The Social Network Perspective

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Network Science - Connecting the Dots and Trails to Predict and Explain Behavior

Figure 3  Trusted Prior Contacts + Meeting Ties [shortcuts]
What is a Network?

**Ties Between Nodes (links)**
- Who do you like or respect?
- Transfer of resources
- Authority lines
- Association or affiliation
- Alliance
- Substitution
- Precedence
- Proximity

**Nodes**
- People
- Units of action
- Coalition partners
- Departments
- Resources
- Ideas or Skills
- Events
- Nation-states

Networks are ubiquitous
We pull out - the Meta-Network

WHO: People, Teams, Organizations

WHAT: Tasks, Events

HOW: Resources, Knowledge

WHERE: Location

WHY: Beliefs

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Tools and Workflows Exist and Are Improving for extracting, analyzing, forecasting, ...
Identify: Who are the Key Players?

Agents 286, 652, 97 repeatedly rank in top three in the measures.

*ORA’s *Key Entity Report* shows 3 agents critical to operations.

Narrow our focus from set of interstitial members to small group of leaders.
Assess: How are they organized?

FOG (Fuzzy Group Clustering) shows suspicious entities organized into 5 groups w/shared members.

Interstitial members are likely to contain coordinators & leaders.
Geo-Enabled Network Analysis

Networks In an Area

Location as Match Criteria

Visualizing Networks in Space

Information Loss Tracking

Trails
Socio-Cultural Data is Every Where

- **Unstructured**
  - Text - e.g. interviews, news articles, blogs, email
  - Various on-line sources

- **Semi-structured**
  - Blogs
  - Emails
  - Crowd-sourced

- **Structured**
  - Government and corporate documents
  - Proceedings

**Unstructured**
- Sudan Tribune Review
  - Year - articles
    - 2003 - 2932
    - 2004 - 6943
    - 2005 - 3828
    - 2006 - 3828
    - 2007 - 5815
    - 2008 - 9266
  - Archive of Lobban writing

**Semi-structured**
- UN Reports
- IDA Study 1796 files

**Structured**
- African gazateer

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Georeferencing news (here, crime) with emphasis on location
MetaCarta, crime around Washington as shown on Google Earth
Khartoum escalates conflict in Eastern, Southern Sudan, and Darfur
Sunday 15 January 2006 01:30.
By Eric Reeves

Jan 14, 2006  A wide range of recent news and policy reports clearly reveal the consequences of ongoing international failure to confront Khartoum's National Islamic Front, the dominant force in Sudan's nominal "Government of National Unity." For the NIF continues to escalate a series of militarily-driven crises in Africa's largest country, all of which imperil the widely heralded north/south peace agreement of a year ago. Physicians for Human Rights and the International Crisis Group have released particularly important reports: on the aftermath of genocidal violence in Darfur; on the growing military confrontation in eastern Sudan; and on Khartoum's continuing support for the destabilizing Lord's Resistance Army in southern Sudan and northern Uganda. Yet other reports suggest that a border war between Chad and Sudan, in areas that are filled with desperate refugees and internally displaced persons, may break out at any time.
WVHTC Lunch Data
Each location is a table.

The “unknown” location is the “enter” or “exit”

Most people go to 2 or more tables.

The 5th column shows the most popular region.

Next step: common trails
Visit Network

Lunch Data - Day 1

4 tables are visited by almost all people (located in middle)

Geo-temporal metric – e.g. following, meeting, hiding
Drug Seizures

Geo-Network Measures Improve focus

Regular

- Louisville
- Nashville
- Houston
- Albuquerque

Betweenness

- Louisville
- Albuquerque

Spatial
Networks Vary Over Time, And Media Choice has Geo-Relation

Are there regular spatial relations?
## Timeline

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Darfur rebellion</td>
<td>International recognition of Genocide</td>
<td>UN Sanctions Autonomous S. Sudan</td>
<td>Khartoum government and Sudan Liberation Movement sign peace accord</td>
<td>War crime charges</td>
<td>Increased UN presence Sudan-Chad accord</td>
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<tr>
<td>Bashir</td>
<td>President</td>
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<tr>
<td>Garang</td>
<td>VP Died S. Sudan President</td>
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<tr>
<td>Taha</td>
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<tr>
<td>Kiir</td>
<td>S. Sudan President</td>
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</table>

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### Summary Table

<table>
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<tr>
<th>Year</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
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<tbody>
<tr>
<td>No of Texts</td>
<td>2932</td>
<td>6943</td>
<td>3828</td>
<td>3828</td>
<td>5815</td>
<td>9266</td>
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<tr>
<td>No of Sudan Agents</td>
<td>28</td>
<td>38</td>
<td>33</td>
<td>39</td>
<td>41</td>
<td>39</td>
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<tr>
<td>No of Total Agents</td>
<td>138</td>
<td>237</td>
<td>208</td>
<td>217</td>
<td>213</td>
<td>222</td>
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<tr>
<td>No of Tribes</td>
<td>33</td>
<td>48</td>
<td>35</td>
<td>47</td>
<td>53</td>
<td>53</td>
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<tr>
<td>No of Sudan Organizations</td>
<td>53</td>
<td>72</td>
<td>62</td>
<td>74</td>
<td>80</td>
<td>79</td>
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<tr>
<td>No of Total Organizations</td>
<td>195</td>
<td>261</td>
<td>254</td>
<td>262</td>
<td>293</td>
<td>311</td>
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<tr>
<td>Density of Sudan Agents</td>
<td>0.044</td>
<td>0.033</td>
<td>0.031</td>
<td>0.028</td>
<td>0.032</td>
<td>0.049</td>
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<tr>
<td>Density of All Agents</td>
<td>0.016</td>
<td>0.011</td>
<td>0.01</td>
<td>0.008</td>
<td>0.009</td>
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<tr>
<td>Density of Tribe Network</td>
<td>0.028</td>
<td>0.038</td>
<td>0.031</td>
<td>0.032</td>
<td>0.025</td>
<td>0.045</td>
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<tr>
<td>Dominant Organization</td>
<td>Sudan Liberation Movement</td>
<td>Fur</td>
<td>Dinka</td>
<td>Dinka</td>
<td>Dinka</td>
<td>Dinka</td>
</tr>
</tbody>
</table>
Increasing Complexity in Tribal Areas of Conflict

Water Rights
Grazing

Land

Politics
Administration

Figures:

2003

2008

Keywords:

Communication
Demography
Ecology_env
Economy
Foreign
Ideology
Land_water_
Military
Peace
Political
Representation
Ecology_res
Justice
Management
Market
Socio_cultural
Cushitic

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Points of Conflict According to the U.N.

Rapid Ethnographic Assessment Provides Better Picture … but – geo-referencing is hard. Are there regular spatial relations?
Within the Sudan at a macro level there is little change
Who Connects Disconnected Groups Within the Sudan?

High Betweenness Low Degree

Bashir

Minnawi

Garang
Who is the Emergent Leader Within the Sudan

Emergent Leader (cognitive demand)

Garang

Bashir
Taha
Kiir
Minnawi
Basic Tribal Structure

Linking Ties to Borders and Areas - Difficult

Sudan Tribal Network - Hereditary

Tribal Network in the News
No Geo-Spatial Relation!
Different Cities have different networks leading to different diffusion patterns and so distribution of results.
Summary & Challenges

• Summary
  - Sufficient Metrics & Visualizations exist
  - Geo-DNA tools exist
    • But they need to be speeded up and size reduced

• Challenges
  - “Drill down” find information of interest from a combined spatial temporal network perspective
  - Location identification in texts
  - Geo-temporal network forecasts