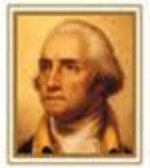


Effects of Systems Engineering on Command and Control Systems Utilizing Innovations in Social Networking

James ter Veen, Shahram Sarkani, PhD., Thomas Mazzuchi, PhD.

Problem Statement

- Purpose of Command and Control Systems (C^2)
  - Integrate data from disparate sensors to produce clear, comprehensible tactical situation awareness
  - Pierce the 'fog of war' which has faced military command and control structures for centuries.
  - Provide decision support for commanders; answer the question: What should I do next?
- Problem Statement: C^2 systems reveal physical elements of the battle space but don't show intentions and plans.
- Approach
  - Apply Systems Engineering techniques to leverage the vast amounts of data present in social media to yield practical knowledge from a mathematical model.
  - Validate the model's performance using social network analysis and natural language processing tools with data from events such as the 'Arab Spring' demonstrations.

Research Question

- Integration of data from disparate sources to produce an accurate situation awareness in a tactical environment is a difficult problem
- Existing systems using radar, sonar and other sensors show physical assets but do not expose intentions
- Online Social Networking media have been adopted by millions of users worldwide

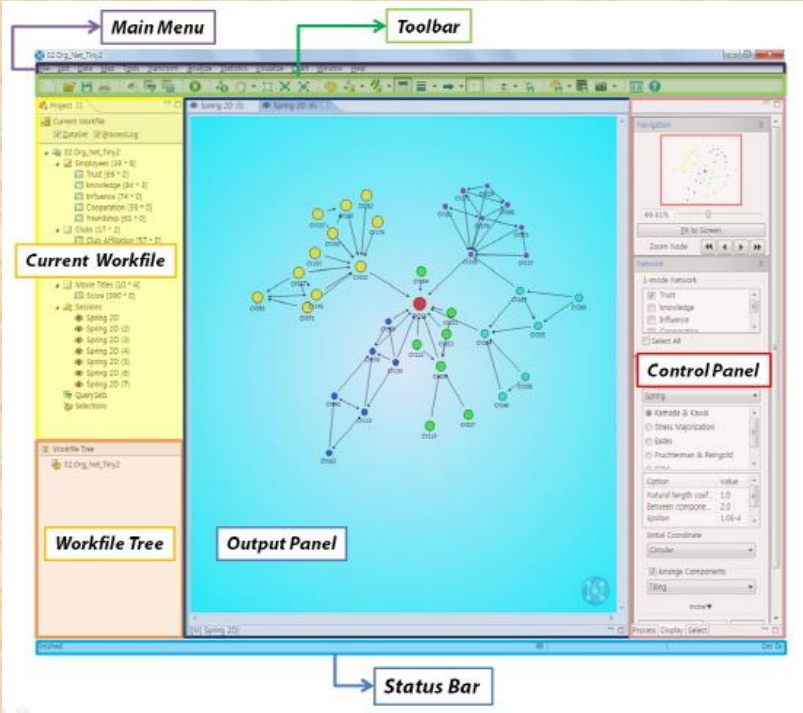
Can Systems Engineering analysis of online social network media be used to enhance command and control systems?

Data Collection Process

- Use large quantitative datasets collected from web crawls of:

Twitter	Blogs
Facebook	RSS feeds

- Use natural language processing tools, such as OpenCalais, to identify protest related content (Protest_FB & Protest_TWT)
- Use tools such as NetMiner, to analyze network characteristics 'cohesion,' 'centrality,' 'distance,' and 'betweeness.'



Hypotheses:

H_0: There is no significant relationship between Protest_FB, Protest_TWT, Cohesion, Centrality, Distance, Betweeness and demonstration attendance

H_1: There is a significant relationship to demonstration attendance

Significance

- Techniques to characterize social networks (online and off) abound in current literature (Anklam 2005, Hansen 2011, Klamma 2006, Pallis 2011, Tang & Liu 2010).
- De Choudhury (2010) presents a Dynamic Bayesian network and uses Hidden Markov Models to characterize information diffusion in a network.
- The next logical step is to use Systems Engineering best practices on large scale quantitative data describing communication patterns and social network features to produce actionable knowledge which can improve C2 system effectiveness.

Pilot Study Progress

- Study Scope: Occupy Wall Street protests in New York City
- Data Collected: 1216 posts from twitter, blogs and online media from 8/2 to 9/25
- Can characteristics of the social media networks be related to reported crowd sizes?

Hypotheses:

H_0: There is no significant relationship between Cohesion and Centrality of the post and author networks to the reported crowd sizes.

H_1: There is a significant relationship between Cohesion and Centrality to reported crowd sizes.

H2: There is no significant relationship between entity trends and reported crowd sizes.

H4: There is a significant relationship between entity trends and reported crowd sizes.

Occupy Wall Street Timeline

THE GEORGE WASHINGTON UNIVERSITY
WASHINGTON DC

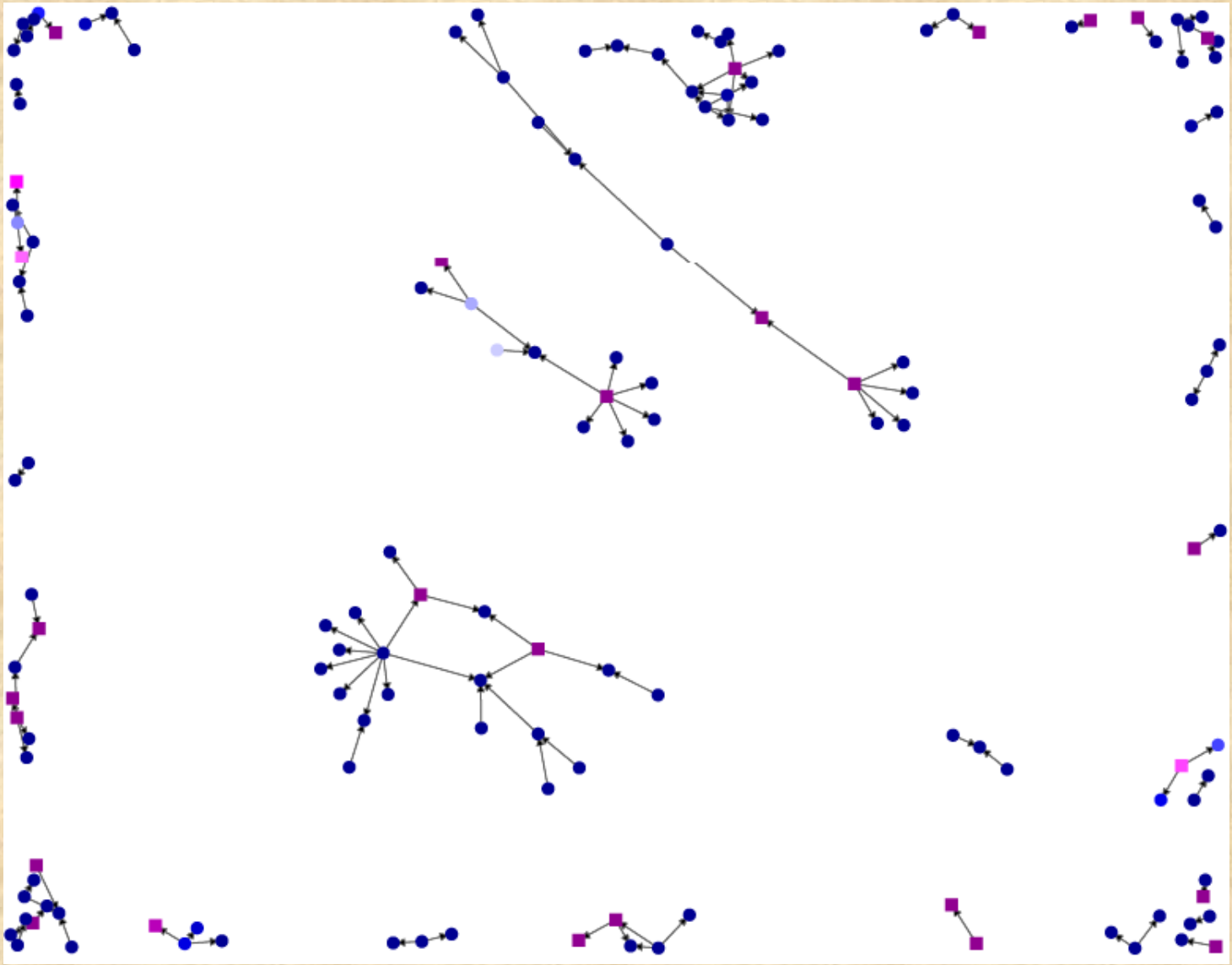
9/17 – A few dozen young demonstrators try to pitch tents in front of NYSE, 1000 gather in Chase Manhattan Plaza

9/19 – NYPD arrests seven protestors

9/24 – ~100 demonstrators arrested, some pepper sprayed; ~ 200 hundred camped at Zuccotti park

9/25 – Network and Data diagrams captured

Post Network Diagram



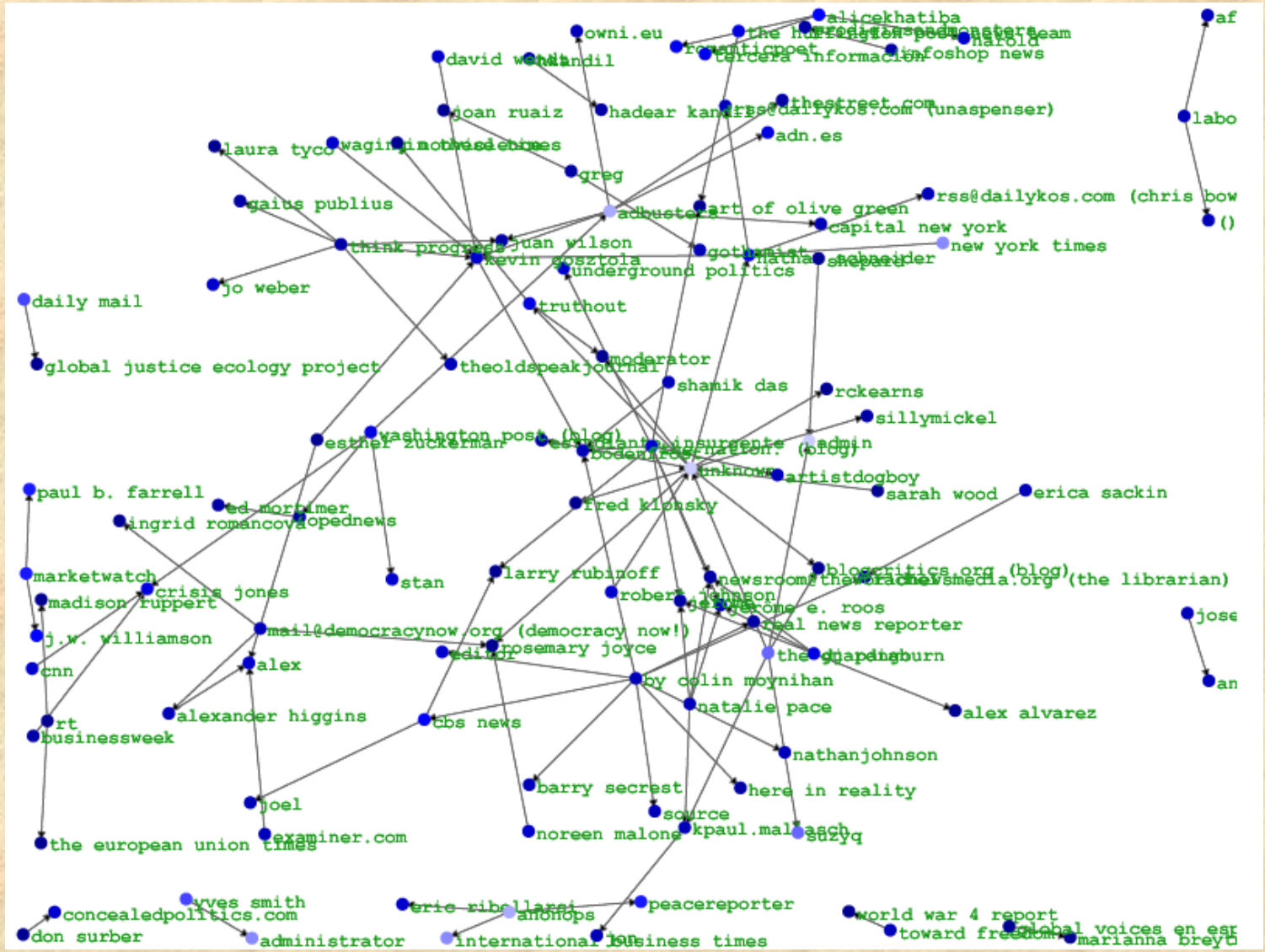
Collected 8/2 to 9/25

Visibly Low Cohesion

Low Centrality

Recent events: 100 arrests, 200 campers in Zuccotti Park

Author Network Diagram



Collected 8/2 to 9/25

Visibly Low Cohesion

Highest Centrality around Author 'Unknown'

Online Roles Analysis

AUTHORITY	
by colin moynihan	8.41%
the nation. (blog)	7.48%
think progress	5.61%
adbusters	5.61%
the guardian	4.67%
dj pangburn	3.74%
washington post (blog)	3.74%
natalie pace	3.74%
nathan schneider	2.8%
alicekhatiba	2.8%
unknown-openletters2you.blogspot.com	2.8%

INITIATOR	
dj pangburn	3.82%
washington post (blog)	3.82%
alicekhatiba	3.6%
unknown-openletters2you.blogspot.com	3.6%
anonops	3.6%
unknown-current.com	3.38%
robert johnson	3.38%
greg	3.38%
marketwatch	3.38%
laborunionreport (profile)	3.38%
rt	3.38%
unknown-news.infoshop.org	3.17%
sarah wood	3.17%
hkandil	3.17%
new york times	3.17%

INFLUENCER	
adbusters	4.78%
dj pangburn	4.37%
nathan schneider	4.19%
the nation. (blog)	4.19%
anonops	4.02%
by colin moynihan	3.14%
kevin gosztola	3.14%
washington post (blog)	2.97%
alicekhatiba	2.62%
unknown-openletters2you.blogspot.com	2.62%
unknown-current.com	2.27%
robert johnson	2.27%
greg	2.27%
marketwatch	2.27%
laborunionreport (profile)	2.27%
rt	2.27%
crisis jones	2.21%

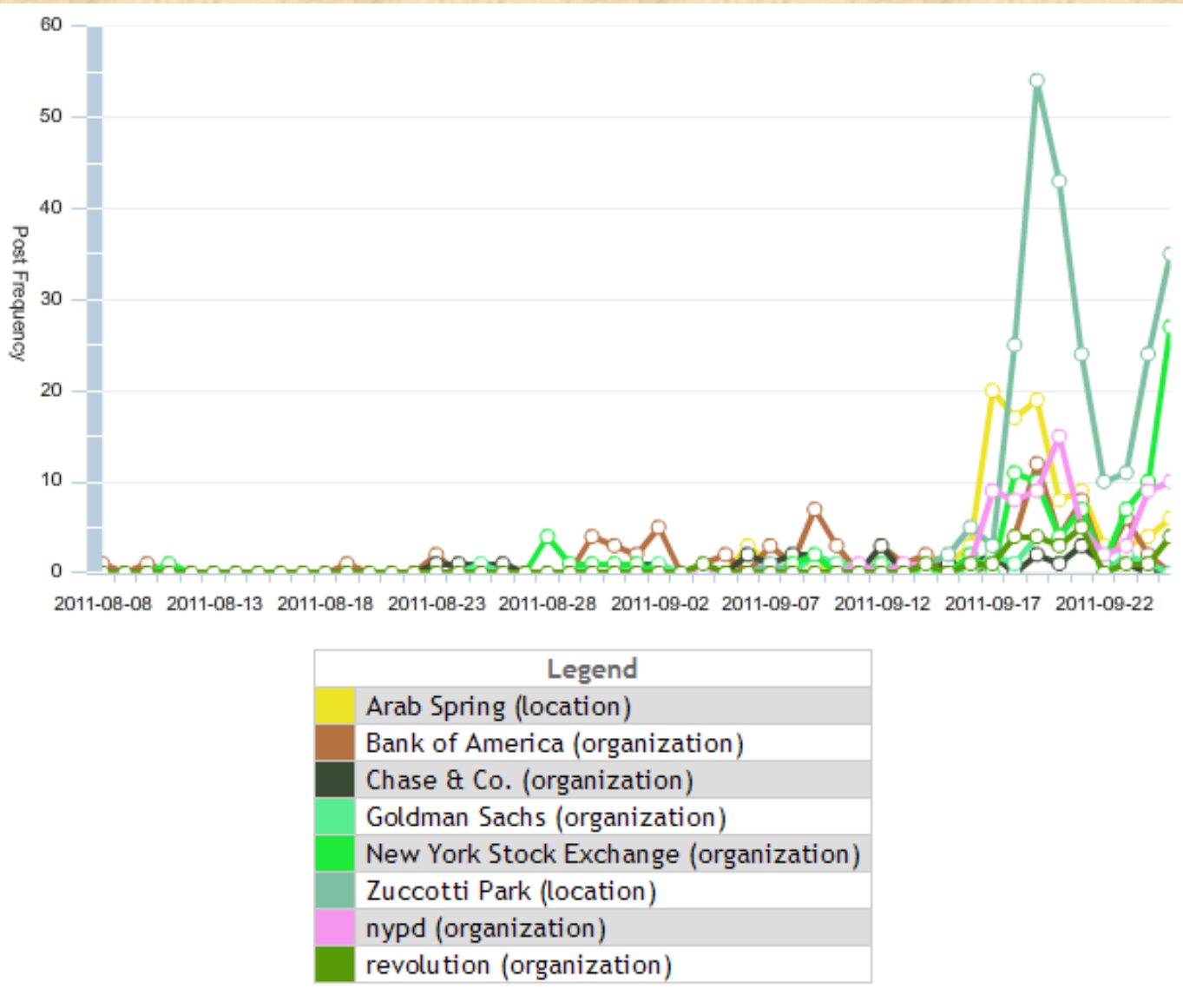
PROVOCATEUR	
businessweek	11.13%
by colin moynihan	7.04%
the nation. (blog)	6.22%
think progress	5%
adbusters	4.66%
the guardian	3.86%
washington post (blog)	3.75%
dj pangburn	3.17%
natalie pace	3.17%
nathan schneider	2.72%

ACTIVE	
nathan schneider	14.46%
kevin gosztola	12.85%
adbusters	12.32%
crisis jones	10.18%
opednews	6.42%

Need to revisit the Provocateur analysis:

Business Week more provocative than Adbusters?

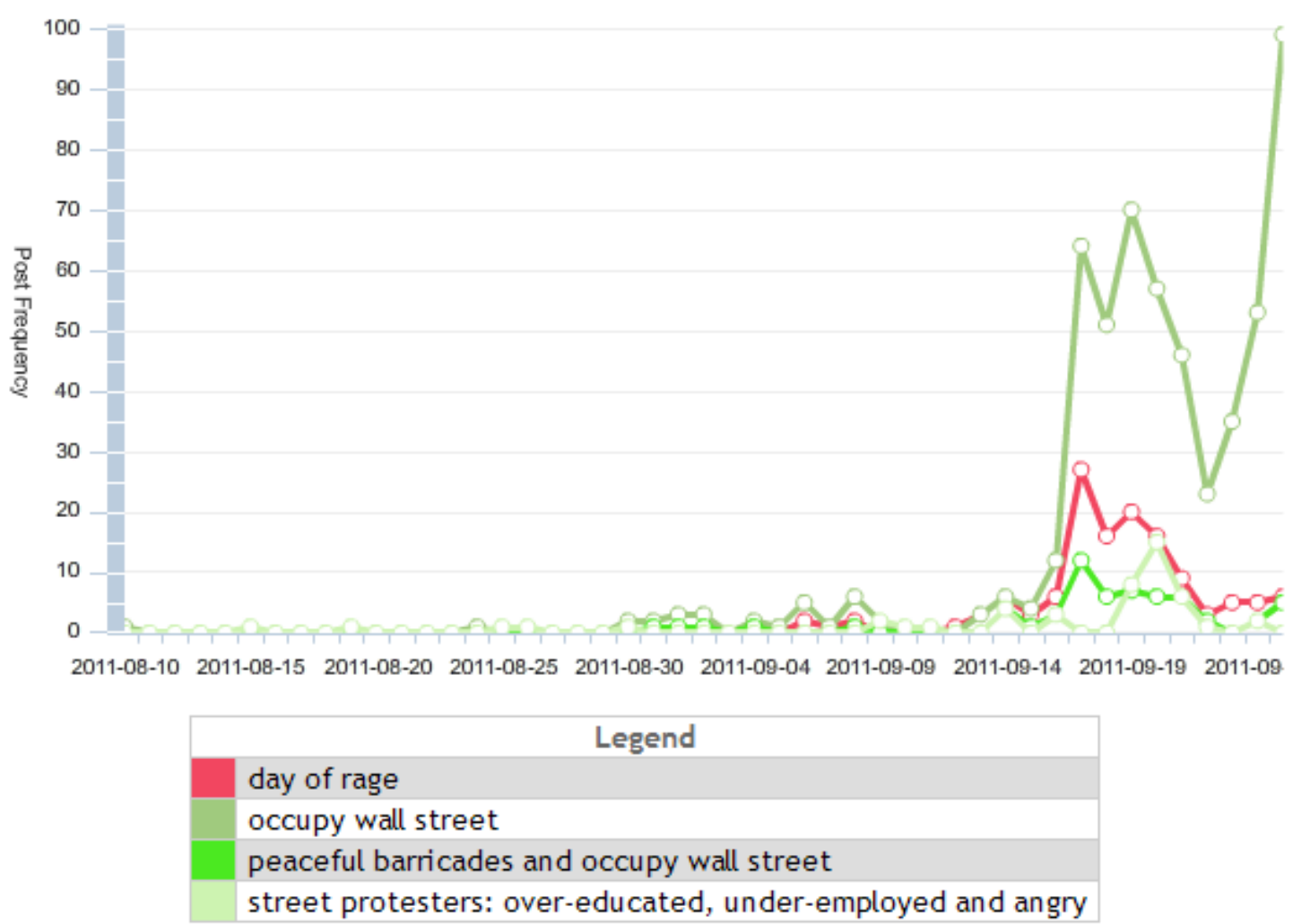
Named Entity Trend



Posts including 'Arab Spring' peaked on the day prior to the 1000 person crowd at Chase Plaza on 9/17

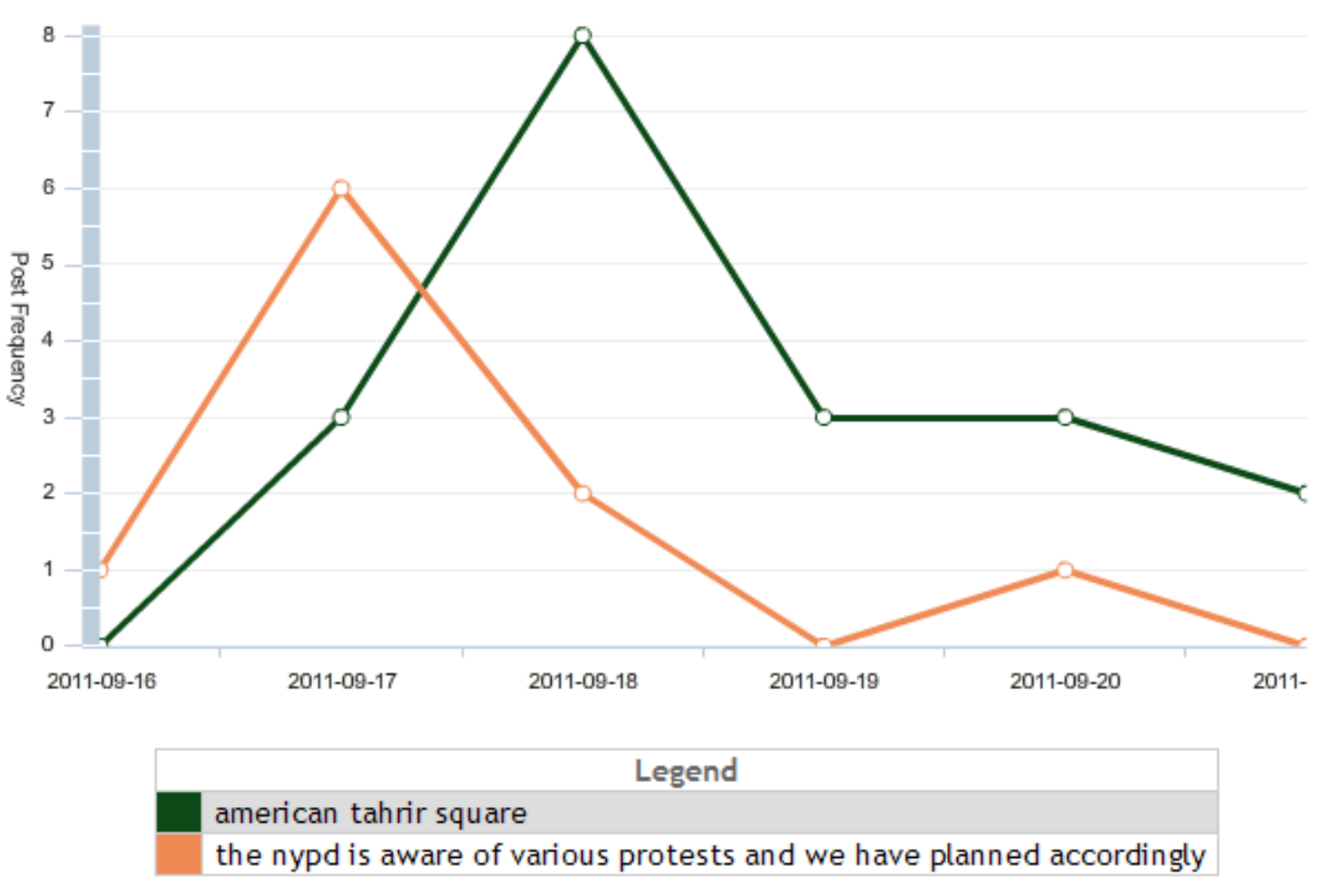
'Zuccotti Park' comments peak two days later

Phrase Trend



'Day of rage' and 'Occupy Wall Street' phrases peak on the 16th, the day before the 1000 person crowd at Chase Plaza

Quote Trend



'American Tahrir Square' trails the 9/17 rally but post frequency is very low

Unexpected Events

9/30 – NYPD estimates 1000 people occupy Liberty Square, blogs claim up to 50,000

10/1 – 700 demonstrators arrested on the Brooklyn Bridge

10/1 – My data collection server crashes!

10/3 – Protests in NY, Chicago, Boston, St. Louis, Kansas City, Los Angeles, Portland Maine & Albuquerque

Data Analysis Progress

- New Data Collection Server Operational 10/6
- Re-run of data collection in progress now with expanded scope
- Regression analyses:
  - Post Network Centrality by date vs. crowd size
  - Post Network Cohesion by date vs. crowd size
  - Author Network Centrality by date vs. crowd size
  - Author Network Cohesion by date vs. crowd size
  - 'Arab Spring' entity trend by date vs. crowd size
  - 'Day of rage' phrase trend by date vs. crowd size
  - 'Occupy Wall Street' phrase trend by date vs. crowd size

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