



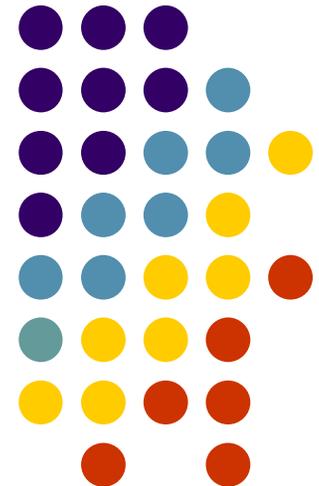
Developing Social Science Based Applications for the Navy: Lessons from ONR



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How can Cultural Intelligence Be Implemented in Military Operations?



- Training
- Decision Tools and Aids
 - Course of Action Analyses
 - Analytical Tools
- Intelligence Analysis Tools and Aids
 - Pattern Detection
- Military Planning at Strategic and Tactical Levels
 - New Conceptual Models
 - New Analytics (ABM, for example)
 - Improved Planning Tools
 - PsyOps (and SocOps?) for EBO



SBIRs as a “next level”

- Sound conceptual model with a good understanding of the “current gaps” in science
- Clear connectivity between the conceptual model and the computational model
- Clear connection of the product to the solution of the military’s problem



Approach: Computational Social Science Modeling

- Conceptual Models
 - Describe the relationships and interdependencies of interest in social and cultural behavior
 - Provide boundaries and definitions for variables
 - Explain phenomena of interest with reference to dynamics of relationships described in the model
- Computational Models
 - Accept inputs, provide outputs (examples)
 - Process statements using mathematical and symbolic representations of the relationships and variables derived from the conceptual model



Sources of Conceptual Models

- Field studies
 - Field experiments
 - Surveys
 - Lab experiments
 - Experimental simulations
 - Computational simulations
 - Formal Analysis
- Intrusive
Natural settings
- Contrived settings
Participation and
Sample Problems
- Unobtrusive
Need input from real life

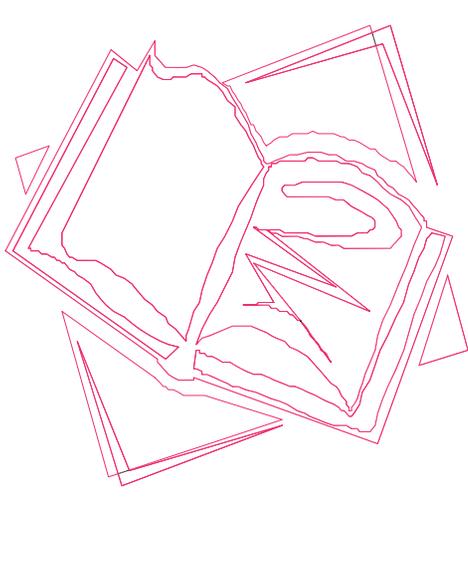


How to Fight Terror Networks (a high level conceptual model)

- Understand their organizational constraints and limitations
- Understand their operational code and “playbook”
- Develop new strategies and tactics against their networks
- Improve warfighting networks so that they can decisively, rapidly intervene

**This ALSO describes how terrorist networks fight
CONVENTIONAL FORCES**

The Role of Modeling and Simulation: Improving Red Team Analysis



RED TEAM PLAYBOOK

WHO: Command and Control

WHAT: Methods & Expertise

WHERE: Target Preferences

WHEN: Timing Preferences

HOW: Preferred Organization (cells)

WHY: Doctrine

Specific data is hard to find, erroneous, partial
Time sensitive—Intelligence goes stale quickly

Scientific Approach of the ONR Research Program



Computational modeling and simulation of terror networks that are based in:

- Organizational and social science research including experimental, survey, and ethnographic work on organizational behavior in many cultures
- New theoretical perspectives in graph theory, social network analysis and theoretical statistics that combine the fields of mathematics and social science
- Mathematical representations of well understood aspects of these problems

Social Network Analysis

Descriptive and Statistical Approaches



Descriptive Approach

Focus on DESCRIBING actor relationships

STATIC “snapshots” of social structure

Formal, mathematical approach to describing social concepts

(Example: kinship, group, social position, isolation, popularity)

Allows measurement of relational concepts

Theory rendered into graph theoretic statements

Statistical Approach

Makes stochastic assumptions about actor behavior

Assumes a probabilistic mechanism for observed network behavior

(i.e., two people who share a friend are probably also friends)

Allows for hypothesis testing

Social Network Analysis



Social Network Analysis is a widely used methodology used by military and intelligence agencies to develop tactics and strategies against terrorist networks and insurgencies.

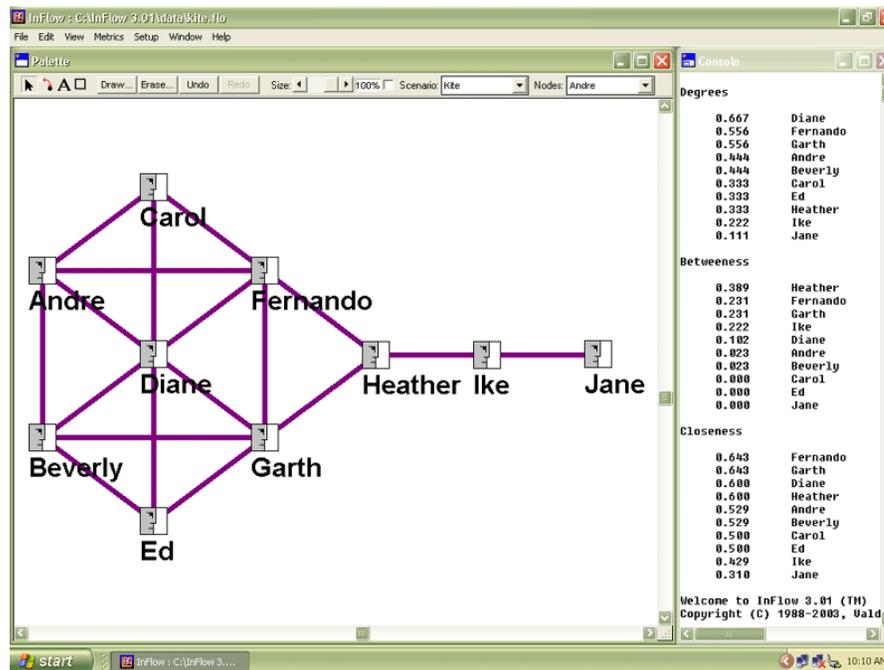


Social network analysis of Saddam's family enabled the Army to capture Saddam Hussein.

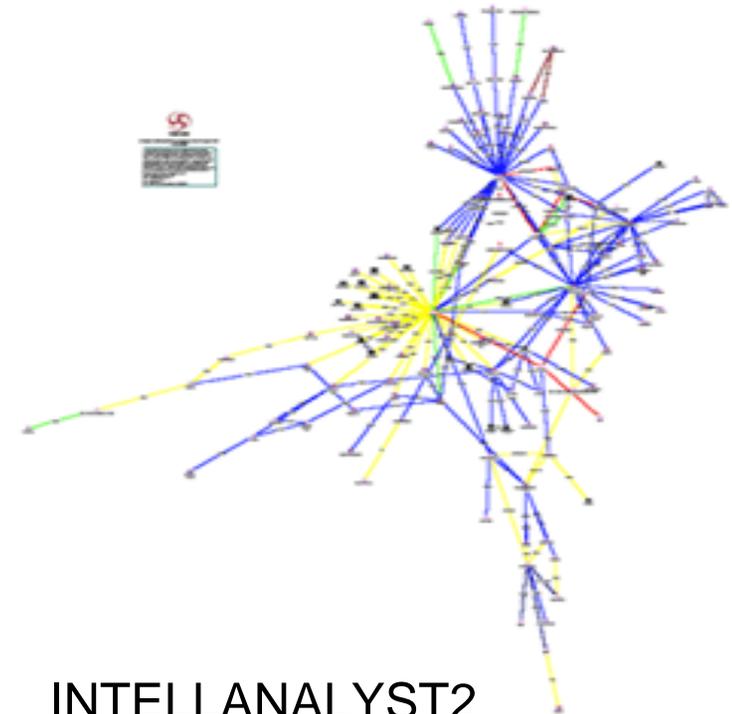


COTS/GOTS Link Analysis Tools

- Can provide static visualizations
- Can provide simple measures of static features
- Current link analysis tools assume complete, accurate data



InFlow, COTS tool



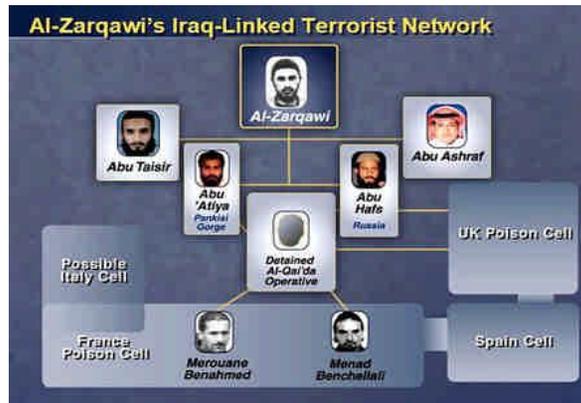
INTELLANALYST2
(GOTS tool)



COTS/GOTS Problems

Current Tools and Techniques CANNOT:

- Account for missing or erroneous data
- Model dynamic changes in network structure
- Model key flows, identify key players
- Detect vulnerabilities
- Perform what-if analyses





Needed Capabilities

- Ability to account for missing and uncertain data in network visualizations and computational tools
- Automated social network data collection
- Ability to analyze events, capabilities, etc.
- Ability to model dynamic change in network structure
- Ability to model key flows, identify key players
- Methods to detect vulnerabilities in networked forces
- New interventions and attack strategies against networked forces
- Ability to leverage information on existing social networks for information operations



Primary Investigators

- **Kathleen Carley, Carnegie Mellon University** (Sociology)
Dynamic Modeling of Terror Networks
- **Steve Borgatti, Boston College** (Anthropology)
Finding the Key Groups and Flow Patterns in Terror Networks
- **Stanley Wasserman, University of Illinois, Urbana-Champaign**
(Sociology) Dealing with Missing and Uncertain Network Data
- **Peter Sheridan and Duncan Watts, Columbia University**
(Sociology, Physics, Geography)
Experiments in Online Connectivity of Real World Networks
- **H. Eugene Stanley and Shlomo Havelin, Boston University and Bar-Ilan University, Israel** (Physics)
Immunizing Very Large, Disordered Networks
- **Catherine Dibble, University of Maryland** (Geography)
Experimental Tools for Modeling Network Data in Realistic Terrain



Conclusion

- Thorough and clear understanding of prior research is essential
- Modelers can “model anything” – Military recognizes the Garbage In-Garbage Out Phenomenon
- A good collaboration between research scientists and computational / decision aid creators is the hallmark of excellence