be that even a diagram such as this is "too much." Hedges, in his radio interview, pointed out that this sort of diagram may well be an example of the Western need to impose structure on an activity that has none.[7]

The breakdown of such a network, whether on the local or global scale, depends obviously on two factors: money and trust. The U.S. and other governments are in hot pursuit of the former, but (given what we know from the media) appear befuddled by the latter. Though the approach to network dissolution seems straightforward, the technique is not. Rothstein, and others, pursuing the Internet analogy, suggest that a virus introduced into the network can help to disrupt it.[8] Sowing viruses of distrust is difficult within a network that has major obstacles to entry, is highly decentralized, and whose leader's status as a symbol is likely to be untouched by what will happen to him (assassination, capture, trial, conviction, escape, or disappearance). Peripheral persons play a role, but primarily as purveyors of needed goods and not as participants; such roles may or may not be useful in infecting the network.

It may be, however, that the nature of the terrorist network itself will provide instruction for its dissolution. The bureaucratic networks that face the problem are unlikely to be able to deal with it in their current network configuration. They will need to look a lot more like the terrorists—in their organization, management, information flow, control, and local flexibility. Fashioning a network that can do the job may be the most significant obstacle to undermining the terrorists. (Didn't we once have such a network, during World War II?) On the other hand, it is also possible that their network will grow and become more like ours. Size and success are the true viruses of failure.

The terrorist manual, recently uncovered,[10] confirms at least some of this conjecture, but contradicts it on several points. First, it is urged that persons in cells not know those in other cells, so as to have less to tell when captured. The manual thus puts secrecy above communication. It is not clear from the few emerging facts, however, that this mandate is obeyed. Second, a strict discipline with regard to "stories" to be told in the event of capture is espoused, but a number of examples belie the ability of operatives to do this. For example, a recent counterterrorist operation successfully aborted a major terrorist strike, in part because of information provided by a key terrorist operative who was captured.[11] (Unfortunately, the counterterrorists were forced to act quickly and missed the opportunity to describe the network in detail.) In any event, the terrorist manual could serve as well as a blueprint for counterterrorism, an opportunity that will hopefully not go unnoticed by the bureaucratic "circuit." The response to anthrax notwithstanding, my guess and hope is that the ponderous bureaucracy has set its own nimble network in motion, and is smart not to tell us.

It has been noted repeatedly that the terrorists are the beneficiaries of the American democratic system that they seek to destroy, a system that permits open movement, freedom of choice, and respects privacy. It is in such a society that the network that they have successfully developed can flourish. It has been noted as well that if we accede to the pressures that terrorists place on American society, they will have won. We are in the process of acceding (e.g. the recent antiterrorism bill that gives expanded power of surveillance to government agencies), and it is likely that the very factors that permitted growth of a terrorist network will be altered. In the long run, our society loses, but so do the terrorists, since their process of network growth will destroy the circumstances that permit it.

Richard Rothenberg, MD
November 2, 2001

Afterward (1-23-2002)

Since this article was submitted (11-1-01), virtually the entire field war in Afghanistan has taken place. A good deal of new information about the terrorist network patterns has come to light, including considerable information about the 19 (possibly 20) hijackers, and about al Qaeda connections with other terrorist groups. New light hs been shed as well on the motivation of the terrorists (Mneimneh H, Makiya K: Manual for a 'Raid' New York Review of Books, 1-17-02). The details 'on the ground,' though clearer, remain fuzzy, but it has come to light that some governments, whose history of being the direct object of terrorism dates than of the United States, have adopted appropriate network tactics. Perhaps the most telling metaphor has been French Magistrate Jean-Louis Bruguière's comparison of the terrorists' network to the AIDS virus, with its enormous capacity to reform itself with renewed resistance (Hedges, C. A Powerful Combatant in France's War on Terror. NYTimes, November 24, 2001).

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[11]Hedges C. The inner workings of a plot to blow up the U.S. Embassy in Paris. New York Times. October 27, 2001

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Mapping Networks of Terrorist Cells

Valdis E. Krebs

orgnet.com

This paper looks at the difficulty in mapping covert networks. Analyzing networks after an event is fairly easy for prosecution purposes. Mapping covert networks to prevent criminal activity is much more difficult. We examine the network surrounding the tragic events of September 11th, 2001. Through public data we are able to map a portion of the network centered around the 19 dead hijackers. This map gives us some insight into the terrorist organization, yet it is incomplete. Suggestions for further work and research are offered.

INTRODUCTION AND BACKGROUND

We were all shocked by the tragic events of September 11, 2001. In the non-stop stream of news and analysis one phrase was constantly repeated and used in many contexts – "terrorist network." Everyone talked about this concept, and described it as amorphous, invisible, resilient, dispersed and other terms that made it difficult to visualize what this structure really looks like. I set out to map this network of terrorist cells that had so affected all of our lives.

I would be mapping a 'project team' – much like the legal, overt groups I had mapped in countless consulting assignments. Both overt and covert project teams have tasks to complete, information to share, funding to obtain and administer, schedules to meet, work to coordinate, and objectives to accomplish. How a normal project team does all of that is easy to map and measure using several set of ties – task, resource, strategy and expertise links. I was surprised at the difficulty of this particular effort – both in data definition and discovery.

My data sources were publicly released information reported in major newspapers such as the New York Times, the Wall Street Journal, the Washington Post, and the Los Angeles Times. As I monitored the investigation, it was apparent that the investigators would not be releasing all

pertinent network/relationship information and actually may be releasing misinformation to fool the enemy. I soon realized that the data was not going to be as complete and accurate as I had grown accustomed to in mapping and measuring organizational networks.

For guidance I turned to previous work by social network theorists who had studied covert, secret, or illegal networks. I found three excellent papers that formed a working foundation for the knowledge I would use to pursue this project. Malcolm Sparrow (Sparrow 1991) has an excellent overview of the application of social network analysis to criminal activity. Sparrow describes three problems of criminal network analysis that I soon encountered.

1. Incompleteness – the inevitability of missing nodes and links that the investigators will not uncover.

2. Fuzzy boundaries – the difficulty in deciding who to include and who not to include.

3. Dynamic – these networks are not static, they are always changing. Instead of looking at the presence or absence of a tie between two individuals, Sparrow suggests looking at the waxing and waning strength of a tie depending upon the time and the task at hand.

Wayne Baker and Robert Faulkner (Baker and Faulkner 1993) suggest looking at archival data to derive relationship data. The data they used to analyze illegal price-fixing networks were mostly court documents and sworn testimony. This data included accounts of observed interpersonal relationships from various witnesses. The hijackers of September 11th were not directly observed by others in great detail.

Bonnie Erickson (Erickson 1981) reveals the importance of trusted prior contacts for the effective functioning of a secret society. The 19 hijackers appeared to have come from a network that had formed while they were completing terrorist training in Afghanistan. Many were school chums from many years ago, some had lived together for years, and others were related by kinship ties. Deep trusted ties, that were not easily visible to outsiders, wove this terror network together.

Data Gathering

Within one week of the attack, information from the investigation started to become public. We soon knew there were 19 hijackers, which planes they were on, and which nation's passports they had used to get into the country. As more information about the hijackers' past was uncovered I decided to map links of three strengths (and corresponding thicknesses). The tie strength would largely be governed by the amount of time together by a pair of terrorists. Those living together or attending the same school or the same classes/training would have the strongest ties. Those travelling together and participating in meetings together would have ties of moderate strength and medium thickness. Finally, those who were recorded as having a financial transaction together, or an occasional meeting, and no other ties, I sorted into the dormant tie category – they would rarely interact. These relationships were shown with the thinnest links in the network.

I started my mapping project upon seeing the matrix in Figure 1 on the web site of the Sydney Morning Herald (AU) (Sydney Morning Herald, 2001). This was the first attempt I had seen to visually organize the data that was gradually becoming available two weeks after the tragedy.

Soon after the matrix in Figure 1 was published, the Washington Post released a more detailed matrix of how the hijackers had spent their time in the USA and with whom (Washington Post, 2001). The most detailed document of the hijackers relationships and activity was released in December 2001 in the Indictment of Zacarias Moussaoui (Department of Justice, 2001).

THE HIJACKERS ...

American Airlines 11
Crashed into WTC (north)

Mohamed Atta
(Egyptian)
Received pilot training

Waleed M. Alshehri
(Saudi)
Commercial pilot

Wail Alshahri
(Saudi)
Possible pilot training

Satam al-Suqami
(Nationality unknown)

Abdulaziz Alomari*
(Saudi)
Possible pilot training
(No picture available)

American Airlines 77
Crashed into Pentagon

Khalid al-Midhar
(Nationality unknown)
Received pilot training

Majed Moqed
(Nationality unknown)

Salem Alhamzi*
(Saudi)
Possible pilot training

Nawaf Alhamzi*
(Saudi)

Hani Hanjour
(Saudi)

UnitedAirlines 175
Crashed into WTC (south)

Marwan al-Shehhi
(United Arab Emirates)
Received pilot training

Fayez Ahmed
(Believed to be Saudi)
(No picture available)

Ahmed Alghamdi
(Possibly Saudi)

Hamza Alghamdi
(Believed to be Saudi)
Possible pilot training

Mohald Alshehri
(Nationality unknown)
Possible pilot training

United Airlines 93
Crashed in Pennsylvania

Ziad Jarrah
(Lebanese)
Received pilot training

Ahmed Alhaznawi
(Saudi)

Ahmed Alnami
(Nationality unknown)

Saeed Alghamdi*
(Seems to be Saudi)

*Disputed identity

AND HOW THEY WERE CONNECTED

Attended same technical college

Hamburg, Germany

Mohamed Atta
Marwan al-Shehhi
Ziad Jarrah

Took flight classes together

Pilot schools in Florida

Mohamed Atta
Marwan al-Shehhi

Pilot schools In San Diago

Khalid al-Midhar
Nawaf Alhamzi

Bought flight tickets using same address

- Mohamed Atta*
  Marwan al-Shehhi
  Abdulaziz Alomari*
  * Also used same credit card

- Waleed M. Alshehri
  Wail Alshahri

- Fayez Ahmed
  Mohald Alshehri

- Ahmed Alghamdi
  Hamza Alghamdi

Known to be together in week before attacks

Stayed together in a Florida motel

Mohamed Atta
Marwan al-Shehhi

Attended a gym in Maryland (Sept 2-6), also seen dining together

Khalid al-Midhar
Majed Moqed
Salem Alhamzi
Nawaf Alhamzi
Hani Hanjour

Bought flight tickets together

Mohamed Atta
Ziad Jarrah
Ahmed Alhaznawi

Picked up tickets bought earlier in Baltimore

Khalid al-Midhar
Majed Moqed

Bought from the same travel agent in Florida

Ahmed Alnami
Saeed Alghamdi

Last known address

Hollywood, Florida

Marwan al-Shehhi
Waleed M. Alshehri
Wail Alshahri
Ziad Jarrah
Hani Hanjour

Other cities in Florida

Mohamed Atta
Fayez Ahmed
Ahmed Alghamdi
Mohald Alshehri
Khalid al-Midhar
Ahmed Alhaznawi
Ahmed Alnami
Saeed Alghamdi

Outside Florida

Satam al-Suqami
Hamza Alghamdi
Abdulaziz Alomari
Majed Moqed
Salem Alhamzi
Nawaf Alhamzi
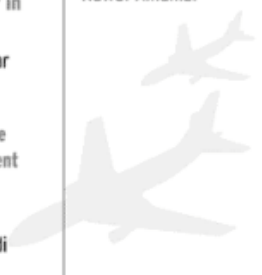
SOURCE: NYT

Figure 1. Early Hijacker Matrix

Once the names of the 19 hijackers were public, discovery about their background and ties seemed to accelerate. From two to six weeks after the event, it appeared that a new relationship or node was added to the network on a daily basis. In addition to tracking the newspapers mentioned, I started to search for the terrorists' names using the Google search engine [1]. Although I would find information about each of the 19 hijackers, rarely would I find information from the search engine that was not reported by the major newspapers I was tracking. Finding information that was not duplicated in one of the prominent newspapers made me suspicious. Several false stories appeared about a cell in Detroit. These stories, originally reported with great fanfare, were proven false within one week. This made me even more cautious about which sources I used to add a link or a node to the network.

By the middle of October enough data was available to start seeing patterns in the hijacker network. Initially, I examined the prior trusted contacts (Erickson, 1981) – those ties formed through living and learning together. The network appeared in the shape of a serpent (Figure 2) – how appropriate, I thought.
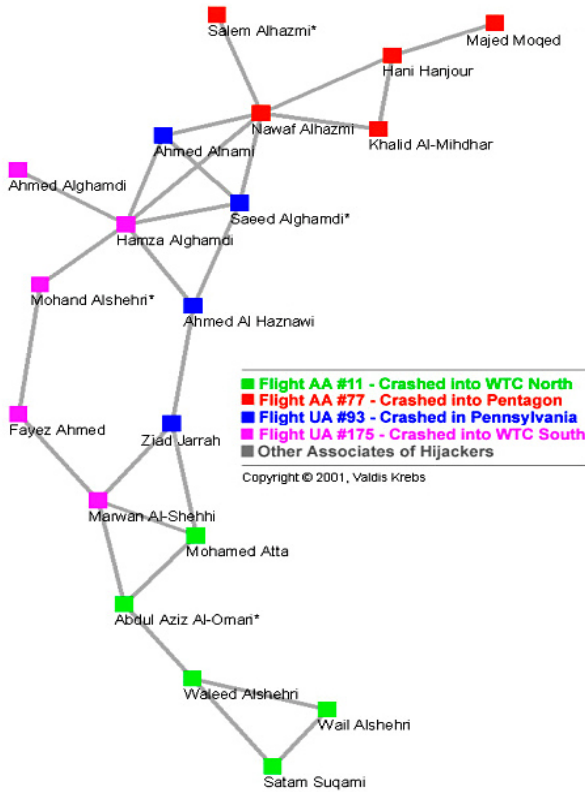
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[1] http://www.google.com

Figure 2 Trusted Prior Contacts

Figure 3 Trusted Prior Contacts + Meeting Ties [shortcuts]

I was amazed at how sparse the network was and how distant many of the hijackers on the same team were from each other. Many pairs of team members where beyond the horizon of observability (Friedkin, 1983) from each other – many on the same flight were more than 2 steps away from each other. Keeping cell members distant from each other, and from other cells, minimizes damage to the network if a cell member is captured or otherwise compromised. Usama bin Laden even described this strategy on his infamous video tape which was found in a hastily deserted house in Afghanistan. In the transcript (Department of Defense, 2001) bin Laden mentions:

Those who were trained to fly didn't know the others. One group of people did not know the other group.

The metrics for the network in Figure 2 are shown below and in Table 1. We see a very long mean path length, 4.75, for a network of less than 20 nodes. From this metric and bin Laden's comments above we see that covert networks trade efficiency for secrecy.

	no shortcuts	with shortcuts
Group Size	19	19
Potential Ties	342	342
Actual Ties	54	66
Density	16 %	19%

Geodesics

= without shortcuts   = with shortcuts

Yet, work has to be done, plans have to be executed. How does a covert network accomplish its goals? Through the judicious use of transitory short-cuts (Watts, 1999) in the network. Meetings are held that connect distant parts of the network to coordinate tasks and report progress. After the coordination is

accomplished, the cross-ties go dormant until the need for their activity arises again. One well-documented meeting of the hijacker network took place in Las Vegas. The ties from this and other documented meetings are shown in gold in Figure 3.

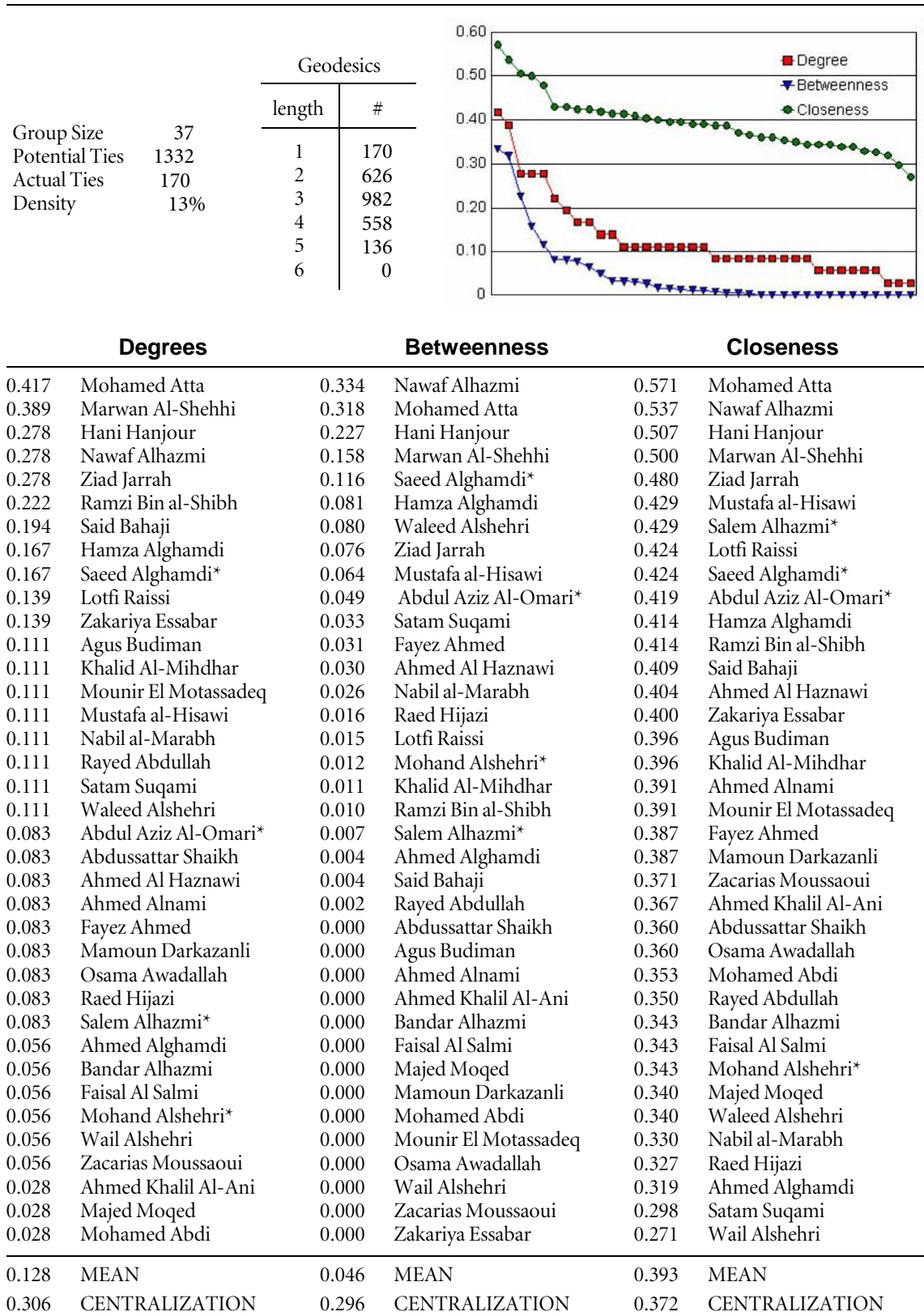| Table 1. Without shortcuts				Table 2. With shortcuts			
Name	Cluster-ing Coef-ficient	Mean Path Length	Short-cuts	**Name**	Cluster-ing Coef-ficient	Mean Path Length	Short-cuts
Satam Suqami	1.00	5.22	0.00	Satam Suqami	1.00	3.94	0.00
Wail Alshehri	1.00	5.22	0.00	Wail Alshehri	1.00	3.94	0.00
Majed Moqed	0.00	4.67	0.00	Ahmed Alghamdi	0.00	3.22	0.00
Waleed Alshehri	0.33	4.33	0.33	Waleed Alshehri	0.33	3.06	0.33
Salem Alhazmi*	0.00	3.89	0.00	Majed Moqed	0.00	3.00	0.00
Khalid Al-Mihdhar	1.00	3.78	0.00	Mohand Alshehri*	0.00	2.78	1.00
Hani Hanjour	0.33	3.72	0.00	Khalid Al-Mihdhar	1.00	2.61	0.00
Abdul Aziz Al-Omari*	0.33	3.61	0.33	Ahmed Alnami	1.00	2.56	0.00
Ahmed Alghamdi	0.00	3.50	0.00	Fayez Ahmed	0.00	2.56	1.00
Ahmed Alnami	1.00	3.17	0.00	Ahmed Al Haznawi	0.33	2.50	0.33
Mohamed Atta	0.67	3.17	0.00	Saeed Alghamdi*	0.67	2.44	0.00
Marwan Al-Shehhi	0.33	3.06	0.25	AbdulAziz Al-Omari*	0.33	2.33	0.33
Fayez Ahmed	0.00	2.94	1.00	Hamza Alghamdi	0.27	2.28	0.17
Nawaf Alhazmi	0.27	2.94	0.00	Salem Alhazmi*	0.33	2.28	0.33
Ziad Jarrah	0.33	2.83	0.33	Ziad Jarrah	0.40	2.17	0.20
Mohand Alshehri*	0.00	2.78	1.00	Marwan Al-Shehhi	0.33	2.06	0.17
Saeed Alghamdi*	0.67	2.72	0.00	Hani Hanjour	0.33	2.06	0.00
Ahmed Al Haznawi	0.33	2.67	0.33	Mohamed Atta	0.50	1.94	0.00
Hamza Alghamdi	0.27	2.56	0.17	Nawaf Alhazmi	0.24	1.94	0.14
Overall	**0.41**	**4.75**	**0.19**	**Overall**	**0.42**	**2.79**	**0.18**

* suspected to have false identification

Six (6) shortcuts were added to the network temporarily in order to collaborate and coordinate. These shortcuts dropped the mean path length in the network by over 40% thus improving the information flow in the network. There is a constant struggle between keeping the network hidden and actively using it to accomplish objectives (Baker and Faulkner, 1993).

The 19 hijackers did not work alone. They had accomplices who did not get on the planes. These co-conspirators were conduits for money and also provided needed skills and knowledge. Figure 4 shows the hijackers and their immediate network neighbourhood – their identified direct contacts.

After one month of investigation it was 'common knowledge' that Mohamed Atta was the ring leader of this conspiracy. Again, bin Laden verified this in the video tape (Department of Defense, 2001). Looking at the diagram he has the most connections. In Table 3 we see that Atta scores the highest on Degrees, and Closeness but not Betweenness centrality (Freeman 1979). These metrics do not necessarily confirm his leader status. We are obviously missing nodes and ties in this network. Centrality measures are very sensitive to minor changes in nodes and links. A discovery of a new conspirator along with new ties, or the uncovering of a tie amongst existing nodes can alter who comes out on top in the Freeman centralities. Recent converts to social network analysis are thrilled about what these metrics may show (Stewart 2001), experienced players urge caution[2].

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[2] Email correspondence with Ron Burt, Wayne Baker, Barry Wellman, Peter Klerks

Table 3. Hijackers' Network Neighborhood

	Geodesics	
	length	#
Group Size 37	1	170
Potential Ties 1332	2	626
Actual Ties 170	3	982
Density 13%	4	558
	5	136
	6	0

Degrees		Betweenness		Closeness	
0.417	Mohamed Atta	0.334	Nawaf Alhazmi	0.571	Mohamed Atta
0.389	Marwan Al-Shehhi	0.318	Mohamed Atta	0.537	Nawaf Alhazmi
0.278	Hani Hanjour	0.227	Hani Hanjour	0.507	Hani Hanjour
0.278	Nawaf Alhazmi	0.158	Marwan Al-Shehhi	0.500	Marwan Al-Shehhi
0.278	Ziad Jarrah	0.116	Saeed Alghamdi*	0.480	Ziad Jarrah
0.222	Ramzi Bin al-Shibh	0.081	Hamza Alghamdi	0.429	Mustafa al-Hisawi
0.194	Said Bahaji	0.080	Waleed Alshehri	0.429	Salem Alhazmi*
0.167	Hamza Alghamdi	0.076	Ziad Jarrah	0.424	Lotfi Raissi
0.167	Saeed Alghamdi*	0.064	Mustafa al-Hisawi	0.424	Saeed Alghamdi*
0.139	Lotfi Raissi	0.049	Abdul Aziz Al-Omari*	0.419	Abdul Aziz Al-Omari*
0.139	Zakariya Essabar	0.033	Satam Suqami	0.414	Hamza Alghamdi
0.111	Agus Budiman	0.031	Fayez Ahmed	0.414	Ramzi Bin al-Shibh
0.111	Khalid Al-Mihdhar	0.030	Ahmed Al Haznawi	0.409	Said Bahaji
0.111	Mounir El Motassadeq	0.026	Nabil al-Marabh	0.404	Ahmed Al Haznawi
0.111	Mustafa al-Hisawi	0.016	Raed Hijazi	0.400	Zakariya Essabar
0.111	Nabil al-Marabh	0.015	Lotfi Raissi	0.396	Agus Budiman
0.111	Rayed Abdullah	0.012	Mohand Alshehri*	0.396	Khalid Al-Mihdhar
0.111	Satam Suqami	0.011	Khalid Al-Mihdhar	0.391	Ahmed Alnami
0.111	Waleed Alshehri	0.010	Ramzi Bin al-Shibh	0.391	Mounir El Motassadeq
0.083	Abdul Aziz Al-Omari*	0.007	Salem Alhazmi*	0.387	Fayez Ahmed
0.083	Abdussattar Shaikh	0.004	Ahmed Alghamdi	0.387	Mamoun Darkazanli
0.083	Ahmed Al Haznawi	0.004	Said Bahaji	0.371	Zacarias Moussaoui
0.083	Ahmed Alnami	0.002	Rayed Abdullah	0.367	Ahmed Khalil Al-Ani
0.083	Fayez Ahmed	0.000	Abdussattar Shaikh	0.360	Abdussattar Shaikh
0.083	Mamoun Darkazanli	0.000	Agus Budiman	0.360	Osama Awadallah
0.083	Osama Awadallah	0.000	Ahmed Alnami	0.353	Mohamed Abdi
0.083	Raed Hijazi	0.000	Ahmed Khalil Al-Ani	0.350	Rayed Abdullah
0.083	Salem Alhazmi*	0.000	Bandar Alhazmi	0.343	Bandar Alhazmi
0.056	Ahmed Alghamdi	0.000	Faisal Al Salmi	0.343	Faisal Al Salmi
0.056	Bandar Alhazmi	0.000	Majed Moqed	0.343	Mohand Alshehri*
0.056	Faisal Al Salmi	0.000	Mamoun Darkazanli	0.340	Majed Moqed
0.056	Mohand Alshehri*	0.000	Mohamed Abdi	0.340	Waleed Alshehri
0.056	Wail Alshehri	0.000	Mounir El Motassadeq	0.330	Nabil al-Marabh
0.056	Zacarias Moussaoui	0.000	Osama Awadallah	0.327	Raed Hijazi
0.028	Ahmed Khalil Al-Ani	0.000	Wail Alshehri	0.319	Ahmed Alghamdi
0.028	Majed Moqed	0.000	Zacarias Moussaoui	0.298	Satam Suqami
0.028	Mohamed Abdi	0.000	Zakariya Essabar	0.271	Wail Alshehri
0.128	MEAN	0.046	MEAN	0.393	MEAN
0.306	CENTRALIZATION	0.296	CENTRALIZATION	0.372	CENTRALIZATION

* suspected to have false identification

Prevention or Prosecution?

Currently, social network analysis is applied more to the prosecution, not the prevention, of criminal activities. SNA has a long history of application to evidence mapping in both fraud and criminal conspiracy cases. Once investigators have a suspect they can start to build an ego network by looking at various sources of relational information. These sources are many and provide a quickly focusing picture of illegal activity. These sources include (DIA, 2000):

- Credit files, bank accounts and the related transactions
- Telephone calling records
- Electronic mail, instant messaging, chat rooms, and web site visits
- Court records
- Business, payroll and tax records
- Real estate and rental records
- Vehicle sale and registration records

As was evident with the September 11th hijackers, once the investigators knew who to look at, they quickly found the connections amongst the hijackers and also discovered several of the hijackers' alters. We must be careful of 'guilt by association'. Being an alter of a terrorist does not prove guilt – but it does invite investigation.

The big question remains – why wasn't this attack predicted and prevented? Everyone expects the intelligence community to uncover these covert plots and stop them before they are executed. Occasionally plots are uncovered and criminal networks are disrupted. But this is very difficult to do. How do you discover a network that focuses on secrecy and stealth?

Covert networks often don't behave like normal social networks (Baker and Faulkner, 1993). Conspirators don't form many new ties outside of the network and often minimize the activation of existing ties inside the network. Strong ties, which were frequently formed years ago in school and training camps, keep the cells interconnected. Yet, unlike normal social networks, these strong ties remain mostly dormant and therefore hidden. They are only activated when absolutely necessary. Weak ties were almost non-existent between members of the hijacker network and outside contacts. It was often reported that the hijackers kept to themselves. They would rarely interact with outsiders, and then often one of them would speak for the whole group. A minimum of weak ties reduces the visibility into the network, and chance of leaks out of the network.

In a normal social network, strong ties reveal the cluster of network players – it is easy to see who is in the group and who is not. In a covert network, because of their low frequency of activation, strong ties may appear to be weak ties. The less active the network, the more difficult it is to discover. Yet, the covert network has a goal to accomplish. Network members must balance the need for secrecy and stealth with the need for frequent and intense task-based communication (Baker and Faulkner 1993). The covert network must be active at times. It is during these periods of activity that they may be most vulnerable to discovery.

The hijacker's network had a hidden strength – massive redundancy through trusted prior contacts. The ties forged in school, through kinship, and training/fighting in Afghanistan made this network very resilient. These ties were solidly in place as the hijackers made their way to America. While in America, these strong ties were rarely active – used only for planning and coordination. In effect these underlying strong ties were mostly invisible during their stay in America. It was only after the tragic event, that intelligence from Germany and other countries, revealed this dense under-layer of this violent network. The dense connections of the 'Hamburg cell' are obvious in Figure 4.
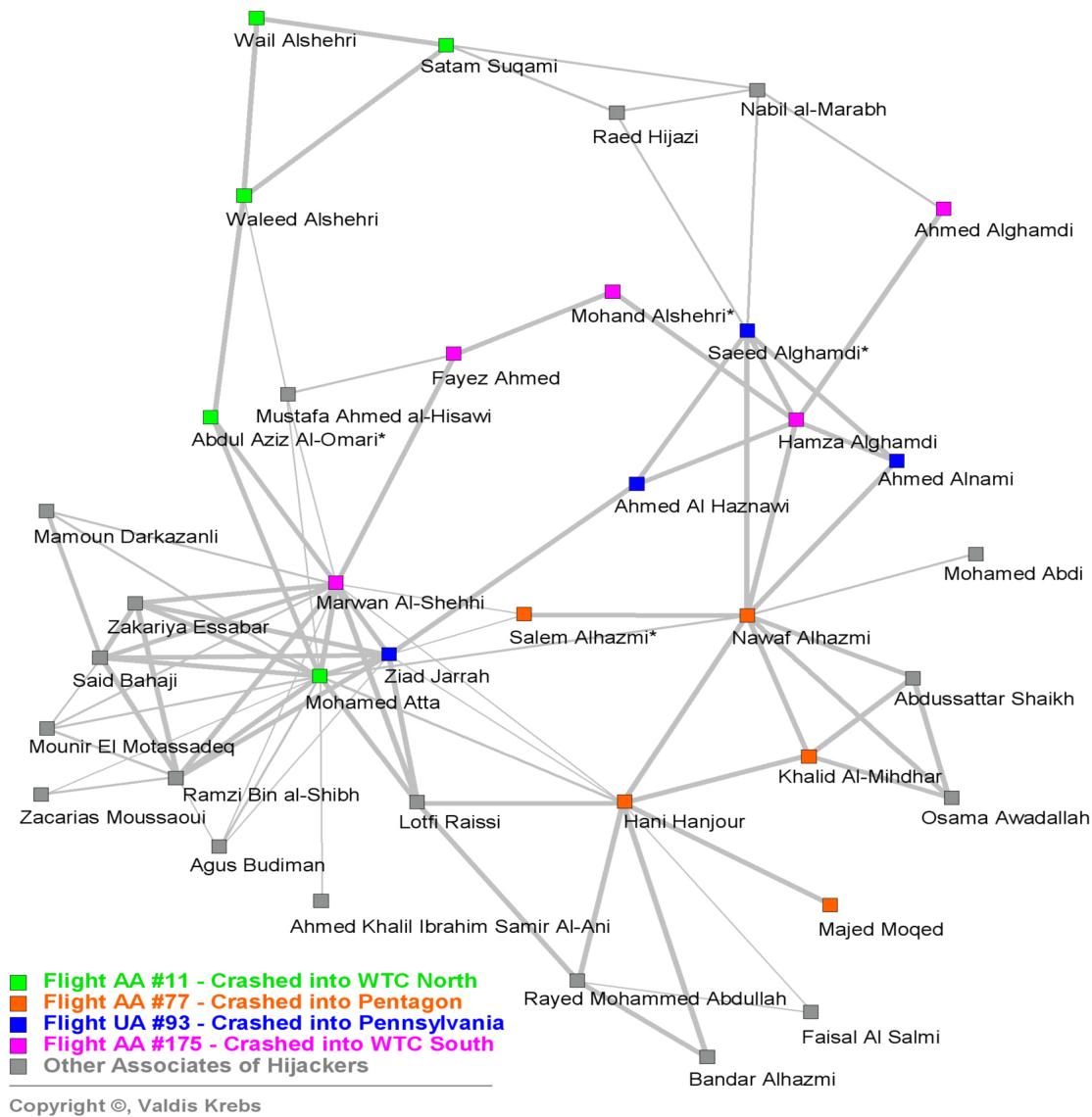
Figure 4. Hijacker's Network Neighborhood

This dense under-layer of prior trusted relationships made the hijacker network both stealth and resilient. Although we don't know all of the internal ties of the hijackers' network it appears that many of the ties were concentrated around the pilots. This is a risky move for a covert network. Concentrating both unique skills and connectivity in the same nodes makes the network easier to disrupt – once it is discovered. Peter Klerks (Klerks 2001) makes an excellent argument for targeting those nodes in the network that have unique skills. By removing those necessary skills from the project, we can inflict maximum damage to the project mission and goals. It is possible that those with unique skills would also have unique ties within the network. Because of their unique human capital and their high social capital the pilots were the richest targets for removal from the network. Unfortunately they were not discovered in time.

Conclusion

To draw an accurate picture of a covert network, we need to identify task and trust ties between the conspirators. The same four relationships we map in business organizations would tell us much about illegal organizations. This data is occasionally difficult to unearth with cooperating clients. With covert criminals, the task is enormous, and may be impossible to complete. Table 4 below lists multiple project networks and possible data sources about covert collaborators.

Table 4. Networks to Map

Relationship / Network	Data Sources
1. Trust	Prior contacts in family, neighborhood, school, military, club or organization. Public and court records. Data may only be available in suspect's native country.
2. Task	Logs and records of phone calls, electronic mail, chat rooms, instant messages, web site visits. Travel records. Human intelligence – observation of meetings and attendance at common events.
3. Money & Resources	Bank account and money transfer records. Pattern and location of credit card use. Prior court records. Human intelligence – observation of visits to alternate banking resources such as Hawala.
4. Strategy & Goals	Web sites. Videos and encrypted disks delivered by courier. Travel records. Human intelligence – observation of meetings and attendance at common events

Of course, the common network researcher will not have access to many of these sources. The researcher's best sources may be public court proceedings which contain much of this data (Baker and Faulkner, 1993), (Department of Justice, 2001).

The best solution for network disruption may be to discover possible suspects and then, via snowball sampling, map their ego networks – see whom else they lead to, and where they overlap. To find these suspects it appears that the best method is for diverse intelligence agencies to aggregate their information – their individual pieces to the puzzle – into a larger emergent map. By sharing information and knowledge, a more complete picture of possible danger can be drawn. In my data search I came across many news accounts where one agency, or country, had data that another would have found very useful. To win this fight against terrorism it appears that the good guys have to build a better information and knowledge sharing network than the bad guys (Ronfeldt and Arquilla, 2001).

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The Network Paradigm Applied to Criminal Organisations: Theoretical nitpicking or a relevant doctrine for investigators? Recent developments in the Netherlands

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The orthodox organized crime doctrine that focuses on more or less stable and hierarchical criminal organizations is slowly giving way to new and more sophisticated paradigmata, such as the enterprise metaphor and the concept of fluid social networks. This has certain consequences for control strategies. Thinking about crime more in terms of opportunity, of risk mechanisms, of personal motives, co-optation and seduction demands a willingness to depart from familiar paths and usual suspects. In the Netherlands, an unprecedented crisis of confidence in law enforcement in the mid-1990s produced the organisational and intellectual space for more elaborate approaches to organised crime. As a result at least two dozen academics have started working with and in Dutch law enforcement in some capacity, many of them with a direct involvement in operational matters. A multitude of solid organized crime analyses and studies have appeared, which confirm that the network mode of organisation between people and functional entities is far better adapted to modern modes of collaboration, trading and communication than the traditional hierarchic structures. Sophisticated network analysis methods need to enable investigators to identify positions of power and to attribute these to specific individual traits or to structural roles that these individuals fulfill. A unique position involving certain intermediate contacts for example can allow someone to monopolize the connection between two networks. Social network mapping can show what material resources someone can mobilise and which information he has access to. It can also introduce dynamics into the rigid and 'frozen' understanding of social structures that traditional organisational diagrams convey. Processes of recruitment become clearer by looking at previous connections, as does the transfer of knowledge and criminal innovations. Innovating criminal analysis alone however will not suffice. Ultimately, controlling organized crime can only be done succesfully through more flexible modes of organisation and operation, thus creating effective law enforcement and intelligence networks to deal with criminal networks.

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EGGHEAD MEETS GUMSHOE

Does it matter at all what criminologists think that crime looks like? Is there any relation between criminological theories as they develop in academic surroundings and the daily practice of those whose job it is to catch criminals? We criminologists like to think that the stuff that we say and write has some relevance to the real world. When I first started to work as an academic in a law enforcement intelligence department back in 1993, the question that puzzled me most was whether my mostly theoretical knowledge would be of any use to the sceptical practitioners who would become my colleagues.[2] In a way, this 'reality test' to me was of more importance than the recognition I received from my peers at university. I had invested a lot in gaining what I thought was not only interesting, but also useful knowledge. Now I was longing for an appreciative remark, a pat on the back from a detective with a modest formal training but substantial 'street wisdom'.

The appreciation was there soon enough, although it was gained mostly by displaying research skills I picked up in journalism instead of university. My ability to locate information on companies, persons, laws and tools from open sources and odd contacts did earn me some reputation, but did it matter to anyone that I read a pile of books on criminology and organized crime? Not in day-to-day work perhaps, but it did prove useful when I was asked to help thinking out wider strategies of crime control. This brief paper explores some of the possibilities and pitfalls when thinking about new ways to understand and deal with organized crime.

A BRIEF HISTORY OF ORGANISED CRIME PARADIGMS

In the criminology classes I teach to mid-level police officers, the module on organised crime begins with a sheet picturing Joe Barbara's estate in Apalachin, NY where back in 1957 the police broke up what is believed to be one of the rare meetings of top Mafioso representing crime families from all over the United States.[3] The stereotypical faces of Vito Genovese, Joe 'Bananas' and other infamous Mafia hoodlums seem all too familiar to my Dutch students: many of them immediately start to hum the Godfather theme. Now why is this relevant? Because to many western people, organised crime until about a decade ago was something that only existed in the U.S. or Italy. The archetypal images and ideas of what organised crime was all about originated from Hollywood: Al Capone, the fictitious Don Vito Corleone, and more recently the Colombian coke barons set out to poison America. The influence of all this is not limited to the general public: in more than one way, the idea of La Cosa Nostra as the primordial criminal conspiracy has shaped the thinking of generations of law enforcement officers, in the U.S. but also through them in many parts of the western world.[4] This knowledgeable audience doesn't need an extensive treatise on the core elements of this orthodox doctrine: serious crime results from an elaborate nation-wide conspiracy, operating through ethnically monolithic and pyramid-like, strictly hierarchical structures led by 'godfathers' and 'capi' that somewhat resemble military or corporate organisations. While this representation of Italian organised crime may or may not have been true in a distant past, it is certainly far too simplistic to explain most of the recent varieties of organised crime that have sprung up in various countries. It originates from a rigid crime-fighting doctrine that thinks in hierarchical terms, and the law enforcement efforts that such thinking produces concentrate on repression, going for the 'big catch' and 'dismantling'

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[2] From late 1993 to mid-1996, I worked as a researcher in the Research & Analysis department of theThe Hague regional police force on a project involving social network analysis of an organised crime group. After a brief period at the Nederlands Politie Instituut (Dutch national police institute) I joined ES&E, Holland's leading specialised security and crime control consultancy firm where most of my work involves research for police organisations.

[3] This event is immortalised in several Hollywood movies, most recently in *Analyze This* featuring Robert DeNiro as a 1990s Godfather suffering of anxieties and depressions.

[4] The export of US crime-fighting doctrine in this respect was detailed by Ethan Nadelmann in his study *Cops Across Borders* (University Park, PA: Pennsylvania State UP, 1993).

supposedly stable organisations by arresting the major 'bosses'.[5]

Now of course, I am oversimplifying and in a way misrepresenting the orthodox organisation-oriented crime-fighting doctrines: their rigidness of the 1970s and 1980s has not remained untouched by more modern insights. Also new and more sophisticated paradigmata of organised crime, such as the enterprise metaphor, have entered the field.[6] Some other scholars and researchers have suggested alternative views, such as the anthropologically-oriented Ianni's, whose ideas hold the potential of coming up with a more empirically-based and fine-grained image of organised crime. However they have shown themselves susceptible to the reproach that they are naïve, since they seem to have largely ignored the more hideous (and hidden) elements of the social phenomenon they have been studying.[7]

But be all that as it may, my conclusion is still that many law enforcement practitioners that I have encountered and whose reports I have read both at home and abroad appear to hold rather simplistic views of their adversaries: they often think in rigid terms of leaders, chains of command, bag carriers and stable criminal infrastructures where I observe mostly improvisation, fluid networks and ad hoc coalitions, opportunistic and very flexible individual entrepreneurs, criminal omnivores and organisational chaos. To some extent this no doubt has to do with our differing objectives: officers of the law are paid to come up with proof of concrete criminal acts and responsibilities, and (if possible) with conspiracies, since a good criminal scheme with a leader and members adds a firm percentage on the final verdict in years behind bars. Social scientists such as myself on the other hand are more interested in the motives, choices, causes and relationships behind the acts. The question is whether this curiosity can contribute anything to an effective controlling of criminal phenomena such as the ones we are dealing with here.

SOME CONSEQUENCES OF THE WAY WE LOOK AT ORGANISED CRIME

The preconceived ideas that we hold about social phenomena shape the things we see, and subsequently what we perceive influences what we do about it.[8] No perception is possible without a theory behind it. This holds true for detectives investigating a group of drug smugglers, but it also applies to policy makers who design the strategies in which society deals with forms of organised crime. To once again put it in simple terms: for far more than a decade, detectives in Holland have explained organised crime to their superiors and later to concerned policy makers in terms of conspiracies, ring leaders, more or less stable and familiar organisations, and mega-profits. This process has decisively influenced the way in which counter strategies took shape, and it has in particular created the nearly unlimited leeway that covert policing until recently was allowed to operate in. All this came to an abrupt end in the period 1994 to 1996, when the heat finally came down and the largest scandal ever to affect the Dutch judicial system struck fear in every covert investigator's heart. But apart from this dramatic climax, the conventional wisdom about serious crime also precluded the introduction of all sorts of more prudent, preventive measures that could have limited the opportunities for such crime to expand in the first place.

Thinking about crime more in terms of opportunity, of risk mechanisms, of personal motives, co-

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[5] In the intelligence literature, this phenomenon of thinking about the adversary in terms of similarity to your own culture and form of organisation is referred to as 'mirror imaging' (cf. Robert B. Bathurst, *Intelligence and the Mirror.* Oslo: PRIO, 1993).

[6] Limited space does not allow me to go into the virtues and pitfalls of the criminal enterprise paradigm, which I dealt with in more detail elsewhere (P. Klerks, dissertation, in print).

[7] My dissertation, which I hope to present coming February, goes into more detail on the development of competing organised crime doctrines.

[8] One of the first things many students of sociology are taught is the so-called Thomas theorem: 'If men define situations as real, they are real in their consequences.'

optation and seduction demands a willingness to depart from the familiar paths and the usual suspects. This is not an easy thing to promote in a world that has more than enough crime to keep all the coppers busy all day long. No wonder putoffs abound: "We have no time to contemplate ethical niceties and come up with subtle theories of why criminals behave the way they do: there's virtually a war going on, and if we don't catch the bad guys soon they become invulnerable and we will have lost for good."[9] It took a confidence crisis of unprecedented magnitude to produce the organisational and intellectual space for more elaborate approaches to organised crime to come up. Over the last five years, at least two dozen academics have started working in Dutch law enforcement in some capacity, many of them with a direct involvement in operational matters. One can expect tactics and strategies to benefit from this, in spite of the much more rigid system of legal checks and balances that has recently been set up and which in itself seriously restricts the operational capabilities of investigative squads.

WHAT DOES IT MEAN WHEN WE REFER TO ORGANISED CRIME IN TERMS OF SOCIAL NETWORKS?

The paradigm of organised crime as social networks has become widely accepted among Dutch criminologists within just a few years. This in itself is remarkable, because until the early 1990s there was hardly anyone in academia who gave any serious attention to organised crime: such shady domains belonged exclusively to dangerous crooks and secretive police operatives, and almost no one else felt the need to get involved or ask questions. The usefulness of the network approach in studying serious crime is by now not only appreciated among researchers in Holland, but also in the UK (where Dr. Dick Hobbs has recently done interesting ethnographic work on serious crime networks) and in the US (where Prof. Phil Williams among others has applied the concept to transnational drug trafficking).

In 1995, a group of four leading criminologists referred to as the 'Fijnaut Group' worked for a year to draw up an extensive panorama and threat analysis of organised crime in the Netherlands.[10] On the whole, they criticised the orthodox idea of semi-stable criminal structures with fixed leaders and some form of coordination between gangs. Instead they emphasized the fluidity of organised crime, the importance of improvisation and the fact that especially the drug trade allows for relatively small operators to expand like a comet on the basis of a few successful drug imports and become criminal 'top dogs' almost overnight.[11] This unprecedented study of organised crime in the Netherlands was based on a detailed analysis of many hundreds of confidential police intelligence reports from all over

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[9] This idea of being involved in a 'war on drugs' is what in the end caused the 'Van Traa crisis', named after the chairman who presided over the parliamentary commission that in 1995 investigated covert policing practices. During the preceding decade, police operatives at the lowest levels had been allowed to operate in a judicial and command vacuum, applying all sorts of intrusive tactics at will and making decisions almost entirely on their own. Individual detectives had been called upon to do the dirty work, while senior officers and public prosecutors either pretended not to know in order to avoid responsiblity, or joined in the fight with even more cowboyish eagerness, ignoring a good part of the penal code in the process. At one point, the Van Traa commission established that the police had been instrumental in bringing 285 tonnes of softdrugs and 100 kilo of cocaine on the market. Such incredible decisions had been made in naïve attempts to 'build up informants' who had to establish credibility with major criminal organisations but who later turned out to have been 'double agents' who became major traffickers on their own account under police protection.

[10] Their report to the parliamentary Van Traa commission was later translated and published as C. Fijnaut, F. Bovenkerk, G. Bruinsma and H. van de Bunt, *Organized Crime in the Netherlands* (The Hague: Kluwer Law International, 1998).

[11] The Fijnaut Group defined organised crime as: "If and when groups of individuals join for financial reasons to sytematically commit crimes that can adversely affect society. And are capable of relatively effectively shielding these crimes from targeted intervention of the authorities, in particular by way of their willingness to use physical violence or eliminate individuals by means of corruption."

the country, and its conclusions gained authoritative status overnight. Policy makers, investigating magistrates and police chiefs were forced to reconsider their strategies and reorient their efforts. This new criminological orthodoxy, together with the introduction of a much stricter set of judicial controls on intrusive police methods, drastically changed the atmosphere in Dutch law enforcement in the second half of the 1990s.

The Fijnaut Group's findings were more or less confirmed by a later report by the ministry of Justice research centre (the WODC), which again looked into the dossiers of over a hundred organised crime cases and confidential investigations dating between roughly 1995 and 1998.[12] However, this study emphasised even more the need to look at "criminal cooperatives" (the term they propose instead of 'organisation', 'group' or 'structure') in terms of fluid network relations with occasional 'nodes' representing the more successful and enterprising operators. The WODC researchers point out that while extensive and prolonged investigations will remain necessary, their observations need to result in a substantial re-targeting of law enforcement intervention efforts toward more 'short strike' missions intended to take out 'facilitators' and clandestine service providers, as these form essential elements in the networks that allow many others to successfully perform their criminal acts. So far, such 'small-time' service providers nearly always remained at the fringes of criminal investigations, with detectives often not being aware that these 'minor' characters surfaced in many of the supposedly different criminal organisations that they attempted to investigate. Another interesting observation is that the supposed ethnic homogeneity of criminal groups that supposedly caused the participating individuals to cooperate and obey is in fact now largely a thing of the past. Also, specific groups are much less likely to restrict themselves solely to one particular drug or criminal activity. Opportunism and ad hoc coalitions, but also relationships based on friendship and even amorous ties now much more than before lay the basis for criminal projects. Women too, it seems, play a very important role in establishing contacts and reinforcing mutual bonds. In short, social ties much more than business relations of formal command structures form the basis for criminal cooperation. Pyramid-like criminal authority structures are increasingly rare, although within separate smaller cells such as nuclear families the more traditional father-son-like authority relations can still be found. (Semi-)independent criminal operators often work in pairs of two, teaming up with several different 'criminal cooperations' instead of belonging to only one group. The WODC researchers and other criminologists have now retrospectively demonstrated that the 'conspiracies' and mega-hierarchies that the police had identified in the past among Dutch and Turkish organised crime were in fact constructions that can not stand up to close scrutiny. What seemed like awesome mammoth organisations were in fact strings of interlinked smaller groups that lacked a central leader but coordinated their activities along logistic trails and through bonds of friendship.

The common thread in all these recent studies is that the network mode of organisation between people and functional entities has proven to be far better adapted to modern modes of collaboration, trading and communication than the traditional hierarchic structures. This is quite obvious to anyone familiar with 1990s economics, but it is even more true for present-day sub-legal activities such as producing and trafficking illicit products and delivering clandestine services. Such activities exist in a hostile environment and thus they need the capacity of rapid innovation, adaptation and avoidance in response to possible law enforcement interventions. According to simple Darwinist reasoning, in a continuously changing world the more flexible 'social life-forms' stand the best chance of survival.

Looking at criminal structures in terms of networks means that certain questions need to be asked, such as what constitutes the bonding mechanisms that tie people together in different constellations? Greed is perhaps the most common motivator among criminals, but the lust for money certainly can not explain all the activities that we observe. Other social mechanisms are equally important, such as ethnic or tribal ties, family relations or common backgrounds in a geographical (neighbourhood) or

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[12] Published as: E.R. Kleemans, E.A.I.M. vanden Berg, H.G. vande Bunt, *Georganiseerde criminaliteit in Nederland. Rapportage op basis van de WODC-monitor*. The Hague: WODC, 1998.

institutional (prison) sense. A common interest in certain cultural or consumer habits (music, consumption, cars) can also form the fabric for cooperation. The social network perspective allows for a greater or lesser concentration on the importance of such social mechanisms, as we shall see later on.

Another typical trait of network structures that makes them rather hard to dismantle is their resilience against damage. The term 'dismantling' used to be quite popular among law enforcement officials in Holland in reference to criminal structures. The way to put an end to a criminal organisation traditionally was to arrest the leaders, thereby incapacitating the remaining bad guys that did most of the leg work. These were somehow considered to be too stupid to initiate any substantial criminal activities by themselves. The official working programmes of many police organisations had until recently as their target for a given year the "dismantling" of at least an x number of criminal organisations. Nowadays, the awareness that a compromised network can often limit the damage by developing other latent functional connections in a short while and thus rebuild most of its original operational potential before long, has made the police a lot more modest in its claims.[13]

VARIETIES IN NETWORK ANALYSIS

In itself, the application of the social network paradigm is not altogether unproblematic. Originating from a long tradition in ethnography and sociometrics, the idea to use the network metaphor to describe and explain social structures has been put into practice by a number of different scholars in a variety of ways. This implies that there isn't such a thing as 'the' social network analysis approach: about the only common element among the different varieties is the conviction that it is useless to explain human behaviour or social processes solely through categorical properties and norms of individual actors. Instead, the emphasis is on their functioning within structured social relations. Individual behaviour is always seen in relation to the behaviour of the groups which a person is part of. In brief, a person manifests itself in a socially relevant way primarily in his or her relationship to others, and therefore these relations deserve careful and systematic scrutiny.

In social network studies, first there are those who work in the 'strictly sociometric' tradition: they are the mathematically-oriented sociologists who revel in the prospect of being able to calculate the exact 'denseness' and 'centrality' of human network relations in any given empirical setting. Researchers of this breed will approach an empirical situation armed with questionnaires for participants to fill out, in which respondents are asked to state exactly who they favour, appreciate or detest and under what circumstances. The results are entered in a computer, which then produces a detailed map representing the entire set of social relations and mutual feelings. This research tradition has spawned a number of quite interesting studies on school classes, hospital settings et cetera, which provided new insights in how people co-operate and realise certain goals, how they resolve conflicts and how they for instance find a new job. Unfortunately, criminals in their natural habitat seldom fill in researchers' questionnaires.

It will be clear that although such methods can offer certain insights in social structures, there are obvious limits to what can be achieved. Measuring and counting presupposes that there is something to be counted, and people who prefer to operate in surreptitious ways seldom expose themselves voluntarily to a sociologist's curious gaze. One can of course attempt to use other ways of collecting data, such as analysing telephone taps and surveillance logs, but in such cases it should be realized that data collection is very partial and certainly biased, since not every actor is exposed to an equal extent and therefore some of those observed (perhaps the 'usual suspects') contribute far more to the data set than others. Any calculations, diagrams and conclusions that are subsequently drawn from such incomplete data sets are by definition unreliable. To perform a network analysis in the traditional way, one needs to know the boundaries of the 'data universe' under study. Empirical experience shows that

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[13] The very existence of the Internet is a result of the awareness of the US Department of Defense in the 1960s that the redundancy of a network would be needed to allow for strategic communications after a major nuclear attack.

in the real world of serious criminality, it is all but impossible to agree on a static boundary which includes some while excluding all others.[14]
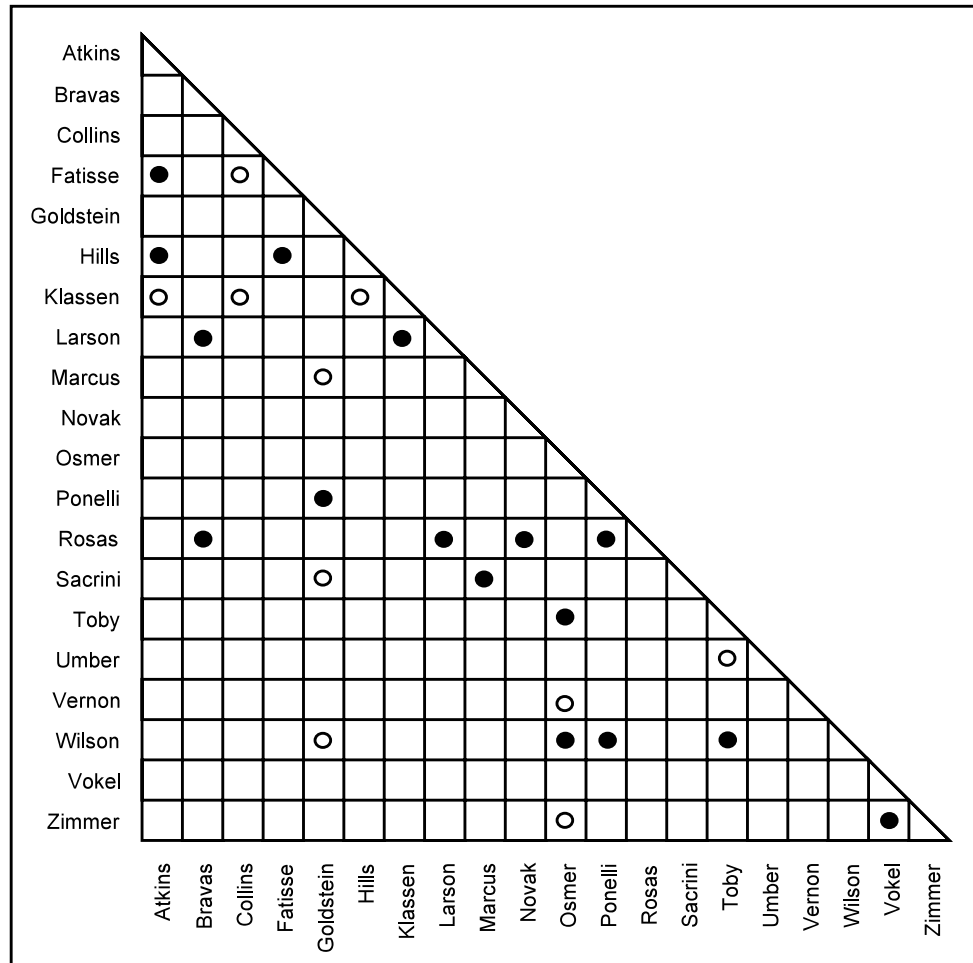
	Atkins	Bravas	Collins	Fatisse	Goldstein	Hills	Klassen	Larson	Marcus	Novak	Osmer	Ponelli	Rosas	Sacrini	Toby	Umber	Vernon	Wilson	Vokel	Zimmer
Atkins																				
Bravas																				
Collins																				
Fatisse	●		○																	
Goldstein																				
Hills	●			●																
Klassen	○		○		○															
Larson		●					●													
Marcus					○															
Novak																				
Osmer																				
Ponelli				●																
Rosas		●						●		●		●								
Sacrini					○				●											
Toby											●									
Umber															○					
Vernon											○									
Wilson					○						●	●			●					
Vokel																				
Zimmer											○								●	

Figure 1. Data matrix (source: Anacapa Sciences, Inc.)

Crime analysts using mapping tools to depict relationships between suspects usually do not bother too much about the exact mathematical density and proportions. Their aim is mainly to visualise who does what to whom, and with what frequency. In spite of all the visual gimmicks, the basic technique behind such link analysis software is quite straightforward: one counts the number of established contacts, and based upon that figure, a stronger or weaker link is assumed. The data thus assembled can be entered in a data matrix (cf. fig. 1). Based upon these data, a drawing can be made of the various entities and their contacts (fig. 2).[15]

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[14] There are only a few examples to be found in the open literature of analysts who have attempted to describe criminal networks using the regular set of instruments (methodology, algorithms and software). A Dutch PhD student with full access to police resources and data and support from leading experts in the network analysis field gave up the project within a year for lack of prospects (J. Herbrink, "Netwerkanalyse. Nieuw vangnet voor de politie?" *Modus* Vol. 4 (1995) No. 3: 2-6). Since then, no serious attempt has been made to apply such sociometric techniques in crime analysis.

[15] Of course, newer generations of analysis software can make all sorts of distinctions between e.g. command links, financial links and logistical (such as drug transport) links. Also, the direction of the relation can be indicated by

The use of analytic linking software in making sense of massive amounts of data is now common among practitioners around the world. In spite of the theoretical and methodological problems with creating sociodiagrams of criminal structures that are outlined above, the availability of such rather sophisticated network analysis software such as i2's *Analyst's Notebook* package and Active Analysis's *Netmap* has motivated some to attempt experiments with 'traditional' network analysis tools. Based on these practices, the use of less familiar analytical techniques such as cluster analysis and the smallest space algorithm is being pioneered by academics and law enforcement analysts alike.[16]
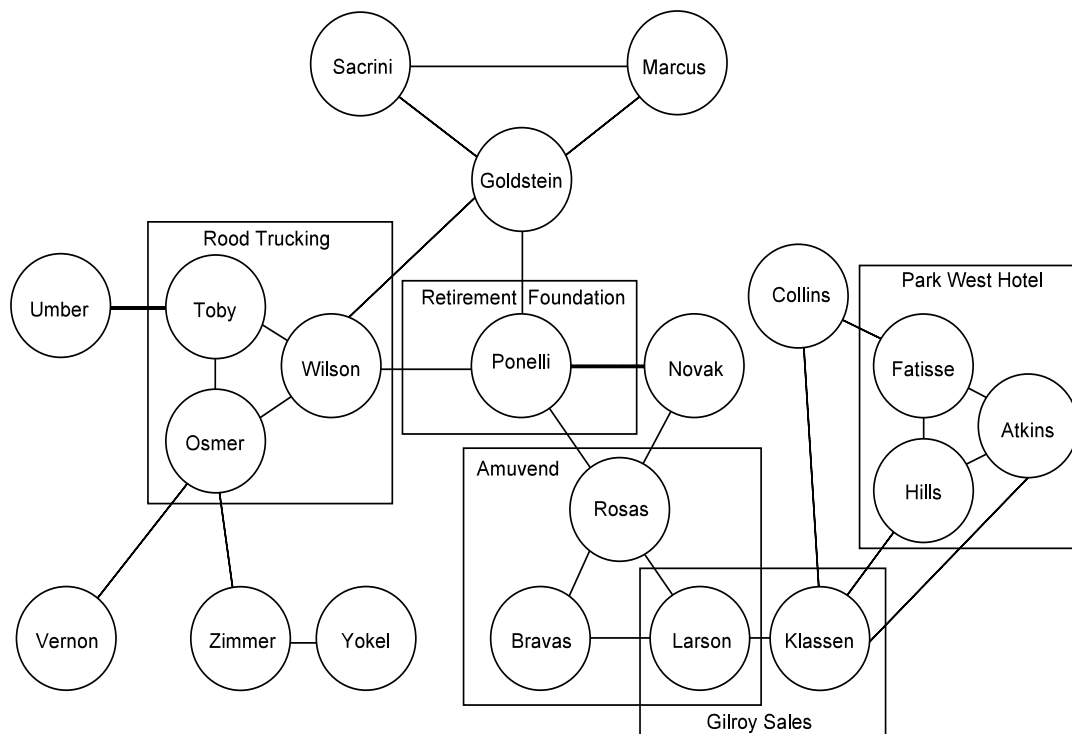
Figure 2. Link diagram (source: Anacapa)

The usefulness of second-generation analytical tools (the first generation being the hand-drawn Anacapa charts and maps with coloured pins) such as i2's Analyst's Notebook software is also widely accepted in Dutch law enforcement, with many dozens of analysts trained in their operational use. The level of sophistication however remains modest, as many analysts use such network mapping software merely to provide graphic representations of the simple raw data obtained from phone taps and physical surveillance reports: A calls B, and B subsequently meets with C an x number of times. The actual content, let alone meaning of such contacts is analysed only in a very crude way. Social network analysis of the sort that we could call 'third generation' would focus much more intensely on the content of the contacts, on the social context, and on the interpretation of such information.

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arrowheads, and the reliability of specific bits of information can be taken into account by drawing unconfirmed relations with a dotted link.

[16] Two examples: Dr. Malcolm K. Sparrow of Harvard University explored several analytical techniques in relation to social network analysis in a number of open and closed publications (e.g. 'Network Vulnerabilities and Strategic Intelligence in Law Enforcement', *International Journal of Intelligence and Counterintelligence* Vol. 5 (1991) # 3); more recently and closer to home, Detective Superintendent Andrew Rennison presented a 'smallest space' analysis based on itemised telephone bills in his paper *Social network analysis of a group of criminals* (Manuscript, 1999).
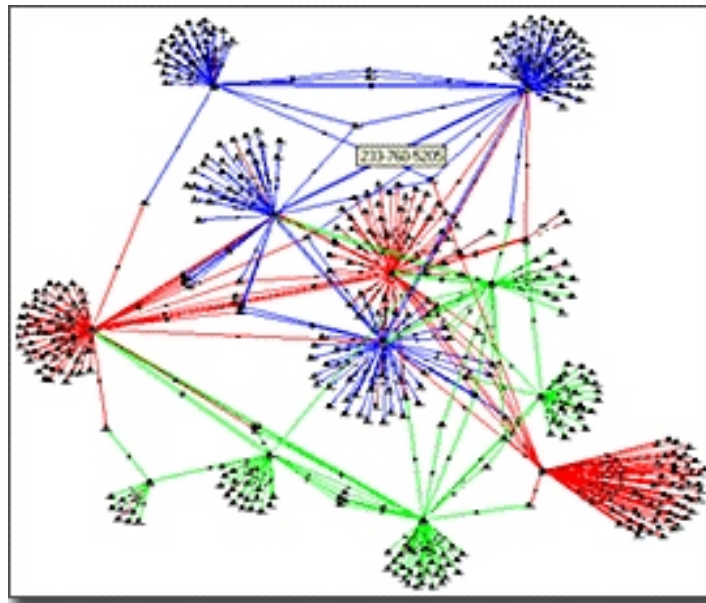
Figure 3: Example of a graphic representation of a large data
set consisting of individuals and business entities with
connecting links. (Source: i2's Analyst's Link Notebook).

My first experiences with such mapping software dates back to 1994, when I had the opportunity to re-examine the raw data that formed the basis of several link diagrams. I soon found out that the almost completely automated generation of such maps disguises certain risks that are inherent to using any data set drawn up by relatively inexperienced personnel. A number of errors were sometimes made in registering and encoding the data. First of all, specific individuals were registered multiple times, e.g. under different spellings of their names. Also, phone calls made to certain persons such as bartenders or girlfriends of suspects were sometimes encoded with the name of that bartender or girlfriend at the receiving end, and on other occasions the suspect who soon after came on the phone was identified as being the receiver. In short, the data proved to be rather unreliable. I decided to re-encode a part of the enormous amount of data, and the link diagrams that I subsequently produced were rather different from the original ones. Strictly speaking, the original data were correct when it came to the technical contact between certain phone numbers, but in a sociographic sense, different people were often involved on both sides of the wire.

My objective at the time was to attempt to use 'third generation' social network analysis on an operational data set. That meant going beyond the mere drawing of links, to registering the more subtle aspects of contacts and relationships, and ultimately to interpreting such data in order to better understand in a qualitative way the behavior, motivations and choices of the individuals concerned. This ambition could never be achieved by merely using the encoded data as they were originally registered. It meant going back to the original telephone and surveillance logs to check each conversation and observation line by line, encoding what occurred there and in the end bringing all those insights in the final analysis of the crime network that I was studying. This is a quite cumbersome exercise, one that in the course of most normal criminal investigations would simply not be feasible. I had drawn up a set of questions to be asked of the data I was analysing. Those were partly simple questions on e.g. the use of threatening of intimidating language, the amount and direction of authority in a conversation and similar aspects. Some other questions were more complicated, such as who talks about which other persons in what way during conversations with third persons. It is not possible to go into too much detail on methods here, but the idea behind it is that through such forms of qualitative content analysis the study of social networks can contribute to a better understanding of vital social processes, power and affinity structures. It would of course be a gross waste of time and resources to go through so much trouble to unravel a simple heroin transport, but considering that the

Dutch police has spend tens of millions of guilders during seven or more years of extensive investigations on certain major criminal networks, it could be worthwhile to get to know such persons in a structured way and by tested methods that do not depend on the skills or biases of individual detectives or analysts.

Third generation social network analysis is intended to enable investigators to identify positions of power and to attribute them to specific individual traits or to structural roles that these individuals fulfill. A unique position of intermediate contacts for example can allow someone to monopolize the connection between two networks. Such a position is worth guarding, as it brings possibilities of selective information management, blackmail and what not. Being the sole supplier of certain goods or services, or the unique channel into a supplier country (perhaps because of language skills) makes one a very interesting person, to fellow criminals but certainly to investigators as well. Social network mapping can show what material resources someone can mobilise and which information he has access to. Such access and power is highly relevant in manipulating social structures as any manager can testify. Social network analysis can also introduce dynamics into the rigid and 'frozen' under-standing of social structures that traditional organisational diagrams convey. Processes of recruitment become clearer by looking at previous connections, and the transfer of knowledge and criminal innovations can also be traced.

A traditional crime analysis can fail to identify the informal 'cliques' by limiting itself to relationships between individuals and 'hard' organisations. Thus it may seem that in a certain field only few enduring structures exist, when a more intense analysis may indicate that among the seemingly transient contacts indirect links exist when people from certain 'pools' (such as sporting schools, coffeeshops or neighbourhoods) are shown to be working together. Social network analysis not only draws attention to established contacts, but also to relationships to appear not to exist and are oddly missing. Conflicts for example may never result in actual contacts and thus never show up in traditional diagrams, but third generation social network analysis will register adversaries and their hostilities, and will thus visualise 'silent' conflicts as well. By paying attention to '*structural holes'* (remarkable white spots and hard-to-fill positions in a network), hypothesis-building can be supported. Blind spots in a 'social floor plan' are noticed soon. By looking at a criminal structure from the angle of social network analysis, certain persons and roles draw attention that otherwise would easily go unnoticed. In the case of the specific group that I was analysing, it became apparent that a number of seemingly insignificant characters always showed up at the right moment and at the right spot to help establishing crucial contacts. Those usually independently operating 'social bridge builders' I refer to as 'criminal contact brokers'.

From the annals of organised crime it is quite easy to illustrate the value of social network analysis over the simplistic 'focussing on the leaders'. Interesting figures who by themselves are no 'heavyweights', but who have access to much vital information through their social functioning quickly draw the analyst's attention. One good example from the U.S. Cosa Nostra literature is Willie Boy Johnson, at one time an FBI-informant from Queens, New York who for personal reasons would play a key role in the demise of Gambino family chief John Gotti.[17] Johnson was a much-wanted 'strong-arm man', who could never formally become a mafioso because he was only half-Italian. He was what both the FBI and Cosa Nostra refer to as a *floater*, someone who is assigned to a specific crew, yet loaned out to other crews for various assignments because of a particular speciality. As a consequence, Johnson had a panoramic view of the entire New York Cosa Nostra. In Holland, such *floaters* have on occasion also been identified.

It will by no means be easy to develop the 'third-generation' social network analysis into an established methodology that can be taught and applied uniformly. Although some progress has been made, a lot

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[17] J. Cummings and E. Volkman, *Goombata: The Improbable Rise and Fall of John Gotti and His Gang*. New York: Avon Books, 1992: 148.

more empirical work based on 'learning by doing' needs to be done. Preferably, those doing such analysis most be thoroughly familiar with both regular criminal analysis and social science methodologies, which means that such method development costs a lot of time and money. The more ambitious and sophisticated criminal intelligence analysts could probably contribute a lot as well, but the problem here is that Dutch analysts often are merely used as administrators for the investigative teams and as post-hoc presenters of complex criminal cases to the public prosecutor and the top brass in order to secure funds and continuity of the investigation. This is now improving somewhat, but the analyst's role is still seen by many LE managers as a supporting one, used to interpret data after they have been collected instead of a proactive involvement in setting out investigative and control strategies.

THE CURRENT SITUATION IN THE NETHERLANDS

With all the new insights available to them, have the prosecutors' strategies changed, do investigators now go about their daily work in a different way, have their aims and tactics been adapted to new insights and if so, how and with what results? As the lessons learned are still quite recent, it is not that easy to identify a trend. In Holland, running investigations against organised crime networks is a demanding job at the best of times. At the moment according to many investigators it is all but impossible. Most prosecutors now maintain a hands-on management role in keeping police investigators on a very short leash, and under new law permission has to be asked to a national oversight body for every application of many of the more intrusive and all innovative tactics and techniques. If for example a telephone intercept records information on an upcoming drug transport, chances are high that the police have to intervene without hesitation to avoid the drugs coming on the market. Allowing any "harmful goods" to go through with the police knowing about it is nearly unthinkable these days. The result is often a 'blown case', since all operational details as well as the immediate cause of the intervention have to be disclosed in court. All this makes it much more difficult to run major investigations over a prolonged period. In a way, this almost forces police teams to adapt their strategies and focus on more intermediate goals instead, an approach favoured by many advocates of the social network approach. On the negative side, the new legal restrictions seem to have a 'chilling effect' which to some extent paralyses certainly those investigators who have to operate in a region where an over-cautious district attorney refuses to allow even mildly intrepid initiatives.

Over the last months, we do see an increasing number of cases in which the police target supposedly major narcotics networks through 'short strike' tactics rather than through the 'long haul' approach, waiting for 'ultimate catch' of a large shipment of drugs. To some extent, this is no doubt the result of the new judicial doctrine that requires the police to intervene almost immediately once a drug shipment is traced. But insiders claim that police managers are really beginning to realise that waiting for the major catch is not all that efficient in terms of return on investment. After all, arrests for transporting a modest amount of cocaine can already result in many years imprisonment, and the extra 400 kilos that you could perhaps catch one day do not justify allowing the criminals to carry on with all their endeavours for many months or even years, building up a reputation of invulnerability in the process and thus presenting a bad example to those susceptible for the seemingly profitable lurings of crime.

Perhaps one could say that an increasing number of analysts begin to see the utility of social network analysis and 'short strikes'. Many tactical investigators however are still hesitant. Perhaps understandably so: they *do* see bosses and hierarchies, as they are conditioned to see them because of the legal requirements of proving that a (semi-)formal organisation exists and that there are identifiable leaders. Besides, criminal structures differ. There is authority certainly in the smaller groups, and occasionally an investigation may even run into *Mr. Big*, the genuine 'Man with the Plan'. So some doubts about the omnipresence of fluid social networks are justified. The concept of the 'criminal broker' and the facilitator is more readily accepted among investigators, especially in the context of 'upper world' contacts in relation to e.g. synthetic drugs and financial and juridical services.

The council of chiefs of police (a body somewhat similar to the UK's ACPO) has recently decided to endorse the 'short strikes' strategy, but several leading public prosecutors are not at all happy with this new policy. They claim that the social network paradigm may hold true for Dutch and -more in general- Western European criminal operators, but in their opinion the much tougher Turkish, Kurdish and Pakistani heroin traders are of a different breed entirely: dealing with these groups requires a more prolonged and fiercer approach. This scepticism regarding the new strategies and even the network perspective in general is not limited to some gung-ho prosecutors. A follow-up enquiry by a second parliamentary commission looking into the implementation of the Van Traa recommendations this summer concluded that the 'short strikes' strategy is generally not supported in the police and the judiciary.[18] It is widely interpreted as "catching the small fry while allowing the big guys to walk." The concept of affecting networks by targeting crucial facilitators has not been explored in any detail, and the commission found that apart from some individual creativity among the ranks of law enforcement, there is very little in the way of systematic thinking about new investigative strategies. It therefore recommends to establish a new centre of expertise for the development of investigative strategies.

Meanwhile, in the field, some creative detectives are already experimenting with applying the new insights. Over coffee, this author heard several recent examples of relatively 'heavy' and notorious criminals who were lured from their relative insulation because they felt they had to become involved once a relatively small drug shipment had been intercepted. The necessary maintenance of their reputation, but also the urge to 'help out their friends' simply didn't allow them to keep a low profile and avoid all risks. They used their (supposedly safe) anonymous cell phones, and showed up on the scene to check what happened and/or to provide comfort. This allowed the police to tie them to the narcotics trafficking and thus via an indirect tactic brought them in the dock. Once such tales of success find their ways to more police canteens, they will provide the best mouth-to-mouth advertisement for such innovations. And of course, introducing them into formal courses and establishing a centre of expertise helps as well.

SOME THOUGHTS ON THE FUTURE

Where does all this lead us? Do police investigators suddenly need to become trained social scientists with a keen eye for affinity bonds? Not really: the majority of criminal investigations will continue to be run largely as they are now, without much more sophisticated analysis support than the familiar link diagrams. It is only the most complicated, prolonged and sensitive kind of projects that could use these new insights. Meanwhile, criminologists still need to ask the deeper question about the usefulness of theory for practical applications: If we as researchers come up with 'better' knowledge and explanations of empirical phenomena, does this have consequences for the practitioners? Does such criminological research have any relevance and influence on the 'real' world?

Closer involvement of trained social scientists and economists in the investigative process will benefit both domains: the cops get more clever and the academics more realistic about what can be achieved. In Holland for example, the process of establishing priorities for the allocation of the many hundreds of specialized organised crime investigators working in large permanent teams has been overhauled with the input of universities and consultants' expertise. Periodical and more objective monitoring 'scans' of the magnitude and nature of organised crime have replaced the old back channels through which gloomy detective chiefs indoctrinated ministers and politicians. In this sense, criminologists certainly can play a role by interpreting information as objectively and intelligently as possible.

Realistic assessments of criminal threats are needed to avoid overkill and unwanted invasions of privacy. In the recent past, the threat of organised crime in some ways have been exaggerated, especially when the alarm was sounded over the "immediate threat" that organised crime was said to

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[18] Handelingen Tweede Kamer 1998-1999, Bijlagen 26269 Nrs 4-5: 201.

pose to democratic institutions such as the courts, local councils and parliament. Any substantial infiltration attempts in 'upper world' power structures have yet to be proven, and the criminals are not out to take over state power in western Europe. But on the other hand, failing to appreciate organised crime for what it is, a social phenomenon closely tied in to our society's structure and profiting from its inherent weaknesses such as greed and ignorance, can in the longer run result in serious problems.

All in all, it is quite likely that law enforcement in the next century can only hope to remain successful in controlling organised crime if can transform itself into more flexible modes of organisation and operation. It will probably take a lot more networking to effectively deal with criminal networks.

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Terrorists/Liberators: Researching and dealing with adversary social networks[1]

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We first describe the recent evolution in the definition of the term "terrorism" following the 11 September 2001 attacks. We presented two specific types of "link analysis" methods used to analyze adversary networks. Ralph McGehee, of the CIA, developed the village survey method used in Thailand in the mid-1960s. We present in detail the evolution of "traffic analysis" (communication link analysis) from its description in World War II US Army manuals to CIA use in the late 1960s against Eastern diplomats in the US and against rebels in Latin American, to MI5 use since the 1970s against the IRA in Northern Ireland (and vice versa), and to modern extra-judicial use by police, intelligence and private parties for "non-intrusive" telephone surveillance. This presentation of traffic analysis includes publicly-available counter-measures that have been developed over time. In the last section, we present Peter Klerk's doctoral thesis on the analysis Dutch criminal networks and strategies against them, including targeting their weakness associated with queue analysis of key network position replacement.

CLARIFYING TERMS: "TERRORISTS" OR JUST ADVERSARIES

When MI5 and the IRA used the same methods of link analysis against each other to target individuals for assassination, it's difficult to call one use "anti-terrorist" and the other "terrorist." Even with the worldwide backing of the US government's "anti-terrorist" campaign against the individuals and organizations responsible for the 11 September 2001 attacks in New York City and Washington, the United Nations was unable to come up with a definition of "terrorism." The head of Reuters news service even went as far as explicitly discouraging the use of the term "terrorist" in Reuters press releases following the 11 September attacks. Indeed, the governments of South Africa, Angola and Zimbabwe — to only name a few — are run by individuals and parties that were widely described as "terrorists" until the regimes they were fighting against crumbled. A very thorough development of this question was recently provided by Seumas Milne (2001) who stated that: "The transformation from terrorist to respected statesman has become a cliche of the international politics of the past 50 years, now being replayed in Northern Ireland."

When the same methods are used by one large company against another, by one intelligence service against another, or by a democratic government against religious fanatics, it seems more appropriate to avoid terms such as "illegal" and "illicit" and to use the term "adversary"; thus the title of this article is "Researching and Dealing with Adversary Social Networks."

This is not to discourage attempts to arrive at a consensus concerning what is "terrorism" and developments since the 11 September attacks have indicated a direction of possible progress. Western Europe reportedly developed the first "modern" definition of terrorism in the 1980s as "violence to obtain political objectives." Thus, the Red Brigades in Italy and ETA in Spain were "terrorists." However, the United States could not condone such a definition which could seriously hinder its foreign policy, particularly in Israel and Palestine where the Israeli government applies an official assassination policy against Palestinian leaders.

Following the 11 September attacks, a consensus seems to be developing around the use of the term "terrorism" to describe "violence to obtain political objectives and involving attacks against citizens of foreign countries not directly involved in a conflict." This, of course, focuses the problem of clarification on the term "directly involved in a conflict," but it makes it clear that the 11 September attacks were "terrorism." However, it leaves open the question of whether or not killing civilians, in a theater of combat, without proof of support of rebels is also "terrorism."

Researching "adversaries," including political or commercial rivals, can take many forms. Even when limiting the field to empirical, data-based methods, there are still numerous possibilities even though this tends to eliminate almost all the "methods" employed by political, commercial and other organizations that are not intended for scientific research. By limiting the field even further to "structural" methods used in scientific research, there are still many candidates and this issue of *Connections* will be presenting several of them. Below, we present two: the village survey method developed by CIA officer, Ralph W. McGehee, and traffic analysis or communication link analysis whose first formalization we have found in a US Army World War II manual.

MCGEHEE's VILLAGE SURVEY METHOD

In September 1965, CIA officer and former Notre Dame football star, Ralph McGehee arrived in Bankok, Thailand, to fight Communist rebels (McGehee, 1983). He soon found out the CIA data on the rebels was not only unreliable but, in many cases, false. This reflects the same discovery concerning official data on adversaries that Klerks notes in his article in this issue of *Connections* concerning Dutch criminal networks. McGehee decided to "go into the field" and develop what he called the "village survey" method which is simply a form of the classic village monograph method in anthropology. McGehee and his district survey team would interview village members and note family and community relationships. Cross-checking was all that was needed in many cases to obtain confessions of Communist Party membership or even arms training.

By returning later to the same villages, redoing another survey and cross-checking data with the previous survey, McGehee often obtained a complete description of the local or even district structure of the Communist Party and its various associated organizations. By surveying 30 Thai villages, he was able to extrapolate results to all of Thailand, and that's where things went wrong. He found more Communists in one province than the CIA officially recognized for all of Thailand. Using available information, the method indicated that if applied to Vietnam, the picture would have been catastrophic: "the surveys would have shown there that the communists could not be defeated" (*ibid*: p. 116). The CIA's response was to award McGehee its highest service medal and keep his results from being known by anyone outside a very small circle of CIA officials including William E. Colby, then CIA Far East division chief and McGehee's more-or-less direct superior, before becoming head of the CIA during the Vietnam "police action."

WORLD WAR II AND EARLY HISTORY OF TRAFFIC ANALYSIS

During World War II, "traffic analysis" was defined as "that branch of cryptology which concerns the study of the external characteristics of signal communications and related materials for the purpose of obtaining information about the organization and operation of a communication system" and presented in a US Army technical manual (1948). Although traffic analysis probably existed in other forms since the use of electronic battlefield communication systems, this is the first mention of the term and the first formal presentation we have found. It is a "filing card" technology system, meaning that its data analysis methods — mostly manual cross-checking — were no different from those McGehee was using in Thailand in the late 1960s before computers were widely available.

One should note in the above definition the use of the term "external characteristics," clearly implying that the structure of communications, and not their content, is the object of study. In its most precise and limited definition, traffic analysis, or "metering," consists of a form of network analysis of many telephone calls (or other forms of contact or communication) to determine who calls whom, in what order, for how long, and at what time. Such analysis does not involve listening in on conversations and is therefore not legally "wiretapping" under most nations' laws. Indeed, since privacy law does not even mention the existence of traffic analysis (or pen registers) in most countries, it can be done by law enforcement agencies, intelligence services, private companies or anyone else who can obtain the necessary "metering" information. Properly done, with good data, and with unaware adversaries not employing counter-measures, traffic analysis can determine "ring leaders," "gate keepers," "messengers," "outliers," and other types of network members and their roles.

POST-WAR "CIVILIAN" USE OF TRAFFIC ANALYSIS

As the Cold War settled in and US military policy in Latin America evolved from sending in the US Marines to CIA-developed "counter-insurgency," traffic analysis reportedly found new life in tracking Eastern diplomats — and potential spies — in Washington, DC, and New York City, NY. In such developments, the British are either not far behind or even working directly with the US, which seems to be the case for traffic analysis. The first detailed publicly-available information we have been able to find on the non-wartime use of traffic analysis was its use in Northern Ireland against the Provisional IRA as part of a system called Movement Analysis developed by the British MI5 internal security service, also known as the Security Service but preferring the acronym "MI5" (Military Intelligence 5) to that of "SS." This information surfaced in January 1989, in London, when MI5 asked the Speaker Office of the House of Commons to withdraw the name of Hal G. T. P. Doyne Ditmas from a question by Labour MP, Chris Mullin. The reason was that MI5 feared Irish subversives would discover that Mr. Ditmas "made a significant contribution to the efforts of British intelligence in Ireland," according to the Dublin newspaper, *The Phoenix*, on 13 January, by developing and applying movements analysis against the IRA both in Northern Ireland and in Great Britain.

Then attributed to Terry Guernsey, the head of the Royal Canadian Mounted Police, or "Mounties" (Canada's internal security service), movement analysis reportedly consists of a data collection system and a statistical analysis system to determine who holds what position and what are their functions. Reportedly used initially in North America against Eastern block diplomats, Mr. Ditmas supposedly adopted it for MI5's work on Eastern block diplomats in London. As a MI5 KY Branch officer in the late 1960s, Mr. Ditmas worked with Barry Russell-Jones of MI5 on the program. Mr. Russell-Jones then became head of MI5 FX Branch in the mid-1970s and head of MI5 S Branch (computer service) in 1979 before retiring in the early 1980s. He then set up Russell-Brooks Associates with MI6 officer, Anthony Brooks, according to press reports.

In movement analysis, data is systematically collected on times, durations, days of the week, places and individuals visited, type of visits, car licence plates, trajectories by car, foot, or public transportation. First, by simple cross-tabulation, and then by more sophisticated statistical methods such a automatic

classification analysis, typological analysis, and factor analysis, specific "types" of behavior can be precisely defined, along with the "outliers" who do not fit easily into the specified types. These types and outliers can then be examined in detail to see if they represent profiles characteristic of adversary activity. Secondly, structural analysis to determine the relationship between the different individuals analyzed can be done using the various network analysis statistical methods such as traffic analysis. These determine who are the leaders of groups, the "gate keepers" between different groups, the peripheral members, and the central members.

When MI5 decided to computerize its operations in Northern Ireland in the mid-1970s, it took several years but, when completed, it was Mr. Ditmas who installed the movements analysis system that covered all Catholic ghetto areas where the IRA operates. Called "Operation Vengeful," it used British soldiers both for routine information collection and for "census" calls on virtually every Catholic household. This aspect closely resembles McGehee's village survey work, but in a "domestic" and much more hostile environment. In October 1990, Mr. Ditmas was named to the newly-created post of Chief Inspector of Transport Security, according to *The Guardian* (31 October 1990). He was officially described as a former under-secretary at the Ministry of Defence and his career "spans periods at the Foreign Office as well as the Cabinet and Northern Ireland Offices." In his new job, he was to be responsible for security at sea and air ports and, of particular importance, the Channel Tunnel. In January 1994, Mr. Ditmas made the news by finding four international airlines operating in Great Britain which failed a security review, including Virgin Atlantic, a member of a consortium which later bid to take over and operate the British portion of the Channel Tunnel railway in January 1995. On 18 November 1996, a major fire broke out in the Channel Tunnel and closed it for some time, but Mr. Ditmas had apparently already moved on.

TRAFFIC ANALYSIS "BITES BACK" AND PUBLIC COUNTER-MEASURES

Mr. Ditmas may still have been working with traffic analysis in Northern Ireland when MI5 discovered not only that the IRA knew about the method, but had actually developed its own version and used its against British intelligence. Reportedly IRA traffic analysis discovered that all Royal Ulster Constabulary (RUC) agents and informants were paid the same day every month and would line up at a certain number of automatic teller machines to draw out their cash, thus permitting the IRA to identify a major part of MI5's secret anti-IRA assets.

The next time traffic analysis entered the public domain, it was because of a 19 July 1992 theft of confidential documents in a Scottish police station. The publication of this information in the newspapers, *Sun* and *Scotland on Sunday*, revealed that the police had carried out widespread traffic analysis of telephones used by 78 persons and organizations. The publication also resulted in the arrest and detention of two journalists that fall. These reports clearly referred to the use of traffic analysis or "metering." It seems like poetic justice that some of those who were "metered" — journalists — were those that exposed the method ... and were put in jail for their contribution to public knowledge.

In early 1994, the first publicly-available "counter-measure," that we have found, was described in press reports. To defeat traffic analysis, a caller needs to protect, at a minimum, both his or her identity and the duration of the telephone call. This impedes establishing a link between the caller and a targeted number under surveillance or being eavesdropped. If it is the caller who is under surveillance or being eavesdropped, this "first-generation" system, the "Stopper," does not work. But the minimum requirements of anonymous caller identity and indeterminate call duration were reportedly met by Stopper which was a secure switching scheme provided by a Washington and Beverly Hills-based privacy lawyer, William Dwyer II. It also kept a caller's unlisted number secure from caller ID systems. By telephoning first to 1-900-stopper (786-7737) at what was then a $1.95 per minute rate, the caller received a dial tone to make a touch-tone call anywhere in Northern America. For $3.95 per minute and an initial call to 1-900 call 888 (225-5888), it was possible to telephone anywhere in the world without revealing your number. Other security features included multiple outgoing calls, which

prevented identifying a call by the time of day and its duration, and the possibility of using Cylink voice encryptors between the caller and Stopper, but such options interest intelligence agents much more than the general public. Nonetheless, US and Canadian officials declared the system legal. It closely resembles current widely-used "Kall Back" systems.

Traditionally, a new director of the Belgian Sûreté d'Etat internal security service gives a press conference concerning the service's priorities. It's a sort of initiation ceremony and the late 1994 appointment of Bart Van Lijsebeth as Sûreté chief was no exception to this rule. A new priority for Mr. Van Lijsebeth was the Belgian extreme right and local religious sects. This axis was probably determined largely by that year's political events including investigations of the Sûreté's shady ties with the neo-Nazi Westland New Post and with the Brabant massacres. Van Lijsebeth also stated he would like to have more personnel and legalize telephone eavesdropping. Because "wiretaps" were still illegal, the Sûreté was reportedly getting around the problem by telephone traffic analysis, "a form of network analysis to find 'gate-keepers' and 'core' persons by analyzing who calls whom at what time and for how long. Since this information does not constitute 'tapping', the Sûreté can resort to it without oversight" (ADI, 1994: 32).

RECENT DEVELOPMENTS IN TRAFFIC ANALYSIS

With such information available in the public domain, it couldn't have been long before the then proud and powerful software industry put traffic analysis tools on the market to replace file-card cross-tabulations and the user-unfriendly "homegrown" programs that were being used by law enforcement agencies, intelligence services, private companies and assorted "adversaries." In spring 1996, Alta Analytics, of Columbus, Ohio, well-known for graphical data analysis, announced a "product development and joint marketing agreement" with a major on-line data service, Lexis-Nexis, concerning a link analysis "data mining" program, Netmap. An ADI (1996: 2) review of the program noted that "information specialists probably didn't notice that Netmap's 'credentials' include being 'widely used in intelligence and law enforcement'. Link analysis is part of a larger category of scientific tools called network analysis and can be applied to all forms of relationships: financial, organizational, command, hierarchical 'pecking orders', telephone conversations, emotional support, counselling and advice."

Up until then, the type of network or link analysis programs available to the general public (outside the social network scientific community) had been mostly "graphical," meaning new and more beautiful ways of presenting data in full color to decision-makers. What Alta had done with Netmap was to adapt certain scientific tools for intelligence work, and for public data mining. The US Defense Intelligence Agency (DIA) Office of National Drug Control Policy had "plugged" Netmap into its new Emerald drug interdiction coordination computer network, and other intelligence services could clearly profit from Netmap applications, according to Alta Analytics, which also recommended Netmap for assisting "in the intelligence production cycle to detect and expose financial crimes and money laundering activities."

Schematically, the program laid out analytical "units" (persons, bank accounts, companies) on the perimeter of a circle and traced lines between the "units" representing a "link" or tie. The darker or thicker the line, the greater the tie (more financial transactions, more telephone calls). This particular graphic technique had already been around in network analysis since the late 1970s and early 1980s, and was used as a starting point of cognitive mapping techniques developed in France at the Ecole des Mines de Paris by Jean-Pierre Courtial (van Meter and Turner, 1992; van Meter and Turner, 1997). Where network analysis and cognitive mapping usually go from this basis into multivariate analysis — and therefore lose the general public and most intelligence professionals — Netmap makes it simpler by sticking to univariate (single variable) analysis and successively "cleans up" the circle diagram (although Netmap does have certain multivariate capabilities). Thus, a circle of 4,003 telephone calls between 1,103 numbers was reduced to 45 "units" (telephone numbers) with more than

20 calls, then to three numbers with 40 or more calls.

If sequence of calls is introduced, then Netmap can help map out the "command hierarchy" of telephone calls (which is not necessarily pyramidal as the general public is usually led to believe) and furnish valuable information on whom to "wiretap" or arrest. This is exactly what the US Army was doing in World War II on bristol cards when it was doing traffic analysis: identifying the adversaries "command hierarchy"...before bombing it. More recently uses of traffic analysis results have often not led to more subtle outcomes. In classic intelligence and law enforcement work, traffic analysis can usually be done without a warrant since conversations are "counted," not "listened to." When several Netmap-like circles (one for telephone calls, one for "work together," one for "leisure time together") are overlaid, one on top of another, or analyzed at the same time (multivariate analysis), the often complex structure of an adversary's network becomes much more clear. What is done with this information is, of course, something else, as we will see below.

HIGH-TECH FOR THE BAD GUYS AND THE GOOD GUYS

But just as the cops were catching up with the crooks — technologically speaking — the crooks "pulled a fast one" with still newer technology that easily defeated Netmap and similar traffic analysis methods: cell phones. As portable or mobile telephones became widely available, they also because widely stolen. Crime bosses would buy a half dozen at a cheap price, use one after another for a few days — it depends on how dangerous your "business" is — and then "recycle" them by either putting them back on the black market or running over them with their car. Dropping them out of a car window on a busy freeway is also considered "cool" ... and probably bothers the police technicians who are trying to follow the location of the cell phone.

In Great Britain, cell phone technology also brought new developments for the "good guys" when, in 1997, it was reported that under the British Interception of Communications Act 1985, the British police were not obliged to seek a warrant to eavesdrop on private conversations made by the then 4 million users of mobile telephones. This interpretation of the eavesdropping law was a direct result of advances in signal technology. The mobile telephone is made up of two items: a base unit, which is part and property of the public telephone network; and a handset, which is regarded as a stand-alone private system using radio waves to transmit instead of a land line. British legislation, as then drafted, allowed the police or other government agents to use signal intelligence equipment to intercept conversations "broadcasted" by private systems without having to seek legal permission to do so. This interpretation was underlined at the time by a Law Lords ruling in the case of a drug dealer, convicted on signal intercepts, which confirmed that "the interception by the police of telephone conversations on a cordless telephone is not subject to the Interception of Communications Act 1985 and evidence at a criminal trial of such conversations is not rendered inadmissible" (ADI, 1997: 4). So who needs traffic analysis when you can listen directly to the conversation and, moreover, record the physical location of the callers? A question for future research is whether or not British crooks went back to land lines when this information became available.

Although not directly related to traffic analysis, although very closely associated, is cell phone location information which we have not found to be covered by privacy legislation in any country. On the contrary, again in Great Britain, its use by authorities has been clearly stated. Mobile telephone location information can be used to trace a caller's physical presence years afterward by employing technology reportedly used for the first time in 1997 in a British murder trial and in a British Winchester football match-fixing trial. In the former case, the police used computer records to track the accused's journey from work to the murder scene and back again, even though no calls were made or received. William Ostrom, of Cellnet, one of Britain's four largest mobile phone providers, stated that the stored data was used for billing purposes, but it was also used to check for "unusual use" and possible theft of a telephone. He claimed: "We can tell where any one of our mobile phones was, as long as it was switched on, for any time and date in the past two years. It's exactly the same for all four mobile networks in

Britain, which deal with nearly seven million users. [...] We are helping the police with three cases at the moment" (*ibid.*) Vodafone admitted that similar data is stored, but another British mobile phone provider, Orange, refused to comment. Orange now belongs to France Telecom but it is possible that British cops have kept Orange's old location information. Another future research project would be to find out what happened to privacy data, and particularly cell phone location information, following takeovers by telecommunication companies from different countries.

When activated, mobile telephones, even when not receiving or sending a call, emit a signal so that base units know where it is and which apparatus it is so that a call to or from it can be quickly routed. This signal serves as a miniature tracking system unknown to the user and reveals the whereabouts of the apparatus at any given time. The electronic signal data, pinpointing the device's location, are stored in service provider computers for several months and, in Great Britain, up to two years. "Smart" mobile phone users often think they have "outsmarted" the system by simply turning off their unit, but most, if not all, units can be turned on remotely with the appropriate high-tech equipment at the disposal of official intelligence services. The only "foolproof" counter-measure is to take the battery out of the mobile unit or put the unit in a "tempested" farad cage, if you have one. Members of the general public usually not.

TRAFFIC ANALYSIS MAKES THE BIG TIME

In March 1998, traffic analysis -- and all forms of social network analysis — "made the big time" in official surveillance and eavesdropping when the American Association of Artificial Intelligence (AAAI) launched its "Call for Papers" for its fall symposium on Artificial Intelligence and Link Analysis in Orlando, Florida, on 23-25 October 1998. The AAAI recognized — as we have mentioned above — that "computer-based link or network analysis is increasingly used in law enforcement investigations, fraud detection, telecommunications network analysis, pharmaceuticals research, epidemiology, and many other specialized applications. Much of the current software for link analysis is little more than a graphical display tool, but many advanced applications of link analysis involve thousands of objects and links as well as a rich array of possible data models which are nearly impossible to construct manually." In short, formal network analysis was necessary, and, as the symposium organizers stressed, "the focus of the symposium is new technologies, not capabilities and applications embodied in current software." Little wonder that the organizers included William Mills, of the CIA Office of Research and Development (R&D), and Raphael Wong, of the US Treasury Department FinCEN financial "cops" specialized in money laundering pattern recognition (ADI, 1998a: 2).

At the same time, in addition to law enforcement and intelligence, network analysis made its entry on the Internet when UCLA sociology graduate student, Marc Smith, used his program, Netscan, to analyze USENET topic groups for patterns of interaction such as how many posts were made to a newsgroup during a given time period, how many different people made those posts, and how many of those posts were cross-posted to other newsgroups; more-or-less traffic analysis applied to USENET activity. Netscan produced simple bar graphs and numbers and could help generate hypotheses about the social dynamics in the newsgroups and what kinds of experiences each group offers its participants. Although Netscan did not actually do multivariate network analysis, it could easily function as the "front-end" of more advanced systems, and Smith intended to develop that aspect.

It also appears that network analysis and associated pattern recognition methods defeated one of the "new pretenders" at the time: neural network analysis. According to an early 1998 study by InfoGlide Corporation, of Austin, Texas, "neural nets are essentially obsolete for fraud detection" when compared to pattern recognition, although this result may be dependent on the specific methods tested (ADI, 1998a: 2). Usually, neural networks are "trained" by multivariate pattern recognition and network analysis methods before functioning independently. If the objects of analysis suddenly undergo a significant change, such as a new form of fraud, the neural net must be "retrained" by the

multivariate methods before it can function again correctly. Since some criminals are not stupid, they often come up with new types of fraud that initially avoid detection by existing systems. Thus, back to traffic analysis.

In early 1998, two of Ireland's top universities, Trinity College, Dublin, and Queen's University, Belfast (QUB), obtained European Commission funding to establish a "transfer technology node" to promote the application of supercomputer technology into commercial and industrial projects such as data mining in the financial sector and simulation of network designs for the telecommunications industry. The ADI disingenuously commented: "Previous major computer programs in Ireland included MI5 'traffic analysis' of IRA suspects' movements and telephone calls, and IRA analysis of automatic teller withdrawals to identify RUC [Royal Ulster Constabulary] agents and informants. The current project appears to be the EU contribution to 'peaceful' use of computer technology" (ADI, 1998b: 5).

THE NEW KGB, PRIVACY INTERNATIONAL, THE FBI & NEW YORK GET INVOLVED

In late July 1998, the Russian FSB internal security service (the successor of the Soviet KGB "domestic" chief directorate) announced that under its Project "Sorm" (System of Operative Intelligence Actions or System for Ensuring Investigative Activity, depending on translations), it planned to monitor the Internet in Russia, in real time, for every email message and Web page sent or received. All Internet services providers (IPS) in Russia would have to install an eavesdropping device on their servers and to build a high-speed data link to the FSB's Internet control room. The US firm, Cisco, probably found a market for its "Private Doorbell" surveillance-friendly encryption system, and, according to the Swedish publication, *Svenska Dagbladet*, the FSB had developed three levels of control: full, statistical traffic analysis (listing all outgoing and incoming telephone conversations), and control of a communication area through network analysis monitoring by a station covering the area. The importance of the project could be judged by the man in charge: FSB deputy director, Aleksandr Bespalov (ADI, 1998c: 29).

In fall 1998, the British group, Privacy International, awarded its annual Big Brother "Name and Shame" privacy invader titles. The product winner that year was WatCall software, produced by Harlequin Ltd., for telephone record "traffic analysis" "which avoids the legal requirements needed for phone tapping."

In May 1999, the administration of President Bill Clinton, through the International Law Enforcement Telecommunications Seminar (ILETS), an umbrella organization set up by the FBI in 1992 which includes security and law enforcement agencies from 20 Western countries, was pressuring EU members to force European ISPs to provide "interception interfaces" for all future digital communications to allow police and spies to monitor an individual's web activity, check newsgroup membership and intercept email. Caspar Bowden, director of the London-based Foundation for Information Policy Research (FIPR), stated at the time that the data-taps probably infringe on the European Convention on Human Rights (ECHR). Mr. Bowden claimed that even if Internet users encrypt their email, sophisticated analysis programs — such as communications traffic analysis — can reveal a great deal to the trained professional about an individual's usage and his or her network of personal contacts. Thus, traffic analysis could be used even to counter encryption-based public privacy in communications. This seems to be one of the uses of traffic analysis by the worldwide Echelon electronic communications eavesdropping system directed by the US National Security Agency (NSA) and the cornerstone of the secret UKUSA security agreement (ADI, 1999: 3).

On 6 July 1999, in a unanimous opinion, the New York Court of Appeals marked a significant shift in wiretapping jurisprudence and gave traffic analysis by law enforcement a real "shot in the arm" by deciding that police may install pen registers — devices that monitor numbers dialed from a telephone line — without obtaining a warrant based on probable cause. "Reasonable suspicion" is now sufficient for pen register surveillance to be initiated. At least, pen register surveillance is now mentioned in law

and can be discussed in court. Few countries are even that far down the road to protecting privacy. Indeed, we made a request to Privacy International concerning information on the legality of traffic analysis and pen registers in Western countries. Privacy International, which keeps tabs on privacy legislation in most developed countries, gave us a polite reply that our question would make a good but difficult project for future research.

HIERARCHICAL THINKING AND KLERK's THESIS ON DUTCH CRIMINAL NETWORKS

Following the 11 September attacks, one would have thought that the concept of pyramidal hierarchical command structures for illicit adversary social networks, particularly for those of Islamic extremists, would have lived out its overextended life. Indeed, both the media and officials, including the Pentagon, have recently called on the social network analysis community for possible contributions in understanding — and fighting or dismantling — such networks. But official thinking has not changed that quickly. Tamara Makarenko, *Jane's Intelligence Review*'s special advisor on transnational crime and lecturer in criminology at Glamorgan University, Great Britain, proved this point in the November 2001 issue of that review. In his article, "Transnational Crime and Its Evolving Links to Terrorism and Instability," he writes in his section on "Structure" that: "Unlike the hierarchically structured criminal and terrorist groups of the past, transnational criminal groups increasingly appear non-hierarchical in their organisation. Furthermore, they are commonly decentralised and fluid, thus suggesting that the leadership positions are easily replaceable — thereby ensuring that the group continues to fulfil its aims and motivations well into the future" (Makarenko, 2001). Although we thoroughly agree, and develop further below, the idea concerning easily replaceable leadership positions, we equally thoroughly disagree with the idea that "criminal and terrorist groups of the past" were "hierarchically structured": it was official thinking about those groups or networks which was hierarchically structured, and in a very rigid manner.

We can think of no better demonstration of this fact than the doctoral dissertation of Dutch researcher and writer, Peter P. H. M. Klerks, "Big in Hash - Theory and Practice of Organized Crime" (Klerks, 2000), which is available in book form in Dutch. His work was based on an original and unique opportunity for a researcher to work directly on criminal intelligence material and have direct access to the specialists involved in the cases under study, thus producing, with the aid of social network analysis and grounded theory from sociology, some rather original perceptions of organized crime and the best — most efficient — ways to fight it (ADI, 2000: 1).

As Klerks explains in his article in this issue of *Connections*, government files on operational investigations regarding organized crime usually remain inaccessible to academic researchers and the general public for reasons of security. When reviewing organized crime literature, it soon becomes clear that the number of cases where an academic researcher has been allowed full access to police files is limited indeed. The Netherlands was no exception. Until the early 1990s there had been almost no attempts in academic circles to gain access, mainly because only a handful of researchers were active in studying contemporary organized crime. Therefore, when a Dutch police commissioner in 1993 needed scholarly assistance to think up new strategies for tackling organized crime problems in his region, there were very few original thinkers he could turn to. Still, he didn't have much trouble raising interest among police researchers once it became clear that full access would be given to all the relevant files and to police staffers who had been involved in a major and problematic investigation that had ran for more than two years.

Once funding was secured through the Justice Ministry for a researcher to work four days a week for two years, the research project entitled, "Underground Organizations in a Comparative Perspective," started in December 1993. While the formal empirical research ended with the production of a final report in November 1995, research was extended for the three following years to become a doctoral dissertation. This required extensive collection and analysis of relevant literature on organized crime, policing methods, intelligence methodology and the sociology of secrecy, and some formalization of

new research instruments developed in the course of the project.

The research project initially began with five central questions. I. What are the definitions of organized crime employed in academic research and by investigative agencies, and what are their usability and empirical foundation? II. Does a sociological-anthropological approach to criminal organizations offer new possibilities for knowledge in researching organized crime? III. What are the tactics and strategies employed by criminal organizations to ensure the continuity and expansion of their operations in reaction to (possible) government intervention? IV. How does the government create its initiatives against these criminal organizations? Which methods, tactics and means are developed and put into action? Which relationships are maintained: (a) within the police organization; (b) with other involved branches of government (public prosecutor, investigative magistrate); (c) with similar operational teams? What are the effects of such operational government actions in relation to those organizations? V. What new ways can be found to better control organized crime? With certain limitations, one can substitute the term "clandestine organization" for "criminal organization" and apply these question to the present post-11 September situation.

FULL ACADEMIC ACCESS TO CRIMINAL INTELLIGENCE DATA

During the final year of the "Underground Organizations" project, the Dutch parliament ordered another massive research project on organized crime in the wake of the so-called "IRT Affair" during which massive amounts of Latin American cocaine, under supposedly secret "police-controlled deliveries," flooded the Dutch market. In the research project, the "Research Group Fijnaut," consisting of four leading Dutch criminologists, was given almost full access to police files nationwide. It was then decided that the "Underground Organizations" project would not devote much time to research questions I. and IV. Moreover, governmental activities in the case study — mainly police investigative efforts — were to be treated only in a summary fashion since it had become clear that it would be impossible to write the full story without compromising methods and individuals. Therefore, the final report and the doctoral dissertation concentrated on developing new insights on the usefulness of what would be a more sociological network-oriented doctrine of organized crime, on the ways in which criminal organizations evade and counter government action, and on innovative strategies and tactics to control organized crime.

Working in the tradition of Glaser and Strauss's grounded theory approach, data were collected, coded and systematized from hundreds of open publications and stacks of operational dossiers, a process which gradually produced a framework for further classification and analysis that has become a separate instrument in itself (the "analytical scheme for criminal organizations"). The original empirical material consisted of the nearly-complete dossiers of the investigative "Ferrari-team" (a fictional pseudonym), some twenty to forty investigators who had been operational for about two years in the early 1990s. More than 200 document files filled some twelve meters of bookshelfs. This paper archive, plus a personal computer, contained about 20,000 logged telephone conversations, 1,700 checked car license plates, thousands of records on individuals, plus several other logs and reports.

In addition, seventeen functionaries were formally interviewed for their insights on the behavior of lawbreakers and law enforcers. While some of the interviews produced unusual results, they also brought up a specific methodological and ethical problem: the interpretation of information obtained in the course of a research project on confidential matters cannot be fully shared with other researchers. This prevents an open discussion of certain essential aspects of the organized crime phenomenon, which, in turn, posed limits on the control capability crucial to any academic work.

After extensively discussing the history of organized crime doctrines in the United States and their current relevance, Klerk's thesis presents "social network" concepts. The history of organized crime in The Netherlands is then briefly described from a policy point of view, while one specific case, the criminal network organized in the 1980s by the late cannabis wholesaler, Klaas Bruinsma, is analyzed

in detail. Subsequently, a panoramic sketch of the main criminological viewpoints in Holland regarding organized crime is followed by a detailed critique of the definition of organized crime presented by the "Research Group Fijnaut" which was dominant in Dutch academic and policy circles at the time. The threat of criminal networks is then analyzed according to financial-economic strength, potential for violence, resistance to dismantling and sociopolitical influence. Using the analytical framework mentioned earlier, first, insights from the literature on issues such as recruitment, leadership, covert logistics, clandestine security, intelligence-gathering, and the culture of trading and hedonism are discussed extensively, followed by a detailed description of the criminal "Verhagen group" (again a fictional pseudonym), its participants, their activities, the social, criminal and market environments, their world view and lifestyle.

THE VERHAGEN CRIMINAL NETWORK

The criminal Verhagen network, named after the person considered to be the nominal boss, consisted basically of informal sub-networks, each clustered around one of a clique of five entrepreneurs who all brought their own contacts and clandestine abilities to a series of criminal projects. Nearly all important individuals were male Dutch nationals between the ages of thirty and fifty and of white (Caucasian) ethnic origin. Some were well-entrenched in the traditional urban underworld, others originated from the milieu of travelers who live in semi-permanent camping sites all over the country. One individual had good contacts among "adventurous" sailors willing and able to arrange worldwide cannabis transport by sea, while another had access to semi-clandestine financial service providers who could launder and stash profits: millions of guilders, British pounds, Deutsch marks, dollars and other currencies that became so bulky they were sometimes kept in garbage bags.

The criminal network was characterized by a near-absence of formal business structures. The threat of violence was a clear factor in the group's success: quite a few one-time partners, lured into participating in a criminal project, were left either stripped of their assets or in a foreign prison, but few dared to protest for fear of reprisal. Ultimately, however, the sometimes impulsive urge to resort to violence in resolving conflicts brought the main players long prison sentences: when they physically attacked a competitor, beating him virtually to a pulp, threatening his family with firearms and stealing most of his expensive furniture, they left him no choice but to report the incidents to the police. Building on these severe and documented offenses, the public prosecutor could charge the perpetrators with much more serious crimes than simply cannabis transport.

The efforts made by the group to keep its activities and communications a secret were also exploited in some detail, leading to the conclusion that while they had access to some surprisingly-detailed information on police activities, the general level of security awareness, methods and techniques employed was somewhat amateurish. Apart from the operational side relating to criminal activities, much attention is given to the social and subcultural aspects, motivations and life philosophy of the main characters.

USING SOCIAL NETWORK ANALYSIS AND QUEUE ANALYSIS RESULTS

In analyzing what exactly makes these criminal networks so resilient in the face of governmental interventions, the only logical explanation seems to be that it is the network structure itself which allows for informal, flexible and opportunistic operations on a project basis with a few resourceful characters mobilizing a great number of interested parties who all contribute and take a share of the profits. According to French intelligence analysis of the Islamic extremist networks in Algeria, the average "service life" of a local war lord is approximately six months. But the Islamic networks have been "stable" — meaning capable of continuing their campaign of massacring the civilian population — for almost ten years. Little formal queue analysis is needed to see that most war lords have a "waiting line" behind them for their key network position and when it isn't the Algerian armed forces that

"retire" a war lord, it is often those in the "waiting line." With a short "service life" but a substantial "waiting line," key network positions remain filled and the network can function.

Although mutual trust is vital in such clandestine environments without written rules, the Dutch study indicated that while Verhagen's reputation was far from reliable and solid, he was still an effective "boss" and had no problem finding business partners eager to invest in his projects. He was known as a mover and shaker, and the greed of smaller or more ignorant players apparently was such that any reluctance was quickly set aside in the face of what seemed to be a profitable deal. It may have also been a means for smaller players to put themselves on the "waiting list" just in case Verhagen was "replaced." Others on the "waiting list" probably included trusted partners Verhagen used as cut-outs to approach vital contacts such as ship captains and investors to gain their cooperation.

This mechanism, combined with a large and eager market for cannabis products in Holland, guarantees that "structural holes" in the network caused by conflicts or arrests can quickly be filled by new players from the "waiting line." Only certain vital positions requiring special knowledge or capabilities, such as technical skills or access to major foreign suppliers in the countries of origin, are harder to fill. Not surprisingly, these vital "broker" positions are held by silent, permanent players who cater to the service needs of multiple criminal groups, rather than the presumed "big bosses" of the drug networks, and would really be the most interesting targets for law enforcement from the point of view of intelligence and disruption.

In the case of Islamic extremists, French intelligence has found that specialists in counterfeit identity documents, trusted couriers, paymasters, and explosives technicians are key positions. French criminal intelligence has reportedly even engaged in some "network sampling" by detaining for questioning certain key individuals such as a document forger just to see which type of counterfeit document disappears from the underground market. Indeed, "selective detention" has been seen as an effective way to disrupt network functioning and, at the same time, to verify the network position of a detained specialist. By detaining one specialists after another, a network can be kept from functioning for some time. Moreover, the "waiting line" behind these specialists to fill key network positions is often very short and replacement rates are usually rather low.

OPENING CLOSED INTELLIGENCE COMMUNITIES FOR NETWORK ANALSIS

One can easily imagine that these ideas and Klerk's critique of law enforcement's mid-1990s conventional wisdom focusing on stable, pyramidal criminal hierarchies that demanded long-term secretive investigations ("to aim for the top" or "to get the boss") have not been easily accepted. Nonetheless, unprecedented access to sensitive data and intensive cooperation with investigators became a day-to-day reality for many Dutch organized crime researchers in the late 1990s. In that sense, the project portrayed in Klerk's thesis has become a pioneering effort in Dutch criminology and law enforcement. The new concepts it introduced, such as flexible and opportunist networked crime, best countered by equally flexible and pragmatic police teams instructed to create opportunities and make maximum use of intelligence to disrupt the continuity of criminal operations ("close-up investigating"), raised quite a few eyebrows in 1995, only to be included in the Justice Ministry's current organized crime doctrine within three years (ADI, 2000: 1).

What remains to be seen is whether or not the Dutch example will be seriously considered elsewhere in the Western world and whether or not the secretive and closed intelligence communities of those nations will be able to adopt and modify these ideas for use in their current urgent work against Islamic extremists. Unfortunately, this requires, as Klerks has shown, a serious and sustained official effort to open a closed community to academics who have almost always been considered and treated as "outsiders" and deprived of the cooperation necessary for a successful effort. Hopefully, this issue of *Connections* will push things in the right direction.

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[2] French "Association pour le Droit … l'Information" (ADI, Association for the Right to Information).

Destabilizing Networks[1]

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The world we live in is a complex socio-technical system. Although social, organizational and policy analysts have long recognized that groups, organizations, institutions and the societies in which they are embedded are complex systems; it is only recently that we have had the tools for systematically thinking about, representing, modelling and analyzing these systems. These tools include multi-agent computer models and the body of statistical tools and measures in social networks.

This paper uses social network analysis and multi-agent models to discuss how to destabilize networks. In addition, we illustrate the potential difficulty in destabilizing networks that are large, distributed, and composed of individuals linked on a number of socio-demographic dimensions. The specific results herein are generated, and our ability to think through such systems is enhanced, by using a multi-agent network approach to complex systems. Such an illustration is particularly salient in light of the tragic events of September 11, 2001.

WHAT CAN OUR TOOLS DO?

There are a number of ways in which our tools, both classical social network techniques and the combination of networks and multi-agent systems, can help us understand network destabilization. Before describing these, an important word of caution is needed. Network tools are clearly not a panacea and it is important that as a community we do not oversell these tools. That being said, there are at least two fundamental ways in which network statistics and measures can be brought to bear to address issues at the heart of destabilizing networks.

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Location of critical individuals, groups, technologies

Given any network, such as a communication network, or alliance structure, or monetary flow, where the nodes are individuals, groups, computers, etc., a number of network measures such as centrality or cut-points can be used to locate critical nodes. Additional measures based on an information processing view of organizations also exist for locating critical employees, redundancy, and potential weak points within groups and organizations. Many of the traditional social network measures and the information processing network measures are embedded within ThreatFinder (Carley, 2000). ThreatFinder is a computer program that uses a combination of network analysis and multi-agent modelling to determining the potential information security risk from personnel that an organization faces due to its architecture. The degree, type, and location of possible threats, such as critical employees and lack of redundancy are assessed. These "location" techniques are useful within companies to help ensure information security and are useful within and among groups and organizations in mitigating the effectiveness of networks. For example, individuals or groups with the following characteristics can be identified:

1. An individual or group where removal would alter the network significantly; e.g., by making it less able to adapt, by reducing performance, or by inhibiting the flow of information. Illustrative nodes are those high exceptionally high in centrality (Bonacich, 1987) or high in structural holes (Burt, 1992).

2. An individual or group that is unlikely to act even if given alternative information. This can be found as an individual high in centrality and Simmelian ties (Krackhardt, 1999).

3. An individual or group that if given new information can propagate it rapidly. Such individuals may be seen as gossips, innovators, or early adopters (Rogers and Shoemaker, 1971). Possible indicators are high degree centrality or high structural holes.

4. An individual or group that has relatively more power and can be a possible source of trouble, potential dissidents, or potential innovators. Individuals with relatively more power may be high in centrality (Bonacich, 1987; Brass, 1991; Brass and Burkhardt, 1992). Possible innovators may be those who are isolates or those who have moved about so much that they have broad and distributed knowledge and contacts.

5. An individual or group where movement to a competing group or organization would ensure that the competing unit would learn all the core or critical information in the original group or organization (inevitable disclosure) (Carley, 2000).

6. An individual, group, or resource that provides redundancy in the network (Carley and Ren, 2001). Measures of redundancy are available in ThreatFinder (Carley, 2000).

For the measures discussed above most can be calculated using UCINET[3] or the meta-network R-package package[4].

Pattern location

Over the past few years, major advances have been made in graph level analysis. These techniques include the P* family of tools, network level metrics (such as group and graph clustering algorithms using distance metrics such as the Hamming distance). These pattern location techniques can be used on any data that can be represented as graphs; such as, interaction or communication networks, monetary networks, inter-organizational alliances, mental models, texts, web pages, who was present at what event, and story lines. These pattern location techniques, particularly when combined with machine learning techniques, are likely to be especially powerful for locating patterns not visible to the human eye. A key to many of the detection algorithms is that they search for behavior that is different

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[3] http://eclectic.ss.uci.edu/~lin/ucinet.html

[4] http://legba.hss.cmu.edu/R.stuff

from some baseline. Thus, if run on network data, The baseline might be networks, biased networks, or a sample of existing networks. For example, the following kinds of patterns or breaks in patterns can be examined:

! The basic components that account for the networks structure can be identified; e.g., the number and types of sub-groups, or the number of triads, stars, and the extent of reciprocity (Anderson, Wasserman, and Crouch, 1999; Wasserman, and Pattison, 1996).

! The central tendency within a set of networks, and the networks that are anomalous when contrasted with the other networks can be located (Banks and Carley, 1994).

! Critical differences between two or more sets of networks can be identified; e.g., are programming teams structured differently than sales teams or are managers' mental models different from subordinates (Banks and Carley, 1994; Carley and Banks, 1993; Butts and Carley, 2001). For sets of concepts, comparison techniques based on the idea of lossy integration and set theory have been used to compare two or more concept networks or mental models (Carley and Palmquist, 1992; Carley, 1997). In principle, these methods developed for text analysis could be utilized for the comparison of social networks.

! Which components in the network are structured significantly differently from the rest of the overall network? A standard approach is to locate the nodes or sets of nodes that differ significantly from other nodes on standard measures such as degree centrality, betweenness, and number of cliques. However, for extremely large networks or where only samples of data on the network exist this approach may not be feasible (processing time is excessive, space requirements are too high, or missing data is too high). Under these conditions, you can use machine learning algorithms such as simulated annealing (Kirkpatrick, Gelato and Vichy, 1983) or Bayesian updating (Butts, forthcoming; German, Carlin, Stern, and Rubin, 1995; Robert, 1994) to search through the network to locate the node or set of nodes that are highest on some criteria or best match some criteria such as excessively high or low centrality.

! Whether the existing network is coherent; i.e., what is the likelihood that there are key missing nodes or relations. One approach here is to locate the differences between an actual network and a network predicted from first principles to see where there are differences. For example, if two individuals are not interacting in the social network but should be based on the principles of relative similarity and relative expertise, then there may be hidden relations. This is one of the calculations in ThreatFinder (Carley, 2000).

What-if analysis and policy guidance
In addition, multi-agent models of adaptive agents embedded in social networks can be used to address issues of network destabilization by providing managerial and policy guidance (Carley, forthcoming a). In a multi-agent computational program the behavior of the group or organization emerges from the actions and interactions of the agents who are members of the group or organization. Typically the agents are able to learn and adapt, although models vary widely in the extent to which the agents are cognitively realistic (Carley, forthcoming b). Few multi-agent models have more then 100,000 agents and in general the number of agents decreases as the cognitive complexity and realism of the agents increases. Multi-agent systems are typically non-linear and exhibit path dependence. Most multi-agent models have no network underpinning. In the artificial life models (Epstein and Axtell, 1997) the agents typically interact on a grid with physical proximity serving as a proxy for networks. In the most cognitively sophisticated models, such as the Soar models (Tambe, 1997), the set of interactions and so the network are predefined. However, recently, there has been a movement to combining multi-agent and network models (More and Ramanujam, 1999; Levinthal, 1997; Macy and Skvoretz, 1998; Carley, 1990; Carley and Svoboda, 1997).

Multi-agent network models, if based on known information about general or specific characteristics of groups, can suggest general or specific guidance about how to affect or protect the underlying group, organization or society. Exactly what these models can address depends on the purpose of the model and its veridicality. Following is a series of illustrative examples of potential applications where various researchers using multi-agent network models have worked or are working:

! Suggesting factors that make groups adaptive or maladaptive (Carley and Lee, 1998).

! Examining the efficacy of different policies for destabilizing networks; e.g., what kinds of networks can be destabilized by simply removing the leader (Arquilla and Ronfeldt, 2001)? What are the characteristics of networks that are difficult to destabilize (Watts. 1999; Carley, forthcoming a)?

! Examining the efficacy of different data collection and privacy policies. For example, would we be more likely to mitigate a bioterrorist attack if we kept absentee data or if we tracked hits on web based medical information pages (Carley, Yahja and Fridsma, 2001)?

! Predicting the rate of information diffusion and the impact of different technologies for spreading information and so changing beliefs through social influence processes (Oram, 2001; Watts, 1999; Carley, forthcoming c; Macy and Strang, forthcoming).

! Predicting voting outcomes or likelihood of consensus in groups, given the existing social networks and initial beliefs (Friedkin, 1998; Bueno De Mesquita and Stokman, 1994).

! Suggesting factors that can slow the rate of response by a network to a new situation or event, mitigate the emergence of new behaviors, and limit the ability of the network to adapt (Wegner1995; Axtell, 2000; Carley, forthcoming a).

! Predicting civil violence (Epstein, Steinbrunner and Parker, 2001)

! Determining how close your group or company is to having its core competencies and processes discovered by another group (i.e. inevitable disclosure) (Carley, 2000).

! Examine the efficacy of different marketing and information warfare strategies (Pew and Mavavor, 1998, ch. 11).

Doubtless each researcher in this area has thought of these and other possible applications. We note that at the moment there are a number of difficulties in applying existing tools to complex socio-technical systems. First, most of the existing multi-agent network models are implemented for small networks. Even when the underlying measure can be used on large networks, containing 1000s or 10,000s of nodes, the underlying computer software or hardware often limits the feasible analysis to small networks, those less than a few hundred nodes. For example, UCINET can handle large node sets, but, in practice the memory limitations on the machine on which it is run and the lack of parallelization procedures means that it is an impractical tool for networks of tens of thousands of nodes. Second, we have no public databases of large networks on which to test new technologies. However, large networks based on web linkages are being developed. Third, the existing measures and tools work best when the data is complete, i.e., when we have full information about the links among the nodes. However, large scale distributed networks may have considerable missing data. We will at best have sampled information, some of the information may be intentionally hidden (hence missing data may not be randomly distributed), the data is likely to be at different time scales and layers of granularity, and the cost and time to get complete information may be prohibitive. Thus, we need to begin to address issues of sampling, of estimating the impact of missing information, of estimating networks given basic human cognitive properties and population level and cultural data, and in combining data from alternative and dispersed sources using techniques such as multiple imputation (Rubin, 1987, 1996; Schafer, 1997; Yuan, 1990). There are obviously other difficulties, but even these provide some guidance for what to expect when applying our existing tools to complex socio-technical systems.

WHY MIGHT IT BE DIFFICULT TO DESTABILIZE DISTRIBUTED NETWORKS?

One possible approach at overcoming, or at least ameliorating, some of these difficulties is to use computational analysis, where the models combine multiple cognitively realistic agents and social networks. We now illustrate the use of such models to address the issue of network destabilization. As noted, socio-technical systems are complex. First, let us consider the source of complexity. We can point to a large number of sources of complexity: e.g., new technologies, emergent cultures, complex trade laws, etc. At a more fundamental level there are two very dominant sources: (1) humans adapt and (2) humans interact. Humans adapt in part because they can learn, but what they learn is limited because they are boundedly rational. Human interactions are of course influenced by the web of affiliations (kinship, religion, economics, etc.) that interlock people to varying degrees at different times. Since individuals can adapt and are woven together into a complex network, the groups, organizations and institutions of which they are members also have these properties. Thus, we have intelligent adaptive agents and multiple networks. However, these are not de-coupled systems. Humans learn when they interact with each other and what they learn changes the knowledge network (who knows what), with whom they interact (the social network), and how they perform tasks. Who you know and what you know are linked together in a feedback loop. The result is that the networks in which people are embedded are dynamic.

Network dynamics is a function of not just the social network, but a meta-matrix of networks – not the least of which are the knowledge network (who knows what), the information network (what ideas are related to what), and the assignment network (who is doing what) (Carley and Hill, 2001, Krackhardt and Carley, 1998). A highly simplified version of this meta-matrix representation of the meta-network is shown in Table 1, where for the sake of simplicity only the networks related to agents, knowledge and tasks are shown. As noted by Agranoff and McGuire (1999) "the ability to tap the skills, knowledge, and resources of others is a critical component of networking capacity," the ability to manage the organization. Similarly, to determine how to change or destabilize a network, then, it is important to consider the further webs in which a social network is situated and the way in which human cognition operates (Krackhardt, 1990; Carley and Hill, 2001).

Table 1. Simplified Meta-Matrix Representation of the Meta-Network			
	Agents	Knowledge	Tasks
Agents	Social Network	Knowledge Network	Assignment Network
Knowledge		Information Network	Needs Network
Tasks			Task-Precedence Network

We have built a relatively simple computational model of this dynamic process — CONSTRUCT-O (for a description of this model, see Carley and Hill, 2001). Such models are valuable in addressing theoretical, social, managerial and policy issues (Carley, 2001; Carley and Gasser, 1999; Epstein and Axtell, 1997). A key feature of these models is that they let us think systematically about the ramifications of policies, at a scale not comprehensible by the unassisted human mind, and so can help uncover major problems. We can use this model to address the question "what leads to the destabilization of networks?" It is worth noting that the predecessor of this model, CONSTRUCT, was used to examine the factors enabling group stability (Carley, 1990; 1991) and the evolution of networks (Carley, 1999).

The model works by first assuming a set of agents who differ in terms of their socio-demographic characteristics (such as age, gender, education), their knowledge and beliefs. Individuals also forget. Individuals interact if they are available for interaction and are motivated to do so. There are two basic motivations to interact – relative similarity and relative expertise – both of which are basic to human nature. Relative similarity is the tendency of people to choose to interact with those who are more

similar. Relative expertise is the tendency of people to seek out new information from those whom they perceive to be more expert. When people interact they learn and their learning changes whom they view as relatively similar or expert, how well they perform the tasks to which they are assigned, and who can be assigned to which tasks.

These changes also alter whether or not there is an emergent leader and which individual takes on that role (Cohen, Bennis and Wolkon, 1962). Individuals are more likely to develop effective leadership skills if they have high cognitive ability, prior experience (Atwater, Dionne and Avolio, 1999), and extroversion (Kickul and Neuman, 2000). Individuals who have high cognitive ability and experience typically take on more tasks, are given more resources, and have more knowledge. Prior experience and extroversion often lead to a wider range of interaction partners. Stress typically occurs when cognitive load increases. Additionally, individuals are likely to emerge as leaders if they have high stress tolerance, have strong self-esteem (Atwater, Dionne and Avolio, 1999) and are open to new experiences (Kickul and Neuman, 2000). As such they are likely to be willing to tell others what to do, shed tasks, give away resources, etc. Individuals with high cognitive loads are likely to be emergent leaders for a variety of reasons including they are most likely to tell others to do things (i.e., shed tasks) and most likely to be in a position of power in terms of what and whom they know. An agent is more likely to be an emergent leader and to direct the activity of the distributed network, even if only temporarily, if that agent is in a strong structural position in the social, knowledge and assignment networks. Overall cognitive load, not simply structural power, is key to tracking who is likely to be the emergent leader. Based on these considerations, we define the emergent leader as the individual with the highest cognitive load (the most people to talk to, the most information to process, the most tasks to do, the hardest tasks to do, the most people to negotiate with to get the job done, etc.) (Carley and Ren, 2001).

The cognitive resources of the group and the leader, the cognitive load, and the behavior of the leader have a combined impact on performance (Fiedler, 1986). Consequently, emergent leaders, by virtue of their centrality across the entire meta-network are good candidate agents to remove if the goal is to destabilize the network. Therefore, the effect of node extraction on network evolution will be examined by removing the emergent leaders from the networks at a particular point in time and then seeing how the networks evolve.
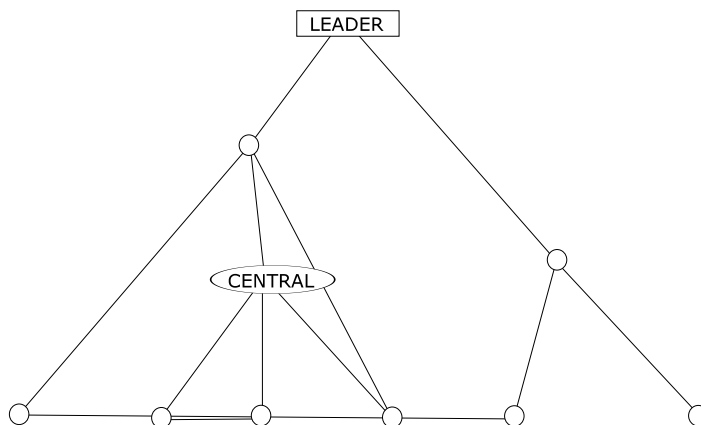
Figure 1. A Stylized Hierarchical Centralized Network

There are at least three indicators of destabilization. One is where the rate of information flow through the network has been seriously reduced, possibly to zero. A second is that the network, as a decision-making body, can no longer reach consensus, or takes much longer to do so. A third is that the network, as an organization, is less effective; e.g., its accuracy at doing tasks or interpreting information has been impaired. There are other instances of network instability, but such measures are sufficient for this brief introduction.

Using this model we examine two very distinct structures – a hierarchical centralized structure and a distributed decentralized one. For both structures, although different in scale, the underlying distributions of knowledge/resources and tasks are similar as are the networks linking knowledge/resources to tasks and tasks to tasks. These other networks are not shown as the figure becomes unwieldy; however, they do impact who learns what over time and so changes in the social network and cognitive load. The Krackplot representations of only the social network component of these structures are displayed in Figures 1 (hierarchical) and 2 (decentralized). In Figures 1 and 2, the spatial arrangement of nodes represents knowledge proximities between agents (i.e., the closer two nodes the more likely they have similar knowledge). Those closer together also tend to share more knowledge. The amount of knowledge, resources and tasks associated with each individual agent is not shown. Individuals seek out others who (1) are similar, knowledge-wise and (2) can provide the resources for completing his or her tasks. A line connecting two agents indicates that during the window of observation these two agents interacted with each other. The bold-lines denote strong interaction network ties that occur when an agent has established a relationship that is part functional (i.e., task-resource based) and part social (i.e., general knowledge and demographic based).

A rectangular node labeled 'LEADER' denotes the "Emergent Leader" agent. This agent is the individual with the highest cognitive load (i.e., most resources, tasks, and communication/network ties). An oval node labeled 'CENTRAL' denotes the agent with the most network ties. If the agent is both the emergent leader and the most central then a rectangular node labeled 'LEADER/CENTRAL' denotes that agent. Some agents may share information with others but are nevertheless not interacting with any of the other agents during a particular window of observation. Such agents will appear as isolated nodes with no lines connecting them to other agents.
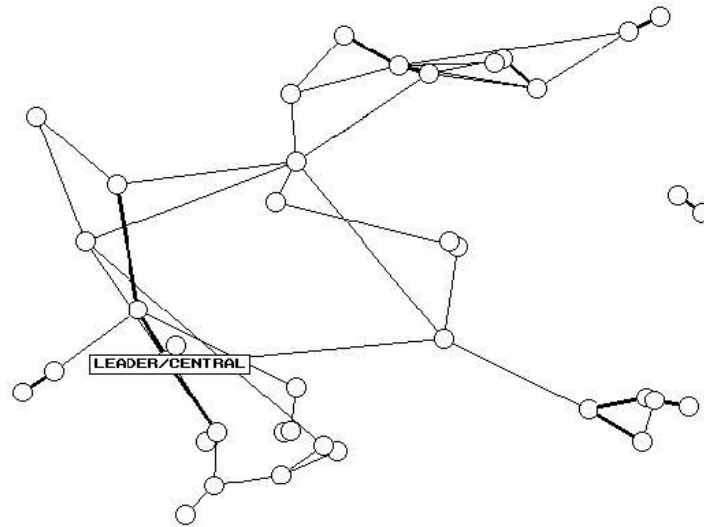
Figure 2. A Stylized Distributed Decentralized Network

It is important to note that if you only observe the social network, as in Figures 1 and 2, you cannot determine who has the highest cognitive load and is therefore likely to emerge as a leader. In the hierarchal network (Figure 1), or for that matter in any network, the emergent leader is not necessarily the most central agent. If we were to only looks at the social network, we might assign leadership on the basis of the power of the agent's structural position. That is, examining just the interaction matrix one might be tempted to conclude that the agent with the highest degree centrality or betweenness was the leader. However, this can be misleading. While there is often a correlation between an agent's position in the social network and their overall cognitive load, it is not perfect. Centrality is only one of the factors that enters into the overall calculation of a cognitive load. To determine loads, the networks

linking individuals to knowledge/resources, tasks are needed, as are the networks linking knowledge to tasks and tasks to tasks. For example, in Figure 1, the most central agent, although interacting with the most others and being cognitively more similar to the most others (closeness in physical space), is not the emergent leader. The reason is that this social network is linked into a set of networks denoting who knows what, does what, what is needed to what tasks, the order in which tasks need to be done, and so on.

When they visually examine the hierarchical network, most people will predict that removal of either the leader or the central agent will be most likely to destabilize the structure. Further, given just the social network, most people predict that the most central agent is likely to emerge as the new leader. In contrast, for the distributed decentralized structure, Figure 2, it is not clear whether there is a single node that could be removed to destabilize the network. There is substantial disagreement among people who examine this network over which node to remove to destabilize the network, and even over whether it is even possible to destabilize the network. This is the case even when, as in Figure 2, the emergent leader is the most central agent. Further, there is little agreement over who will emerge as the leader.

To really determine whether removal of a node will destabilize a structure we need to account for adaptation. Since individuals can learn, the underlying social networks are dynamic. They will change whether or not various nodes are removed. Further, individual learning will lead the overall structure to adapt, often in unforeseen ways as nodes are removed or isolated. As a result, removing a node may result in a new emergent leader. This new emergent leader cannot be predicted just from the social network. A possible path of change for the hierarchal network in Figure 1 is shown in Figure 3 and a transition path for the distributed network of Figure 2 is shown in Figure 4. In each graph, the emergent leader is again shown as a rectangular node labeled 'LEADER' and the most central agent as an oval node labeled 'CENTRAL.' In addition, to help orient the reader, when an agent is removed the position that that agent would have had if he/she had not been removed is labeled with the word 'REMOVED.'
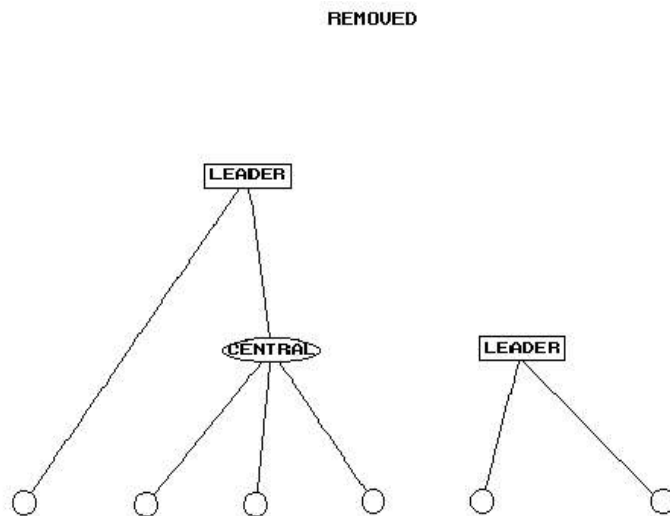
Figure 3a. Removal of an Emergent Leader in a Stylized Hierarchical Centralized Network – Immediate Response to Removal of Emergent Leader

For the hierarchy, we begin with the hierarchy shown in Figure 1. Initially, the emergent leader's cognitive load is significantly higher than the subordinates in the hierarchy. Then over the course of the simulation the emergent leader is extracted. Upon destabilization, the distribution of cognitive load shifts such that more agents have higher loads, and more than one leader emerges. Figure 3a contains the resultant network that emerges after the original emergent leader is removed. Immediately, the extraction of the leader agent in Figure 1 causes the hierarchy to break up into two smaller networks.

Once the leader is extracted the network reforms with two emergent leaders who are essentially competing for control – neither of which is the most central agent. After further simulation, the network has adapted to the loss and a new single leader has emerged (see Figure 3b). In reforming itself back into a hierarchy, a new leader emerges whose cognitive load is higher than that of the first leader, indicative of a less pure hierarchy. Not all hierarchies will change in this way – but this diagram is illustrative of the impact of extracting a leader on a hierarchical network.

Removing the leader in a hierarchy not only destabilized the network, it also makes the overall communication structure more decentralized. When centralized groups become decentralized initial leaders are often demoted and moved to positions of least importance (Cohen, Bennis, and Wolken, 1962). Cohen, Bennis and Wolken (1962) suggested that such a change may be a psychological response to imposed leadership. Our analysis suggests that this may simply be the result of structural differences in the meta-network which lead to differences in cognitive load. Notice that the leader on the right in Figure 3a is demoted in 3b.
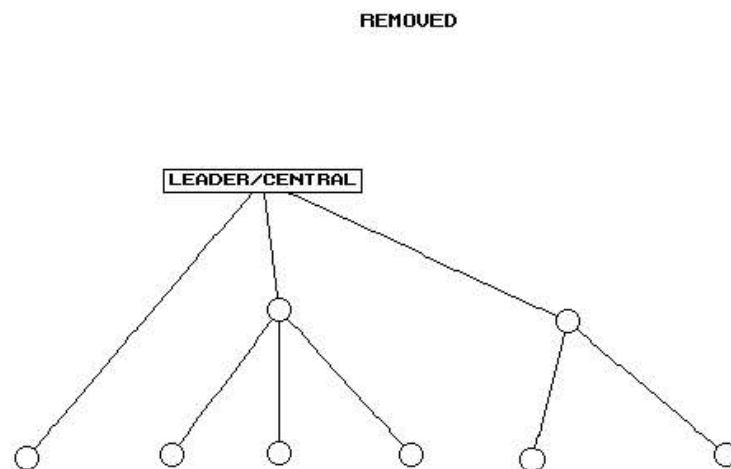
Figure 3b. Removal of an Emergent Leader in a Stylized Hierarchical Centralized Network – Eventual Response

This example illustrates that destabilizing a hierarchy may have unintended consequences — demotion of leaders and initial in-fighting. It also illustrates that visual inspection of the social network alone led to an incorrect prediction as to who would emerge as the new leader. We might ask, what if the central agent rather than the leader was removed. Further simulation analysis shows that not only does the hierarchy not break into factions initially, but its performance is hardly even affected. For hierarchies, the simulation analysis suggests that regardless of the size of the hierarchy, removal of the leader degrades performance more than removal of the central agent. Moreover, hierarchies, relatively quickly restabilize with only a single new emergent leader. A number of actions may have consequences similar to node removal: e.g., isolating, hiring away the leader, reducing the number or complexity of tasks the leader is doing, or stopping the flow of information or resources through all links connected to the leader. For the hierarchical network, the leader's ability to control the hierarchy can also be decreased by adding new links in the social network. Such additional linkages can also lead to performance drops.

In Figure 4, the consequences of removing an emergent leader on a distributed decentralized network are portrayed. The initial structure is that in Figure 2. As with the hierarchy, during the course of the simulation the emergent leader, LEADER/CENTRAL, is now extracted. In Figure 4a, like Figure 3a, the position that the original leader would have held if he/she had not been extracted is denoted by the word 'REMOVED'. In Figure 4a we see that after that a new leader emerges in the same vicinity as the

original LEADER. However, this newly emergent leader is neither the most central nor does he/she re-establish the ties that were lost with the former leader. In the long run, Figure 4b, multiple new leaders emerge. In addition, the agent who in Figure 4a was the most central also becomes an emergent leader. A third leader emerges in a structural position very similar to that of the original leader (who was removed). The fact that two of the new leaders are near the original leader is indicative of the fact that the structure of the task, knowledge and resource networks (which are not visible) in that vicinity promotes the development of emergent leaders. Further, when the original leader was present, that agent was inhibiting the emergence of alternative leaders. The original leader had maintained key resources, knowledge and important ties. The original leader had played the role of the gatekeeper between the left and right sides of the network. Once the agent LEADER/CENTRAL was removed, tasks and resources could be redistributed, agents had to rely on other experts, and multiple leaders could eventually emerge.
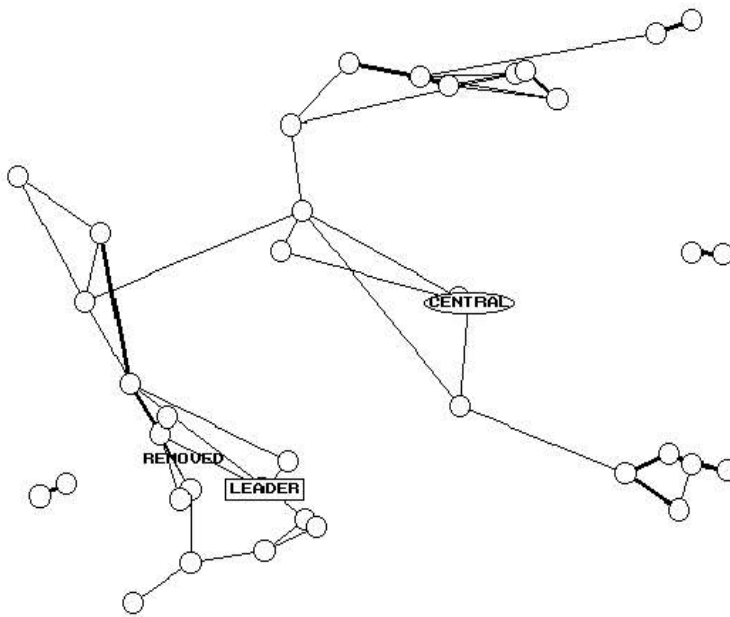
Figure 4a. Removal of an Emergent Leader in a Stylized Distributed Decentralized Network – Immediate Response to Removal of Emergent Leader

Computational analysis reveals that even the removal of the LEADER/ CENTRAL agent may have unforeseen effects. In the distributed network adding or dropping links is as likely to increase an individual node's power as to decrease it. Consequently, the overall impact of removing the leader in a distributed network is not as likely to create a power vacuum as in the hierarchical network. If this is the case, then removal of that agent will have little impact. It may be necessary to simultaneously remove more nodes to have the same impact on a distributed decentralized system as removing one node would have on a hierarchy, In this sense, the problem of destabilization is more difficult for a distributed than for a hierarchical network. We might ask what if the leader was not also central. As with the hierarchy, further simulation reveals that the removal of the central agents as opposed to the leaders is less likely to degrade performance. Computational analysis also reveals that removal of a single node does not transform the structure, despite agent adaptation; i.e., hierarchies remain as hierarchies and distributed structures remain distributed.

We note that many resistance groups are organized as distributed decentralized networks. For example, in the Earth Liberation Front (ELF) according to ELF publicist, Craig Rosebraugh, there is a "series of cells across the country with no chain of command" (Barr and Baker, 2001). In such cases, there is "no central leadership where they can go and knock off the top guy and it will be defunct" (Barr and Baker, 2001). Our analysis suggests further that even if you find emergent leaders, removing them

simply paves the way for new leaders to emerge and the overall network will remain more or less intact. However, unlike the hierarchy, the removal of the initial LEADER may serve to, in the long run, increase internal fighting as multiple LEADERS are likely to eventually emerge. The hierarchy splits in to factions then reforms as a hierarchy with one leader, the distributed system does not faction at first but may eventually as multiple leaders emerge.

To really track and understand network dynamics, to really be able to determine how to destabilize networks, we need to consider the position of individuals and groups as they are embedded in the overall meta-network. We need to move beyond embeddedness in the social network (Granovetter, 1985) to overall embeddedness in the meta-network. Although he does not use the network nomenclature, this is essentially Schein's (1985) point in his discussion of leadership.
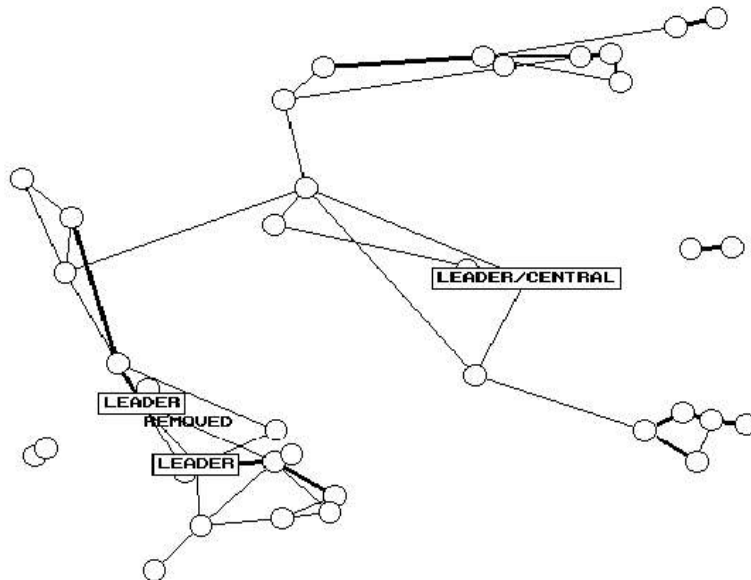
Figure 4b. Removal of an Emergent Leader in a Stylized Distributed Decentralized Network – Eventual Response

Herein we used cognitive load to track embeddedness in the overall meta-network linking personnel, knowledge/resources and tasks. Now examine the change in the distribution of cognitive load for the distributed decentralized network (Figure 5). These distributions, going form left to right, correspond to Figure 2, Figure 4a and 4b respectively. The original leader has a much higher cognitive load than do other members of the distributed decentralized structure. Initial destabilization results in multiple
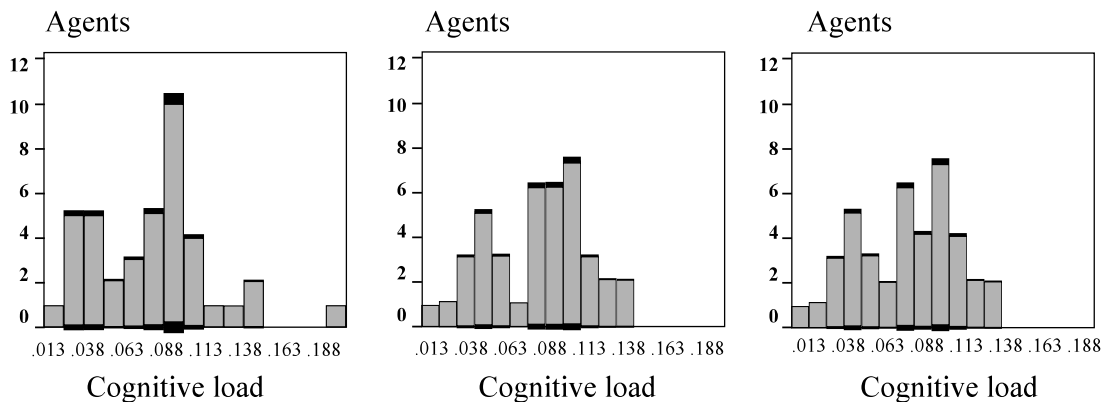
Figure 5. Change in the distribution of Cognitive load

emergent leaders forming, as indicated by the subsequent distributions of cognitive load. While the number of emergent leaders drops as the network re-stabilizes, the emergent leaders are not as distinctive as the original.

As network theorists, we often think about networks as snapshots – pictures of a group at a point in time. The techniques and tools that have been developed over the past several decades are extremely useful in understanding such networks (assuming of course that the data is complete or almost so). Moreover, we often think of networks primarily in terms of a relatively small, single relation and single type of node; e.g., friendship among students. At this point in time, few tools are available to the analyst interested in large, adaptive, multi-plexed, multi-coloured networks with high levels of missing data. The development of such tools is necessary if we are to successfully meet the challenge of understanding, predicting and explaining the behaviour of multi-agent networks of this ilk. Whether the topic is terrorism, the global economy or the nature of the Internet, we are dealing with complex socio-technical systems that are large, multiplex, multi-nodal and adaptive. It is critical that we rise to this challenge and develop a new set of tools combining the methodologies of social networks and computer science. Without such tools, we will be theorizing in the dark.

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Applying Social Network Analysis Concepts to Military C4ISR Architectures[1]

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We discuss the application of Social Network Analysis concepts to military C4ISR (Command, Control, Communications, Computers and Intelligence, Surveillance, & Reconnaissance) architectures. In particular, we describe what we call the FINC methodology, which calculates a number of simple metrics for comparing and quantifying organisational network aspects of C4ISR architectures. This facilitates a more complete evaluation of the costs and benefits of various organisational structures. We have constructed a Java-based tool called CAVALIER, to carry out this and other forms of Social Network Analysis. After outlining the methodology, we apply it to a case study relating to a (hypothetical) military-led humanitarian assistance mission.

INTRODUCTION

Decoding "Milspeak:" What are C4ISR Architectures?

The term C4ISR architecture[3] is used by the US and other militaries to refer to the organisational structure used by military forces in carrying out a mission. Such a mission need not involve traditional warfare: increasingly military forces are involved in operations other than war, such as peacekeeping, humanitarian relief, flood control, etc. The key aspect of C4ISR is command (authority and responsibility) and control (exercising authority over subordinates). These two indivisible aspects of leadership are referred to as C2. Since communications and computer technology are important in carrying out these leadership functions in a large organisation, the acronyms C3 and C4 are used to include these facilities.

Since leadership cannot be carried out without information of some kind, the acronyms C3I and C4I are used to include intelligence. It must be emphasised that this does not refer to the movie-inspired image of men in trench coats licensed to kill: it simply means the collection of information of every kind, increasingly from publicly available sources such as reference books, the Internet, and television news. The acronym C4ISR includes two specific sources of information: surveillance (systematic observations of something) and reconnaissance (observations on a specific occasion).

Traditionally military structures have been very hierarchical, but modern innovations in communications and computer technology have made a wide range of other structures possible. At the same time, an emerging emphasis on operations other than war may require more flexible non-traditional organisational structures. In this environment, there is a need for formal techniques for the evaluation of a wide range of organisational structure options. We believe that Social Network Analysis techniques are the obvious choice for such evaluation.

SOCIAL NETWORK ANALYSIS

Social Network Analysis is an approach to analysing organisations focusing on a network-based view of the relationships between people and/or groups as the most important aspect. Going back to the 1950's, it is characterised by adopting mathematical techniques especially from graph theory (Gibbons, 1985; Krackhardt, 1994). It has applications in organisational psychology, sociology and anthropology. A good summary is found in Wasserman and Faust (1994).

Social Network Analysis provides an avenue for analysing and comparing formal and informal information flows in an organisation, as well as comparing information flows with officially defined work processes. In previous work, we have applied Social Network Analysis to military organisations in more or less standard ways (Dekker, 2000).

The first goal of Social Network Analysis is to visualise relationships between people and/or groups by means of diagrams. The second goal is to study the factors which influence relationships (for example the age, cultural background, and previous training of the people involved) and also to study the correlations between relationships. The third goal is to draw out implications of the relational data, including bottlenecks where multiple information flows funnel through one person or section (slowing down work processes), situations where information flows does not match formal group structure, and individuals who carry out key roles that may not be formally recognised by the organisation. The fourth and most important goal of Social Network Analysis is to make recommendations to improve communication and workflow in an organisation, and (in military terms) to speed up what is commonly known as the observe-orient-decide-act loop or decision cycle (Allard, 1996).

In this paper, we extend traditional Social Network Analysis to the specific area of C4ISR architectures by introducing a specific methodology for evaluating and comparing organisational structures which we call FINC (Force, Intelligence, Networking and C2). This methodology combines Social Network Analysis techniques with military thinking about organisational structure. After outlining the methodology, we apply it to a case study relating to a (hypothetical) military-led humanitarian assistance mission.

THE FINC (FORCE, INTELLIGENCE, NETWORKING AND C2) METHODOLOGY

We will illustrate the FINC methodology using the simple and relatively traditional military structure shown in Figure 1 (the figure is produced by our Java-based CAVALIER tool). In this example, two brigade-level units (BDE 1 and BDE 2) are controlled by a divisional-level headquarters (DIV HQ),

which in turn is controlled by a joint headquarters (JNT HQ) which also controls strategic intelligence and air assets. We provide this example structure purely in order to describe the methodology, and are not suggesting that it is appropriate for any specific purpose. In the second part of this paper we provide an application of the methodology to a less traditional and more realistic structure for a military-led humanitarian assistance mission.
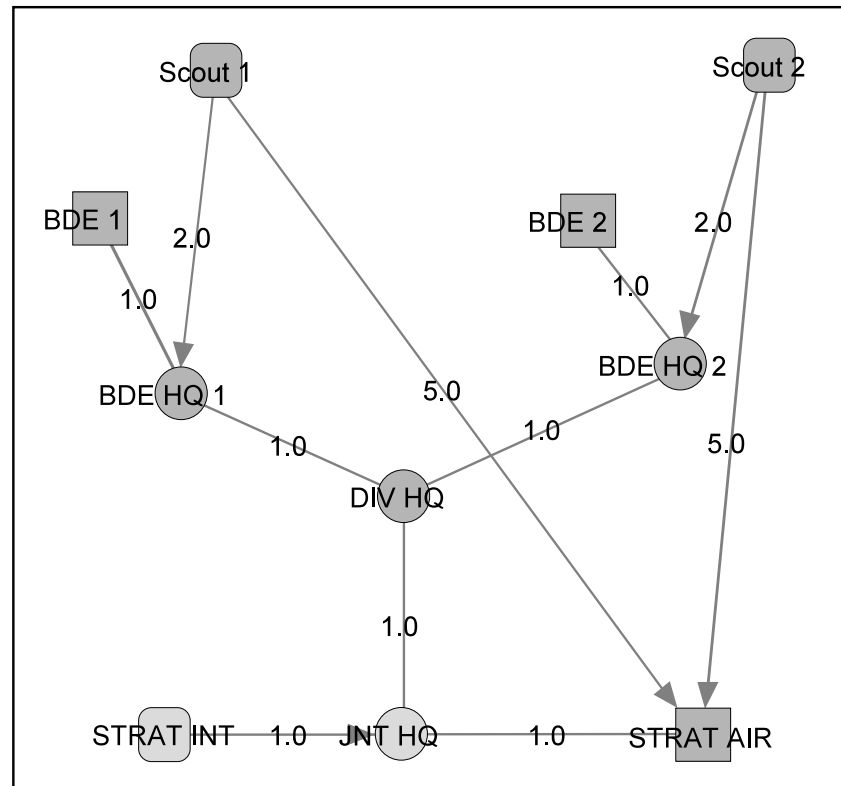

Figure 1. A Simple Military Organisational Structure

The FINC methodology analyses an organisational structure relatively simply in terms of force (assets which carry out any kind of military task, indicated by square boxes in Figure 1), intelligence (assets which collect any kind of information, indicated by rounded boxes in Figure 1), networking (which provides communication between assets, indicated by lines or arrows in Figure 1, depending on whether information flow is unidirectional or bidirectional), and C2 (command and control or decision-making, indicated by circles in Figure 1). The force and intelligence assets are often themselves organisations that can be subdivided in a similar way, if necessary.

Essentially, the FINC methodology models an organisation as an information-processing structure, together with the interactions between the organisation and its environment. The organisation receives information from its environment (intelligence), makes decisions, and produces some effect on its environment (force). In this way, it resembles a model of a biological organism. Ultimately, the performance of an organisation (or an organism) depends on the appropriateness of its response to its environment.

Our methodology need not of course be restricted to military organisations. For ordinary commercial organisations, the force assets include the sales force and business units; intelligence assets include research and development, market research, and recorded sales figures; and C2 assets include management and decision-makers.

Force and intelligence assets are associated with a particular area of operations, which for simplicity is assumed to be approximately circular. In Figure 1 these assets are:

    Scout unit 1 (Intelligence), radius = 100 (in arbitrary units)
    Scout unit 2 (Intelligence), radius = 100
    Brigade BDE 1 (Force), radius = 100
    Brigade BDE 2 (Force), radius = 100
    Strategic air (STRAT AIR) assets (Force), radius = 400
    Strategic intelligence (STRAT INT) assets (Intelligence) radius = 400

In cases where the areas of operation for intelligence and force assets overlap, there is benefit in providing a flow of information from the intelligence asset to the force asset. In Figure 1, candidate information flows are:

    Scout unit 1 to Brigade BDE 1
    Scout unit 2 to Brigade BDE 2
    Strategic intelligence (STRAT INT) to Brigade BDE 1
    Strategic intelligence (STRAT INT) to Brigade BDE 2

    Scout unit 1 to Strategic air (STRAT AIR)
    Scout unit 2 to Strategic air (STRAT AIR)
    Strategic intelligence (STRAT INT) to Strategic air (STRAT AIR)

Different intelligence assets differ in the quality of information they provide. Although such differences can be quite complex, for simplicity we model this using a numerical quality score for various modes or bands. Given two intelligence assets in the same band, we prefer the highest quality information, while two intelligence assets in different bands are assumed to be complementary. If a single asset produces different kinds of information, we simply model it as multiple co-located assets. For Figure 1, quality (in arbitrary units) is taken to be:

    Scout unit 1 (Intelligence), quality = 0.5
    Scout unit 2 (Intelligence), quality = 0.5
    Strategic intelligence (STRAT INT) assets (Intelligence) quality = 0.2

In other words, the strategic intelligence assets in this example provide information which overlaps with the information provided by scout units, and which is lower-quality but available over a wider area (we emphasise that this example is not realistic, and is provided merely to illustrate the methodology). The issue of how actual sensor characteristics are translated to numerical quality scores is outside the scope of the present paper.

Each communication link in the network has varying reliability and bandwidth characteristics which for simplicity we model as an average delay in transferring information across the link. Delays (in arbitrary units) are indicated on the links in Figure 1. Again, the issue of how actual bandwidth and reliability characteristics are translated to numerical delay scores is outside the scope of this paper.

Each C2 node in the architecture processes intelligence information and passes it on (as well as many other C2 functions). This introduces an additional delay factor which is added to the delay factor for communication links. In Figure 1, all delays for C2 nodes are assumed to be 1.0 (in the same in arbitrary units as for links).

Our model does not consider cognitive factors in the ability of C2 nodes to process and correlate information. Approaches similar to TASCCS (Verhagen, and Masuch, 1994) or ACTS (Carley and Prietula, 1994) would be required to examine this; we intend to include such modelling in future work.

The FINC methodology uses the information in this model to conduct three kinds of analysis: delay analysis, centrality analysis, and intelligence analysis.

DELAY ANALYSIS 1: THE INFORMATION FLOW COEFFICIENT

In delay analysis, we consider the combined delay (i.e. the combination of communication delays and C2 delays) for each candidate information flow. Where multiple communication paths exist, we take the one with the shortest delay. For Figure 1, the delays for the candidate information flows are:

Scout unit 1 to Brigade BDE 1, delay = 2.0 + 1.0 + 1.0 = 4.0
Scout unit 2 to Brigade BDE 2, delay = 2.0 + 1.0 + 1.0 = 4.0
Strategic intelligence (STRAT INT) to Brigade BDE 1, delay = 7.0
Strategic intelligence (STRAT INT) to Brigade BDE 2, delay = 7.0

Scout unit 1 to Strategic air (STRAT AIR), delay = 5.0
Scout unit 2 to Strategic air (STRAT AIR), delay = 5.0
Strategic intelligence (STRAT INT) to Strategic air (STRAT AIR), delay = 3.0

The first metric we use for assessing C4ISR architectures is simply the average of these delay values, which we call the information flow coefficient. It provides a measure of how effectively the military organisation can mobilise information to carry out a task. For the example in Figure 1, this coefficient is 5.0. For this metric, low values are desirable.

The information flow coefficient provides one simple way of assessing changes to to the military structure. For example, eliminating the direct links between scout units and strategic air assets in Figure 1 reduces the effectiveness of information flow, and increases the information flow coefficient to 5.86. Conversely, reducing the delay on those direct links from 5 to 3 improves the effectiveness of information flow, and will decrease the information flow coefficient to 4.43.

DELAY ANALYSIS 2: THE COORDINATION COEFFICIENT

The second metric we use for assessing C4ISR architectures is the coordination coefficient. It provides a measure of how effectively the military organisation can coordinate activities. This metric is calculated by averaging the delays along paths connecting force assets. For the example in Figure 1, these paths are:

Brigade BDE 1 to Brigade BDE 2 and vice versa, delay = 7.0
Brigade BDE 1 to Strategic air (STRAT AIR) and vice versa, delay = 7.0
Brigade BDE 2 to Strategic air (STRAT AIR) and vice versa, delay = 7.0

Consequently, the coordination coefficient is 7.0. For this metric, low values are also desirable.

CENTRALITY ANALYSIS

In centrality analysis, we try to identify the most "central" node in the architecture, which provides some indication of the "centre of gravity" (von Clausewitz, 1997) of the structure. Centrality is a traditional idea in Social Network Analysis, and there are several possible definitions of the concept (Wasserman and Faust, 1994), but a suitable definition for the degree of centrality of node i in a network where there is a concept of varying "distance" or "strength" of links is:

(AVERAGE (j != i) {1 / delay (i, j)} + AVERAGE (j != i) {1 / delay (j, i)}) / 2

i.e. the centrality score for a particular node is the sum of inverse distances to all the other nodes — the most central node is the one that he is "closest" to everything else.

For the network in Figure 1, the most central node is the divisional headquarters (DIV HQ), while the second most central node is the joint headquarters (JNT HQ). This provides an indication that the architecture in Figure 1 is indeed an army-focused rather than a joint-focused structure.

INTELLIGENCE ANALYSIS: THE INTELLIGENCE COEFFICIENT

Our third form of analysis measures the degree to which intelligence is used. For each candidate information flow from an intelligence asset to a force asset, we estimate the effective intelligence quality to be the intelligence quality discussed above divided by the delay factor for the path. This is a somewhat crude calculation, since some information retains its value even after considerable time has passed, while other information becomes useless almost immediately. However, this calculation provides a simple approximation to the way that information loses value over time.

For Figure 1, we calculate as follows:

> Scout unit 1 to Brigade BDE 1, delay =4.0, quality = 0.5, effective quality = 0.125
> Scout unit 2 to Brigade BDE 2, delay = 4.0, quality = 0.5, effective quality = 0.125
> Strategic intelligence (STRAT INT) to Brigade BDE 1, delay = 7.0, quality = 0.2, effective quality = 0.029
> Strategic intelligence (STRAT INT) to Brigade BDE 2, delay = 7.0, quality = 0.2, effective quality = 0.029
>
> Scout unit 1 to Strategic air (STRAT AIR), delay = 5.0, quality = 0.5, effective quality = 0.1
> Scout unit 2 to Strategic air (STRAT AIR), delay = 5.0, quality = 0.5, effective quality = 0.1
> Strategic intelligence (STRAT INT) to Strategic air (STRAT AIR), delay = 3.0, quality = 0.2, effective quality = 0.067

These calculations are repeated for each intelligence band or mode.

For each force asset and intelligence band, we calculate an intelligence volume which is the product of effective intelligence quality and relative area (within the area of operations of the force asset) covered by the intelligence asset. In cases where the areas of operations of intelligence and force assets only partially overlap, we assume that there is sufficient flexibility of position to make this overlap total when needed.

For example, for the strategic air (STRAT AIR) asset in Figure 1, strategic intelligence covers the entire area of operations (radius = 400) with effective intelligence quality = 0.067, while the two scout units cover smaller areas (radius = 100) with slightly higher effective intelligence quality = 0.1 of the same kind of information. Figure 2 illustrates this:
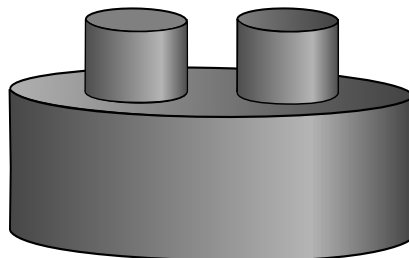

Figure 2. Intelligence Volume for Strategic Air Asset

In this diagram, the intelligence assets relevant to STRAT AIR are indicated by grey cylinders. The area of each cylinder indicates the physical area covered by the intelligence asset. The height of each cylinder indicates the corresponding effective intelligence quality, so that the two cylinders representing scout units stand out above the slightly lower effective intelligence quality of the strategic intelligence (STRAT INT) asset. The intelligence volume for the strategic air asset is simply the total

volume of the combined shape (divided by pi for simplicity):

    intelligence volume for STRAT AIR
    = 0.067 * 400 * 400 + (0.1 - 0.067) * 100 * 100 + (0.1 - 0.067) * 100 * 100
    = 10720 + 330 + 330
    = 11380

The intelligence volume for each brigade ignores strategic intelligence assets, since for this example we assume that the scout units provide exactly the same kind of intelligence and they have a higher effective intelligence quality of 0.125:

    intelligence volume for BDE 1 or BDE 2
    = 0.125 * 100 * 100
    = 1250

The intelligence coefficient of the architecture is simply the total of the intelligence volumes for each force asset and intelligence band. For Figure 1 this is 11380 + 1250 + 1250 = 13800, approximately. For this metric, large values are desirable.

The intelligence coefficient can be improved either by improving the quality of individual intelligence assets, decreasing the delay on communication paths, or by adding intelligence assets (on new bands) which complement existing assets. We believe this metric provides a reasonable way of assessing the impact of such changes.
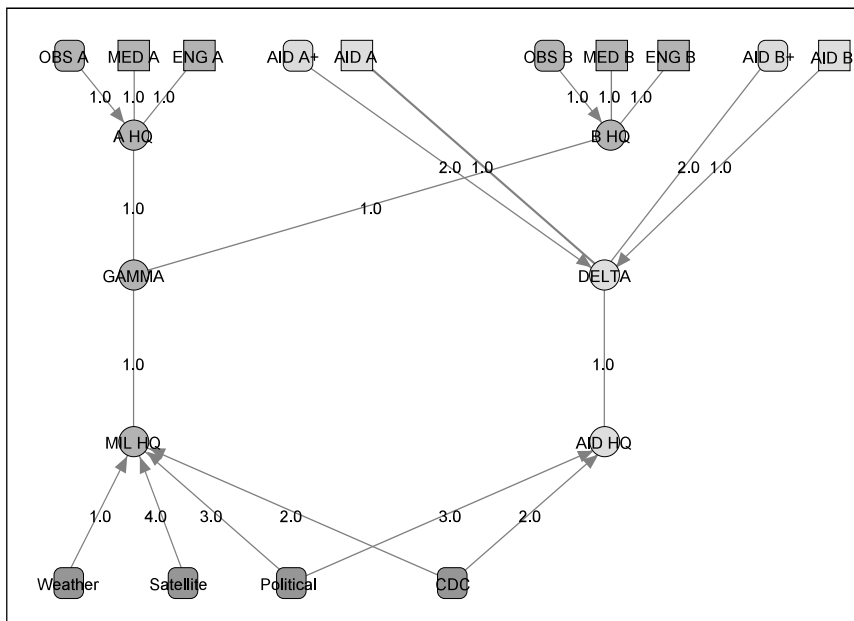

Figure 3.   Flawed Architecture for Humanitarian Assistance

For example, eliminating the direct links between scout units and strategic air assets in Figure 1 not only reduces the effectiveness of information flow (as indicated by the increase of the information flow coefficient to 5.86), but it also reduces the effective intelligence quality of the scout assets as applied to strategic air assets to 0.0625, thus reducing the intelligence coefficient to 0.067 * 400 * 400 + 1250 + 1250 = 13200, approximately. Increasing the quality of strategic intelligence from 0.2 to 0.3 increases the intelligence coefficient to 18500, while adding a new strategic intelligence asset with quality = 0.1 in a different band increases the intelligence coefficient to 24100.

A HUMANITARIAN AID CASE STUDY

Having described our FINC methodology, we now turn to a practical application of it in a more realistic scenario. Figure 3 shows a C4ISR architecture for a hypothetical humanitarian assistance scenario. A volcanic eruption has occurred in the small third world country of Omega, particularly affecting the towns Alpha and Beta. A military assistance mission consisting of medical and engineering staff has been dispatched to render assistance, and an international aid agency is independently providing distribution of food and clothing.

The architecture for this mission in Figure 3 shows almost every possible design flaw. The force assets (square boxes) providing assistance here are military medical and engineering units in Alpha and Beta, and the independent aid units in Alpha and Beta. The military units are co-ordinated by small headquarters elements in the towns of Alpha and Beta, and by an intermediate headquarters in Gamma (the national capital), but are ultimately organised from a military headquarters back in the donor country. The independent aid effort, on the other hand, is co-ordinated from the mining town of Delta, which has the only suitable air strip for the agency's aeroplanes. The aid agency also ultimately organises its efforts from the donor country. There is no coordination of the military and aid efforts whatsoever.

There are five information sources (rounded boxes in Figure 3) in five different bands:
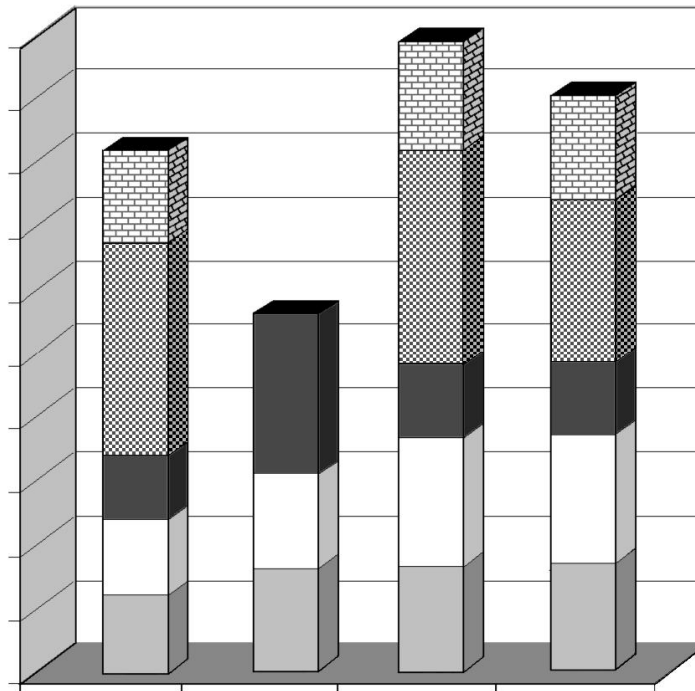

Figure 4.   Comparison of Intelligence Volumes for Humanitarian
             Aid Architecture

1. Observers on the ground (independently for the military and aid teams). The delay factor for the aid organisation's observers is slightly greater, since they do not have a permanent presence at Alpha and Beta.

2. Weather reports provided to the military headquarters in the donor country.

3. Military satellite imagery, showing the extent of devastation in rural areas, lava temperature, etc. This is provided to the military headquarters with the substantial delay of 4, reflecting processing delays.

4. Political information about Omega's own response is provided to military and aid headquarters via the Omega embassy in the donor country (delay = 3).

5. Medical information about potential disease outbreaks is provided by the Centers for Disease Control and Prevention (CDC -- http://www.cdc.gov) in Atlanta, Georgia (delay = 2).

All information sources have quality = 1. For this architecture we have an information flow coefficient of 6.9 (reflecting the long path from information sources in the donor country to the affected areas), an infinitely large coordination coefficient (since there is no coordination between the military and aid contingents), and an intelligence coefficient of 41200.

The left-hand side of Figure 4 shows intelligence volumes for the military medical contingent (far left) and the humanitarian aid contingent (centre left). Here information in different intelligence bands is coloured:

1. GREY: medical information from CDC

2. WHITE: political information from Omega embassy

3. BLACK: satellite imagery

4. DOTTED: information from observers on the ground

5. BRICK PATTERN: weather information

The thickness of the DOTTED bands indicates higher effective intelligence quality for the military medical contingent since the observers are closer to the active units in the field.
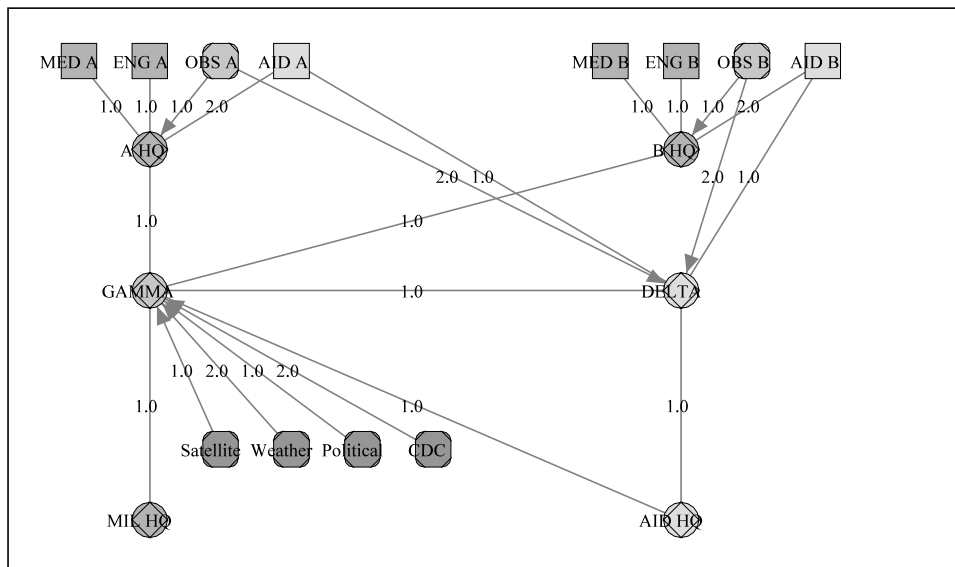

Figure 5.   Improved Architecture for Humanitarian Assistance

Figure 5 shows an alternative architecture. Both military headquarters in Alpha and Beta and the aid agency air strip in Delta now receive the same reports from observers on the ground, and aid units in Alpha and Beta liaise with the military headquarters in those areas. The main coordination site is now in the national capital of Gamma, and planning is done there by military and aid staff together. This is a good choice, since Gamma was in fact the most central node in the old architecture. Staff at Gamma are in regular contact with headquarters back in the donor country and with the air strip at Delta. All information (other than reports from the field) is now provided directly to the shared headquarters at Gamma:

1. Weather reports are obtained from a neighbouring country and provided directly to the headquarters at Gamma (delay = 2).

2. Satellite imagery is now obtained from a commercial company at reduced quality (0.6) but this is more than compensated for by a substantially shorter delay (delay = 1).

3. Political information about Omega's own response is now provided directly from the Omega national government in Gamma (delay = 1).

4. Medical information about potential disease outbreaks is still obtained from CDC (delay = 2).

The substantial improvement in efficiency is reflected in our metrics, i.e. FINC analysis provides a way of quantifying the intuitive idea that this new architecture is better. The information flow coefficient is now 5.0 (28% better, i.e. lower), the coordination coefficient is now 5.4 (infinitely better, i.e. lower), and the intelligence coefficient is now 54200 (32% better, i.e. higher)

The right-hand side of Figure 4 shows the new intelligence volumes for the military medical contingent (centre right) and the independent aid contingent (far right). These have improved by 22% for military medical and 61% for independent aid. Military medical still has a slightly higher score than independent aid since the permanent establishments on the ground provides better access to observer reports (reflected by the thicker dotted band).

DISCUSSION

We can see that the FINC methodology provides a way of quantifying the benefits of the second architecture in Figure 5. Naturally, there may be costs associated with both architectures (particularly relating to communication across cultural barriers), and so the methodology does not prove that the second architecture is the best, but by quantifying the benefits it provides a clear starting point for discussions of cost/benefit tradeoffs.

In related work (Dekker, 2001), we demonstrate the utility of the FINC methodology in predicting organisational performance in a simple simulation scenario.

CONCLUSION

We have presented a methodology for evaluating and comparing organisational structures which we call FINC (Force, Intelligence, Networking and C2). This methodology combines Social Network Analysis techniques with military thinking about organisational structure, and provides three kinds of analysis: delay analysis, centrality analysis, and intelligence analysis. We have constructed a Java-based tool called CAVALIER for carrying out this and other forms of Social Network Analysis.

We have illustrated the FINC methodology with a case study involving humanitarian relief in conjunction with a non-government aid organisation. The FINC methodology provides a way of evaluating the efficiency of organisational structures for military (and also non-military) organisations, particularly in relation to the flexible structures required when military forces carry out non-traditional activities.

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Rapoport at Ninety[1]

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A few months ago Science for Peace celebrated Anatol Rapoport's ninetieth birthday. I couldn't go, so during the August heat wave I took my tape recorder and paid a social call instead. Anatol's wife Gwen welcomed me again into the house that first became familiar to me in the early eighties, when Anatol was president of Science for Peace and the directors used to meet there, planning a peace and conflict studies program at the University of Toronto.

The house is the same and the occupants are as kind and engaging as ever, but even the Rapoports have not entirely escaped the effects of time: Gwen is half blind and Anatol half deaf. Last autumn he finished his teaching career but he is still publishing circles around the rest of us. In 2000, his memoirs, Certainties and Doubts, appeared in English, and a book about Tolstoy, Dostoevsky, and Lenin is being published in Russia. A Canadian publisher is dickering to bring it out in English. This year he has produced a paper on ecology, and he is working on another book on whistleblowers – notably Alexander Solzenitsyn. I have known of Rapoport's work since the early 1960s, but only during the eighties was his extraordinary influence made apparent to me when Rob Prichard, then president of the university, asked me to write a letter supporting Anatol's nomination for a Nobel Peace Prize. He didn't win it, but not for lack of admiring letters. Later I was in Estonia with him and Gwen, attending the European Nuclear Disarmament conference, and could watch the journalists surround him requesting interviews. Throughout the Cold War his books had been published in the Soviet Union but kept in the special section of libraries to which only party members and a few other reliable intellectuals had access. Books acquired a special cachet by being kept there; the privileged readers used to show off at parties by discussing the "dangerous ideas gleaned from such sources. I have heard that Aleaxander Yakovlev, the most influential person in Gorbachev's circle, was influenced by one of Rapoport's books."

Certainties and Doubts recounts, not only the main intellectual concerns of his mature years, but also some great stories about his youth. He was born in Ukraine before the revolution, the only child of a couple who soon moved to Crimea. Both of his parents tutored children privately in their home. They were socialists – his father a social democrat, his mother initially leaning toward the Bolsheviks because they promised to quit the war in Europe. In the civil war following the revolution, the Bolshevik regime punished Crimea for being a "White" stronghold. The Rapoports' relatives could hear the screams of victims being massacred nearby, so no one believed anymore that those Bolsheviks in power were beneficient. The only decent people had been killed, had emigrated, or were powerless. Although this

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was the New Economic Program period, when partial free enterprise was reinstated, its lenient rules did not apply to Crimea, where the inhabitants were starving.

FLIGHT TO THE WEST

In 1921, Anatol's father had a month-long leave from his job and took his family to visit his wife's parents in Ukraine, where food was plentiful. Anatol's mother announced that she would not go back. She convinced her husband to go to the border of Poland and Russia – a no-man's land where no government had established itself. She managed to cross over into Poland and to contact an agency that helped Jewish refugees. Only after hair-raising adventures did her husband and son succeed in following her a few weeks later. Eventually they were able to join relatives in Chicago, where Father became a milkman (later a grocer) and 11 year old Anatol resumed his schooling.

He was an exceptional musician, and at the age of 18 was sent to Vienna, where he studied piano five years. His training culminated in a successful recital, and a he returned to America hoping to establish a career as concert pianist. However, in both Chicago and New York, any young pianist needed to be the protégé of wealthy people, and Anatol disliked any such dependence. He went to Mexico for a year and concertized throughout the country, learning Spanish along the way. But even then, he realized that sponsorship would be necessary to gain recognition in the United States, so he decided to go into mathematics instead. (But he continued performing sometimes, playing his last concert on this 85th birthday). He had always enjoyed math and quickly proceeded through to a doctorate at the University of Chicago, finishing exactly at the time of Pearl Harbor and immediately entering the armed forces.

He served the four war years as a supply officer in Alaska and India. Then he returned to Chicago, took an academic post, and married Gwen, who had been involved in industrial relations. The new family would grow as they became parents of a daughter, Anya, and two sons, Alexander and Anthony. Anatol had belonged to the Communist Party from 1938 to 1941, quitting when he joined the military. After the war he would have joined again, but its US leadership had become more inflexible and Anatol was keenly sensitive to demagogy, which was prevalent both in the party and among anti-communists. During that witch hunt period he expected to be called to testify about his previous activities in the party, but this did not happen. While still preoccupied with such political concerns in 1954, he left Chicago for a year at Stanford's prestigious "think tank" – the Center for Advanced Study in the Behavioral Sciences. There he continued discussions with several like-minded scholars with whom he created the International Society for General Systems Research. After the year in California, he and his family moved to the University of Michigan, where he taught fifteen years.

Although he was still calling himself a mathematical biologist and working in the field of mental health, his interests actually centered on general systems analysis and conflict situations – especially the theory of non zero sum games, of which the most famous example is the "Prisoners' Dilemma". He wrote a book about that dilemma and he continued expanding that area of mathematics as a field called "decision theory". (See the sidebar on Prisoners' Dilemma). This interest inevitably led him into an intellectual confrontation with strategic analysts, the theorists who were developing the nuclear deterrence model on which the Cold War was being waged. This interest combined with his popularity as a teacher, and in the 1960s led to his active opposition to the Vietnam War, particularly by taking a leading role in Ann Arbor's mass tech-ins. By then, more than half his publications dealt with themes of peace, war, or conflict.

He was feeling that the United States was not where he wanted to live and raise his growing sons. After briefly immigrated to Denmark, the family settled in Toronto in 1970, where Rapoport taught until his official (mandatory) retirement in 1976. (In fact, he continued teaching in Canada and abroad until 2000). For four years he was director of an institute of advanced study in Vienna, spending his summers in Toronto.

THE STUDY OF CONFLICT

In 1984 Rapoport joined the newly-formed organization, Science for Peace, which was encouraging the application of science to problems of peace. He was elected president of the group and proposed to form an inter-disciplinary curriculum in peace studies at University of Toronto, of which he offered to teach two courses. After two years of discussions and revision, Science for Peace received permission to launch this four-year degree program. It is still flourishing.

I asked Anatol why he had developed such an interest in peace, war and conflict. Was there a special personal motive behind his scholarly preoccupation? After reflecting a moment, he said that probably Gwen had influenced him, for they have been married over half a century. Gwen had even been opposed to fighting World War II, whereas he had served in the military without hesitation. He would not do so today, if he had to make such a decision again, for he calls himself an abolitionist.

By this term he means to set himself apart from pacifists. The distinction in his mind is between two alternative approaches to the elimination of warfare. A pacifist, to him, is someone who believes that the willingness or unwillingness to engage in violence is a moral trait, and that peace requires a change in the minds and souls of individuals, so they will refuse to wound other human beings. Tolstoy and Martin Luther King were pacifists. Rapoport, however, believes that Gandhi was not a pacifist, but an organizer of nonviolent resistance. An abolitionist is someone who thinks of war as a social institution. Anatol sees warfare as a system with sub-systems, including the military complexes of various states. Military institutions support each other, each one of them justifying the existence of its counterparts in potentially adversarial societies. To abolish war, he argues, we must uproot it institutionally. This effort has little to do with the psychology of individuals. Studying the inclination of individuals to fight will not get us very far. "I'm for killing the institution of war," he says. Of course, even though he advocates an institutional, political approach, he personally admires pacifists, such as the Quakers and Mennonites. He spoke especially fondly of Kenneth and Elise Boulding – both devout believers and anti-war activists who had been his close friends in Michigan.

INDIVIDUAL AND COLLECTIVE RATIONALITY

Rapoport's greatest intellectual fascination has concerned the deceptiveness of rationality. We need to distinguish between individual and collective rationality, as we learn from the familiar allegory, the "tragedy of the commons." In a village all the cows graze on a common pasture. It is in their individual interest for all farmers to keep as many cows as possible and let them eat their fill. But if all the farmers do so, the grass will soon be gone and all the cows will starve. So it is in their collective interest for each farmer to limit her herd. A similar example comes from fishing: if all the fishers take the maximum number of fish, the fishery will soon be depleted because individual rationality again runs counter to collective rationality. Or, to cite one more example, in a burning theater everyone wants out, but if everyone rushes to the exit without self-restraint, no one will escape. Again, the rational pursuit of individual and collective interests are contradictory. But the clearest example is the Prisoners' Dilemma, where it is perfectly rational to defect, though doing so yields a worse result than mutual cooperation. Fortunately, the motivation to defect can be overcome over the course of a series of games instead of a single game, for it is possible to build up mutual trust.

Trust is strongly influenced by the evidence the other player provides by demonstrating his actual decisions, one after another. Clearly, if I can trust you, the other player, to cooperate, it will make sense for me to cooperate too, and by continuing our mutual cooperation over a whole series we both would win. But if you defect on one game while I cooperate and lose, you probably cannot convince me to trust you next time and cooperate again. That is how we establish our trustworthiness in real life – by demonstrating it in a series of interactions. The question then becomes, what kind of game plan allows a player to benefit most over an indefinitely long series of games? In 1984 Robert Axelrod published a book, The Evolution of Cooperation, which presented a solution to the Prisoners' Dilemmas. He had

established it by organizing a computer tournament that pitted strategies against each other, pairwise, over a series of games. Game theorists around the world had submitted these strategies. Anatol Rapoport won the tournament with a strategy called TIT-FOR-TAT, which always entered the first round of games with a cooperative play. Thereafter, it played exactly as the other side had played in the preceding game. If the other side had defected, TIT-FOR-TAT also defected for that one game. If the other side had cooperated, TIT-FOR-TAT then cooperated on the next round.

In effect, TIT-FOR-TAT punished the other player for selfish behavior and rewarded her for cooperative behavior – but the punishment lasted only as long as the selfish behavior lasted. This proved to be an exceptionally effective sanction, quickly showing the other side the advantages of cooperating. TIT-FOR-TAT won the tournament. It also set moral philosophers to proposing this as a workable principle to use in real life interactions.

LET YOU AND HIM FIGHT

I asked Anatol why this simple rule of reciprocity was so powerful. To my surprise, he said that TIT-FOR-TAT cannot beat anyone! It can never get a better score than the other player, since all it is doing is following what that player had just done. Then how did it win the tournament? By allowing all the other strategies to eliminate each other. ("Let you and him fight!" he explained).

He gave some examples to illustrate the principle. A former student of his had developed a scenario called a "truel" – a duel for three shooters, all of whom should shoot at the same moment. The first man is known to be a crack shot; he hits his target 95% of the time. The second man is almost as good a shot; he hits his target 90% of the time. The third man is a poor shot; he can hit a target only 50% of the time. So which of these three "truelists" is most likely to survive? Answer: the third guy. The other two men will kill each other, leaving the worst marksman unscathed. TIT-FOR-TAT's victory represented a similar outcome: it allowed the other strategies to kill each other off.

Illustrating the principle in another way, Rapoport recalled having put this question to friends in Russia and the United States during the Cold War: During a war would you be safer in the United States or Costa Rica? In Finland or the Soviet Union? The answer was obvious, yet it was a telling criticism of the whole theory of deterrence.

"So you decided to be an 'abolitionist?'" I inferred.

"One doesn't make decisions," he replied. "One discovers them. And I guess Gwen discovered this one first."

"How should we pursue the abolition of war?" I asked.

He said, "I hope a world-wide unified left will develop from today's left – the ecologist, the peaceniks, the anti-capitalists, and the champions of true democracy. I want to get the war makers completely out of power. That will be abolition!"