Dynamic Patterns of Terrorist Networks:
Security versus Efficiency in the Evolution of 11 Islamic Extremist Groups

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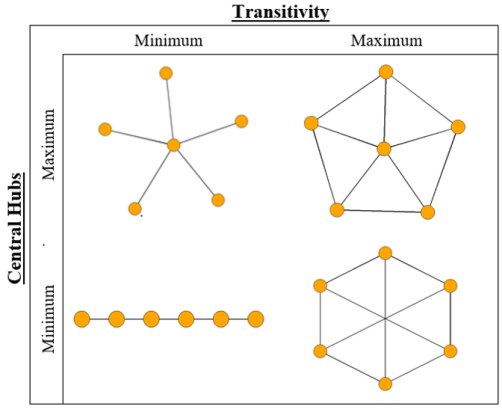
Objectives

- Investigate terrorist network evolution over time:
  - 11 attack-focused terrorist networks
  - Each with multiple time period snapshots
- Focus on transitivity and the role of central hubs:
  - Relate to current literature on "security" vs "efficiency"
  - Do the network characteristics change over time?

Research Questions

1. As terrorist groups approach the execution of an attack, do social ties form in a chain-like manner, or is there a tendency towards transitivity?
2. What role do central hubs play in structuring the formation of social ties in terrorist networks?



Illustrations of network structures that support transitivity versus the development of centralized hubs

Approach

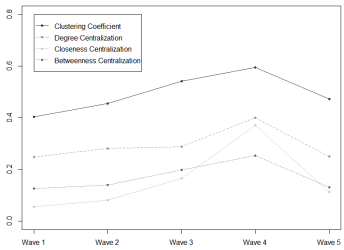
- Use a subset of the *John Jay & ARTIS Transnational Terrorism Database* (JJATT):
  - 11 networks surrounding different terrorist attacks: nodes are terrorists, edges are social relationships
  - 5 waves of data for each attack: 3 years before the attack, year of the attack, 1 year after attack
- Apply STERGMs (Separable Temporal Exponential Random Graph Models) to estimate what causes ties to form and dissolve
- Interested in parameters that predict transitivity (GWESP) and the development of central hubs (degree popularity squared)

Military & Coalition Relevance

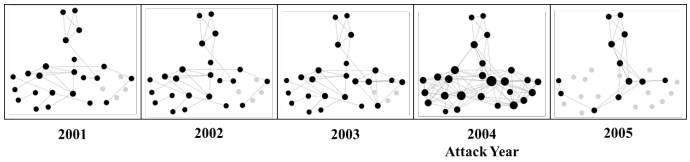
- Results imply different detection and disruption techniques according to the stage in the group development
  - At their inception, terrorist networks can be broken up by randomly targeting actors.
  - As the networks mature, central hubs make more tactical targets.

Results

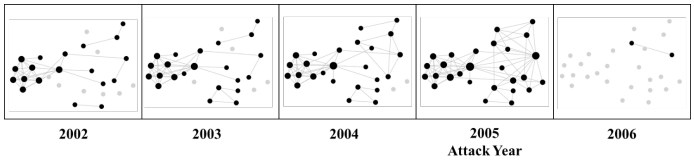
- Attack-focused terrorist networks develop increasingly more transitive relationships as they approach an attack
- They also become increasingly centralized and structured around central hubs over time



Network-level averages across all waves (n = 11 terrorist networks)



2004 Australian Embassy bombing network from 2001 to 2005



2005 Bali bombing network from 2002 to 2006

	Coef.	S.E.	
Formation			
Edges	-4.897	0.422	***
GWESP (weight = 0.1)	1.178	0.243	***
GWDSP(weight = 0.1)	-0.053	0.049	
Degree Popularity Sq	0.144	0.056	*
Dissolution			
Edges	1.051	0.370	*

*Table 1. Meta-analysis of STERGM results for 11 terrorist networks. Note: Robust standard errors shown. *p < 0.05, ***p < 0.001.*

Summary & Future Work

Awareness of network composition and the changes over time can help inform the intelligence analysts during the "sense making process" (e.g., Pirolli and Card, 2005)

It is also possible that machine processing such as network analytics could be employed to process data from extremist networks to alert analysts when certain connectivity thresholds are passed that indicate the potential for an impending attack

Publication

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