Social Media & Text Analysis

lecture 1 - big data social science

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Instructor: Wei Xu

Website: socialmedia-class.org

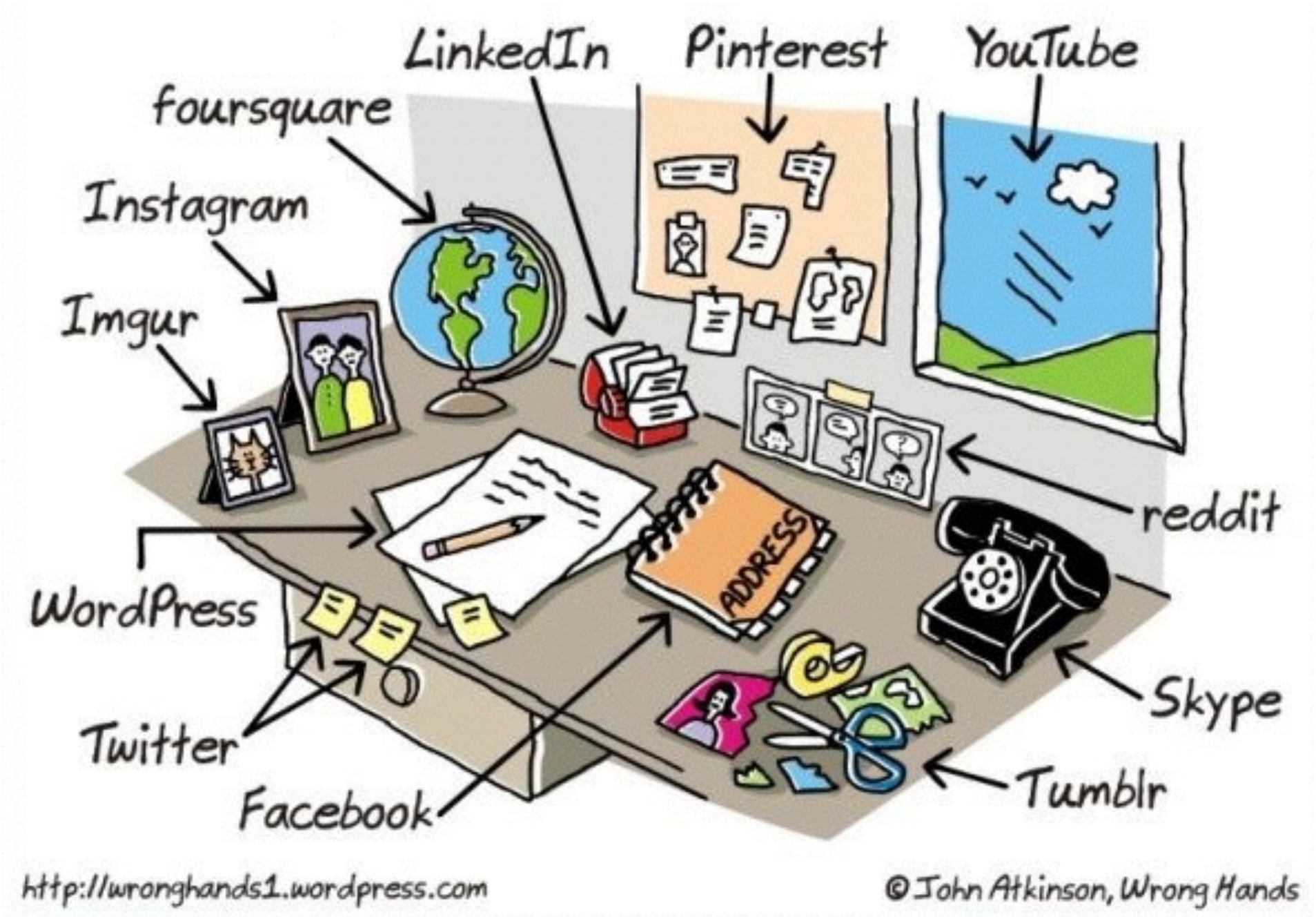
Syllabus

Part I	Computational Social Science
Part II	Twitter API Tutorial
Part III	Natural Language Processing
	overview, language identification
	tokenization and normalization
	part-of-speech, chunking, named entity recognition
	summarization, paraphrase, sentiment analysis

What do you expect to learn

- cutting edge research on
  - natural language processing (NLP)
  - computational social science
- popular machine learning algorithms
  - (supervised) Naïve Bayes, Conditional Random Field, Logistic Regression
  - (unsupervised) Brown Cluster, PageRank
- useful NLP tools, especially for Twitter text
- Twitter API for obtaining Twitter data

Vintage Point of View



Broader Point of View

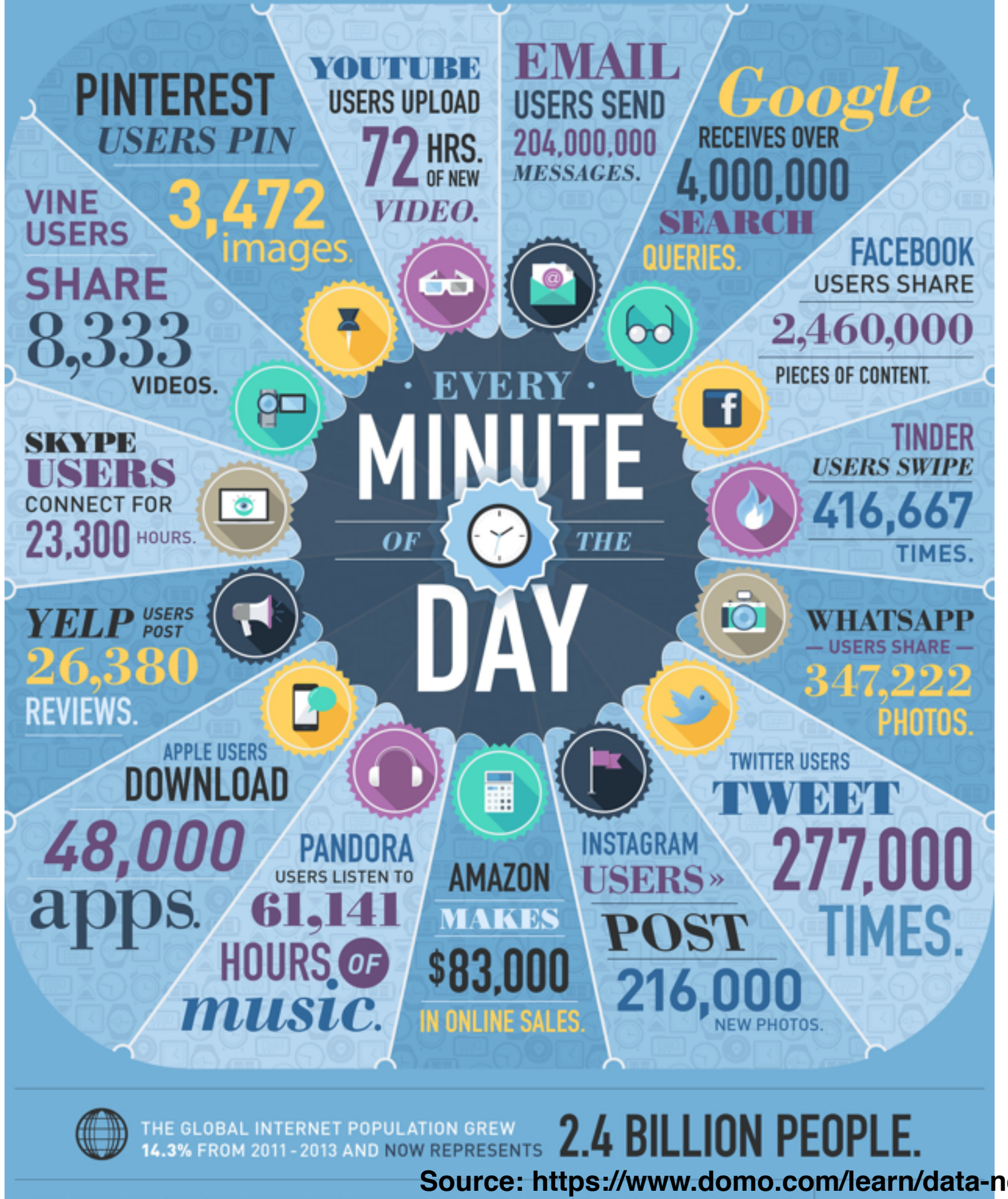
Source: http://www.conversationprism.com/

Common Features

- Posts and/or user profiles (a lot of data are text)
- Social network (explicit or implicit)
- Cross-post / user linking
- Social tagging
- Comments
- Likes / favorites / starring / …

Source: Tim Baldwin

Big Data



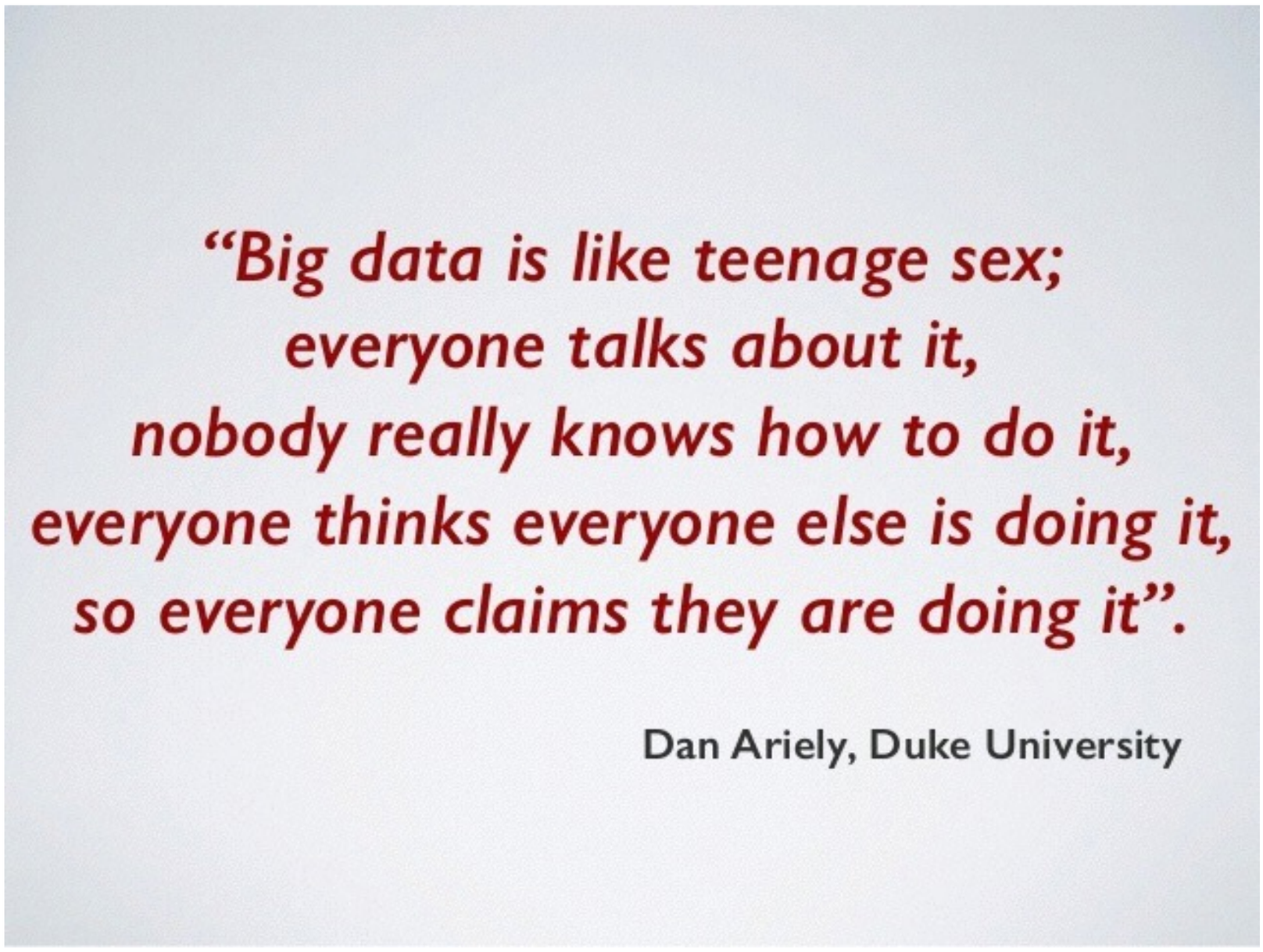
Source: https://www.domo.com/learn/data-never-sleeps-2

Big Data

- Definition (Doug Laney, 2012):
  - Volume
  - Velocity
  - Variability
- and countless other definitions …

Big Data

- the infamous definition:



the location of Twitter messages and Flickr photos in New York City
Source: Eric Fischer

Impact

- Politics
- Business
- Socialization
- Journalism
- Cyber Bullying
- Productivity
- Privacy
- Emotions
- …
- and our language (!)

skip
@han_horan

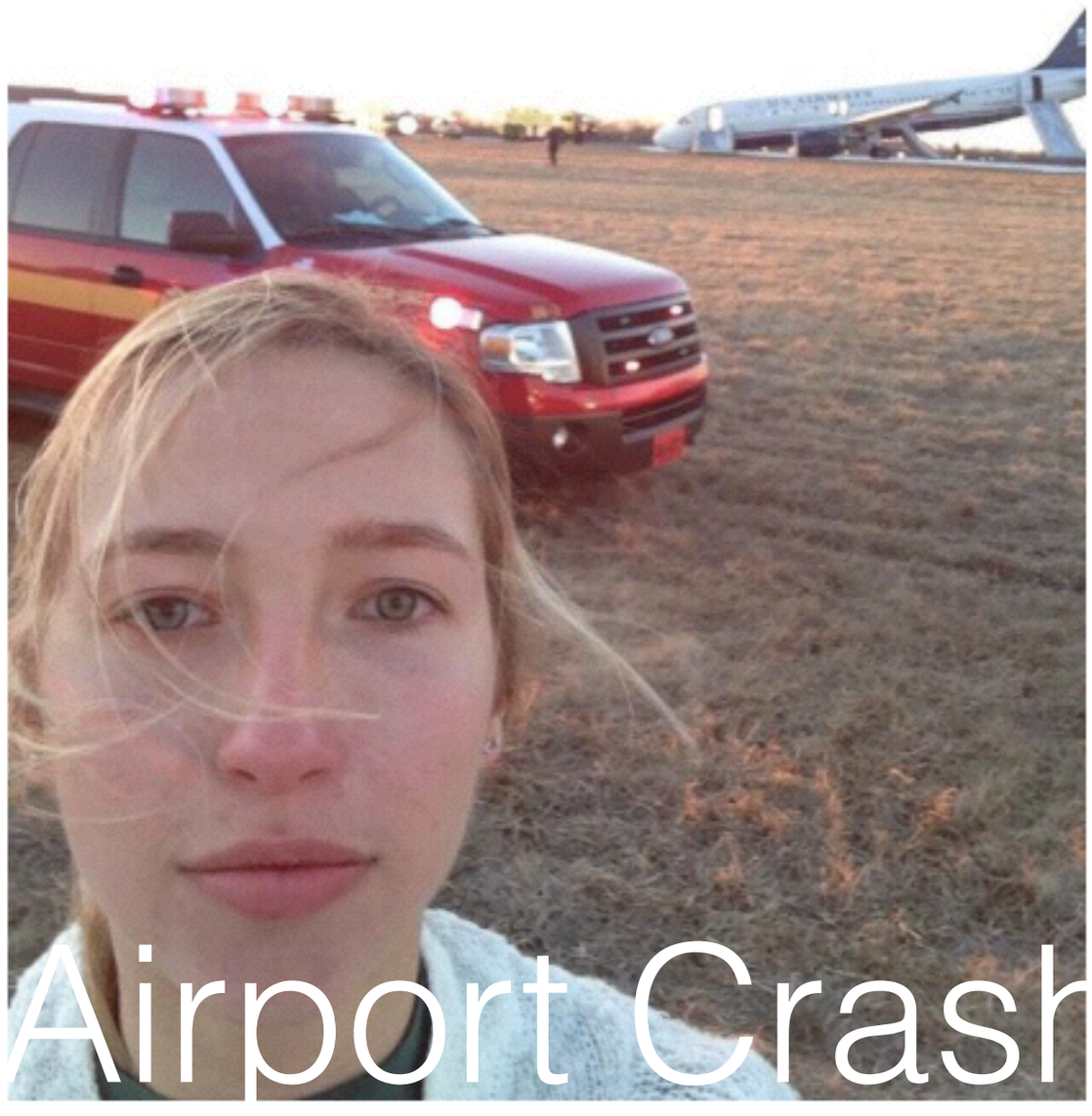
so my plane just crashed...
pic.twitter.com/X51BLwa5PS

Reply Retweet Favorite ••• More

skip
@han_horan

so yup pic.twitter.com/2WuLUWzpND

Reply Retweet Favorite ••• More

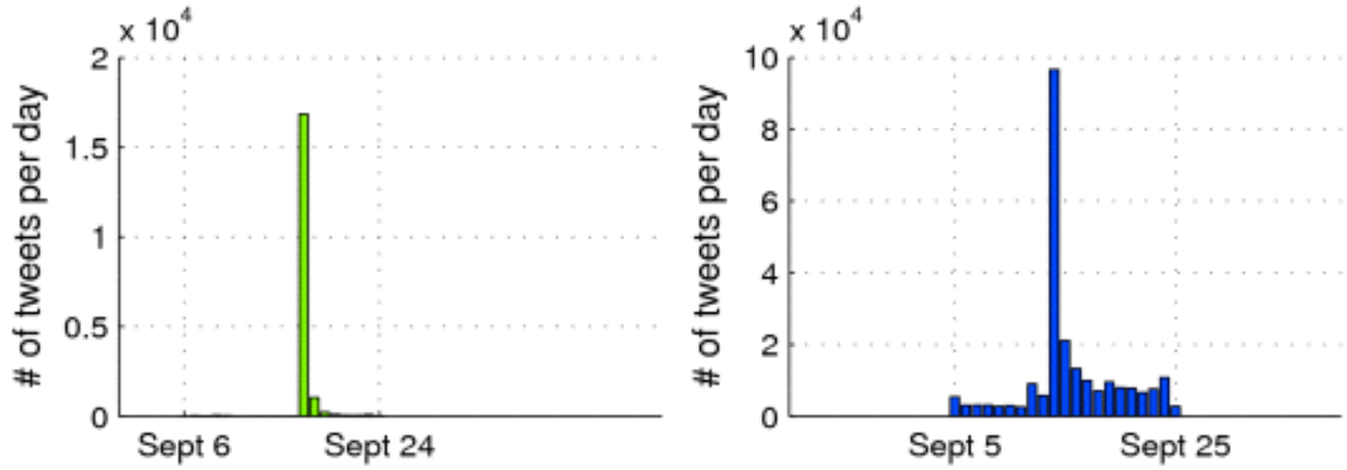


2014 Philly Airport Crash

Breaking News

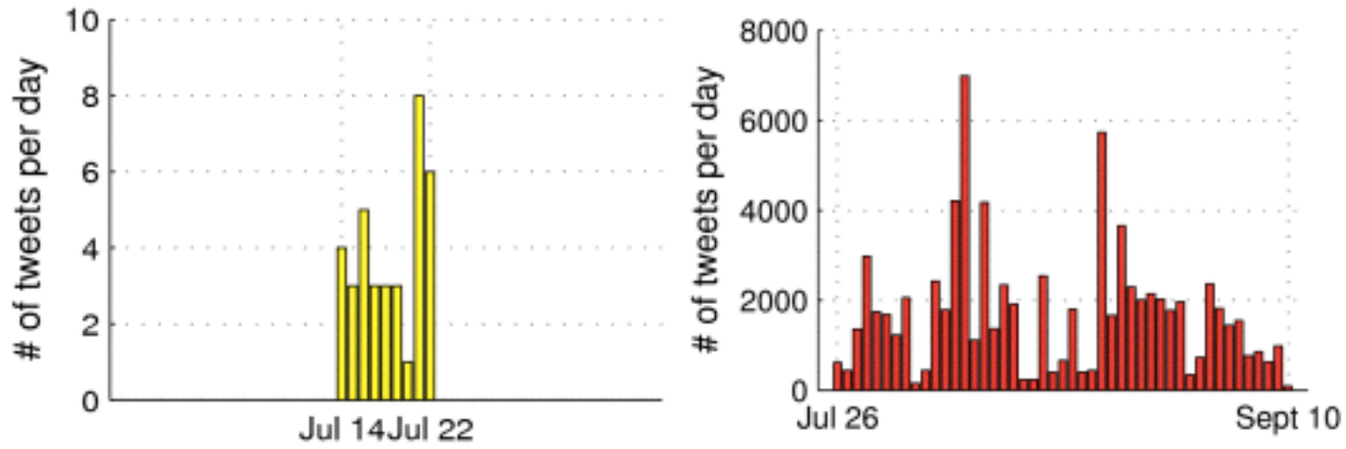
	Subcritical		Critical	
Exo.	31.5%	(1,905)	54.3%	(3,290)
Endo.	6.9%	(419)	7.3%	(444)

Table 1: # of topics in each category



(a) Exogenous subcritical (topic '#backintheday')

(b) Exogenous critical (topic 'beyonce')



(c) Endogenous subcritical (topic 'lynn harris')

(d) Endogenous critical (topic '#redsox')

Source: Kwak, Lee, Park and Moon."What is Twitter, a Social Network or a News Media?" WWW 2010

Military

POLICYWATCH 2186

Foreign Jihadists in Syria: Tracking Recruitment Networks

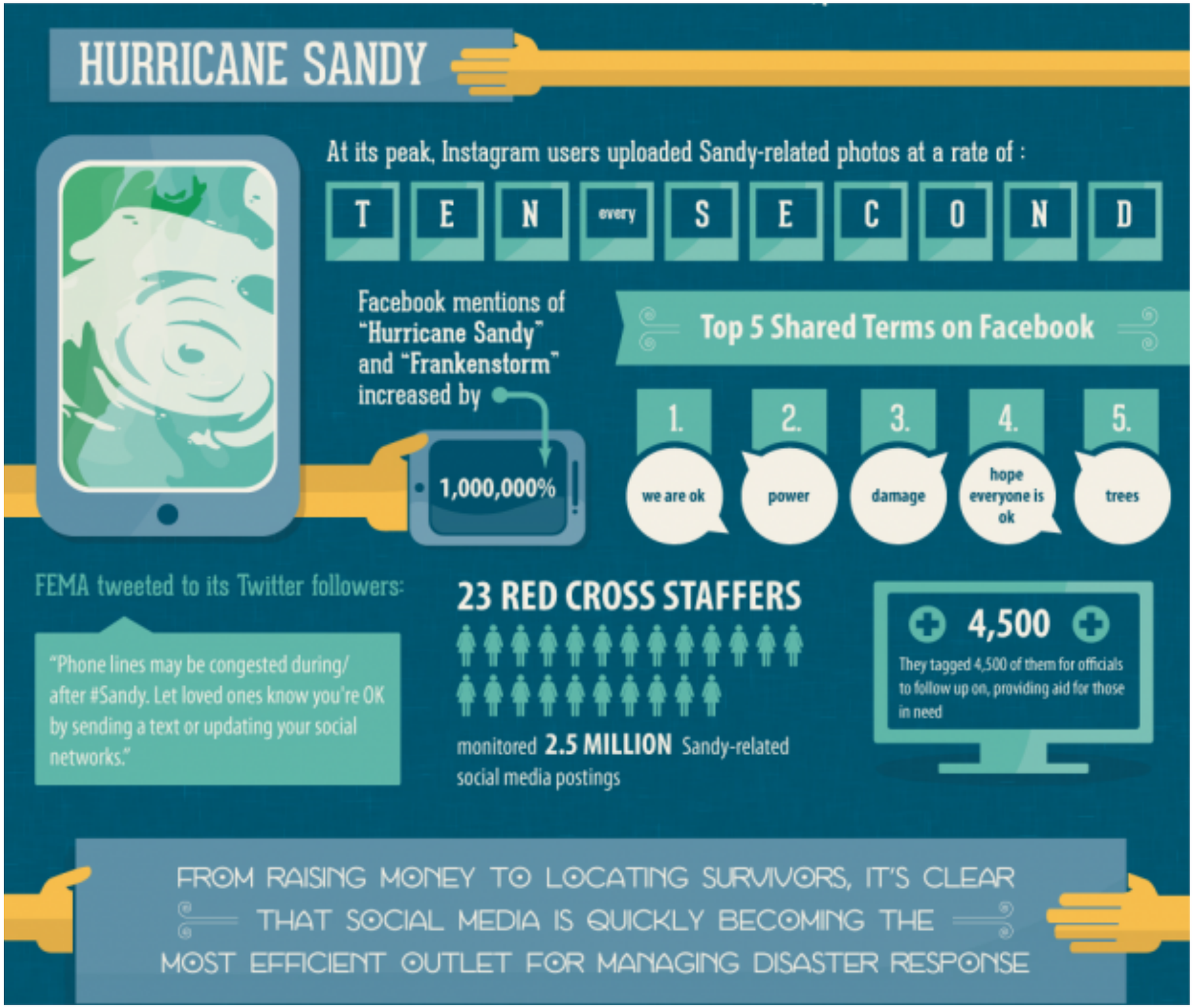
Aaron Y. Zelin

Also available in العربية

December 19, 2013

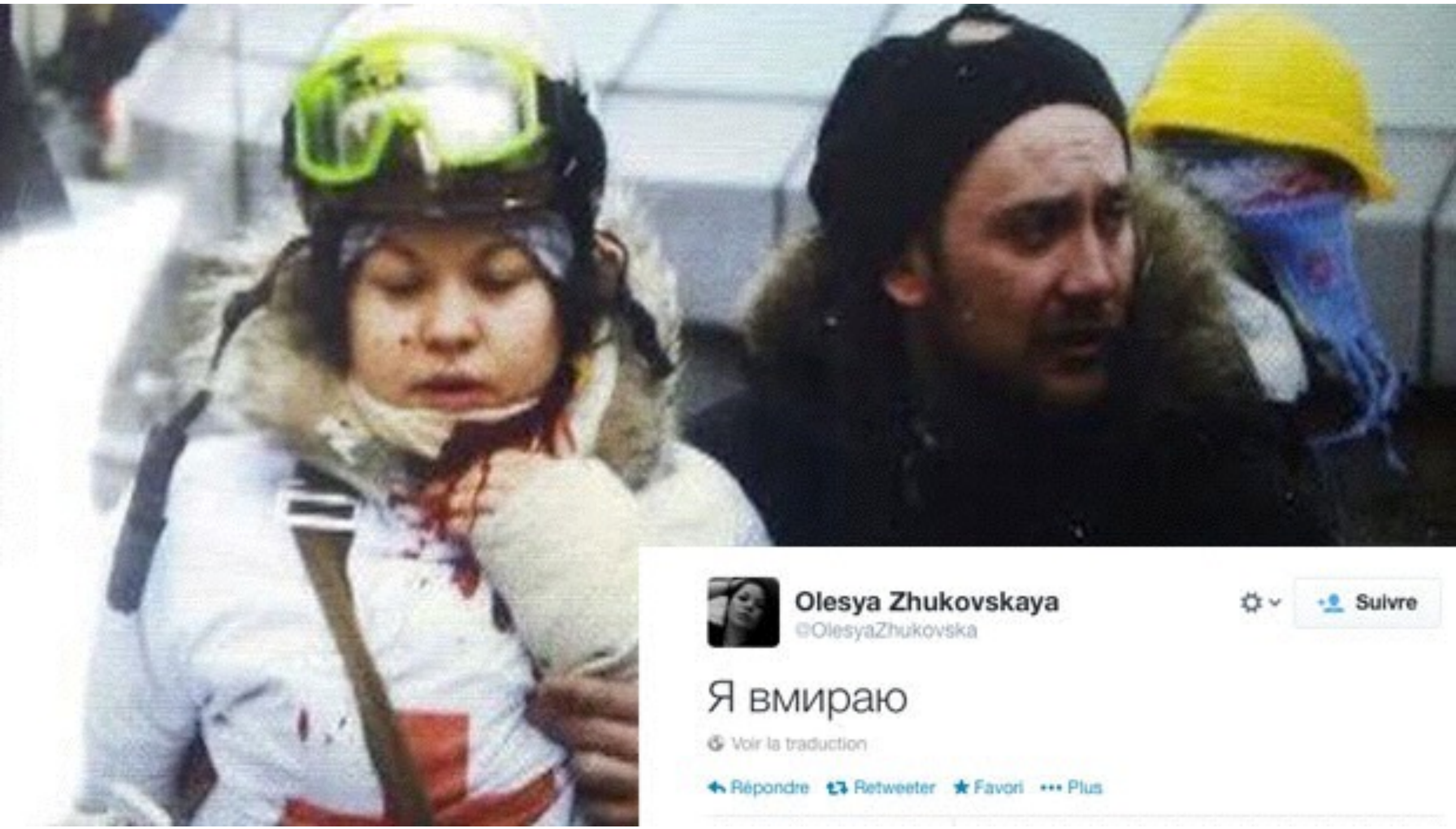
Monitoring jihadist social-media networks reveals where fighters are coming from, where in Syria they are fighting, and how best to stem their continued recruitment in countries such as Saudi Arabia, Libya, and Tunisia.

Disaster Relief



Source: http://www.ihubmedia.com/social-media-the-new-face-of-disaster-response/

2014 Ukrainian Revolution



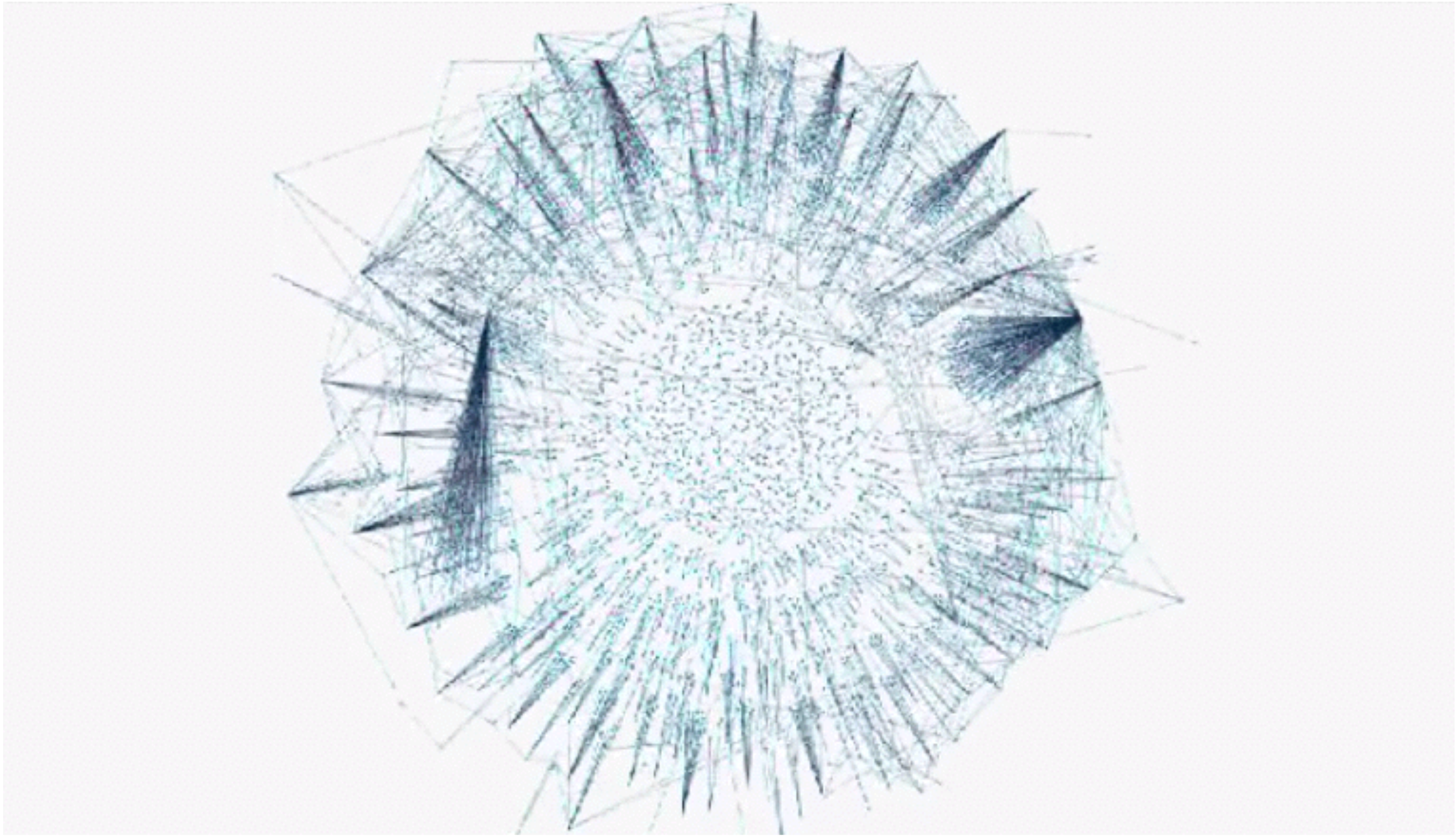
2010 Arab Spring

Social Media Use in Revolution

- to evade detection of protest activity
- spread ideas
- recruit new members
- video the progress of the movement
- organize events

Source: Kyle Jernigan & Richard Skinner

Social Media / Network



Source: André Panisson https://www.youtube.com/watch?v=2guKJfvq4ul

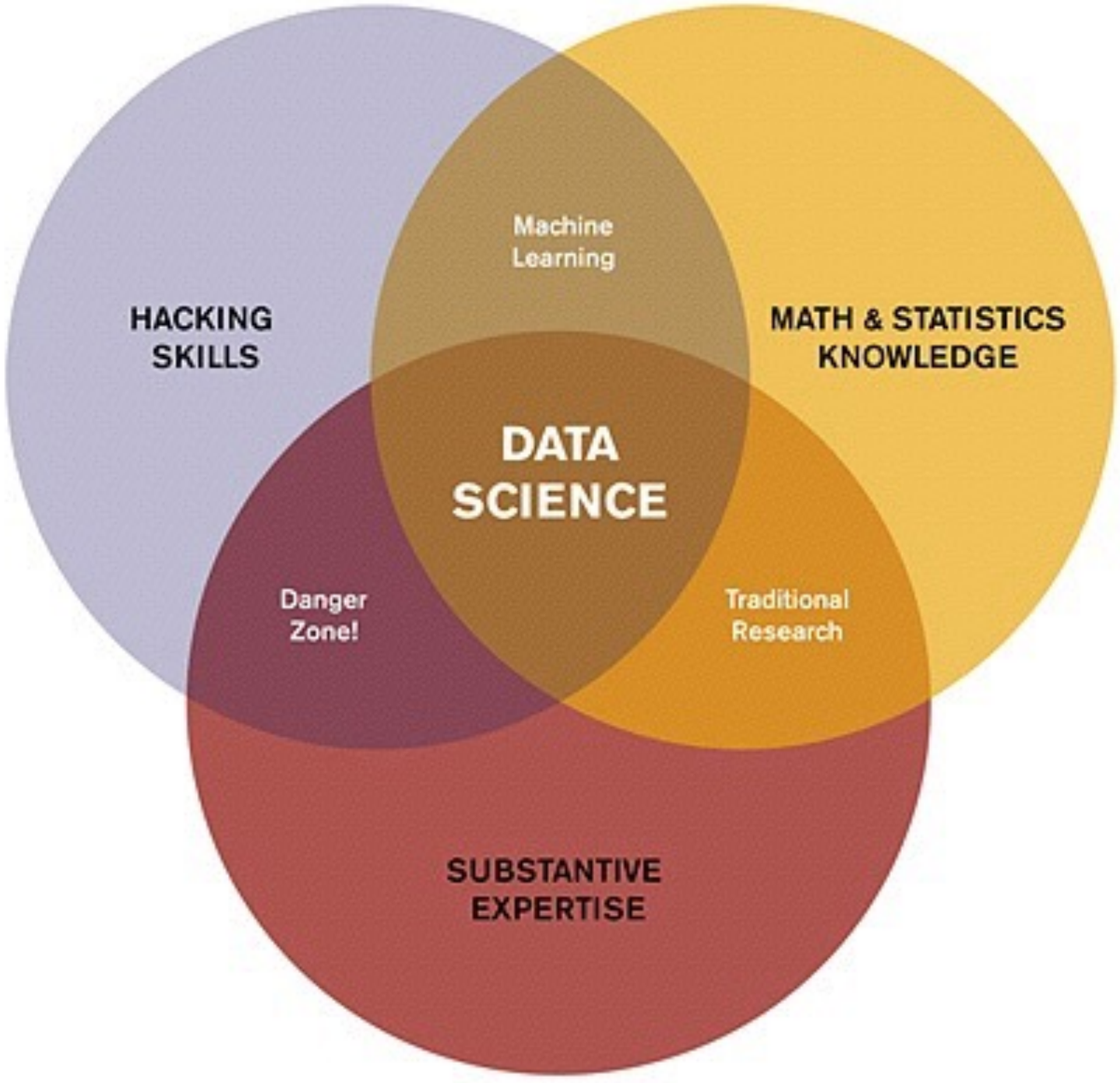
Research Value

- In contrast to survey/self-report
- A probe to:
  - **real** human behavior
  - **real** human opinion
  - **real** human language use
- Easy to access and aggregate **a lot** of data
- thus **a lot** of information

Research on Social Media

- **Data Science** (part I of this course)
  - marketing, politics, finance, health, military …
- **Text analysis for social media data** (part II)
  - statistical analysis methods, off-the-shelf NLP tools, Twitter API …
- **Social media data for text analysis** (part III)
  - paraphrase, semantics, sentiment …

Data Science



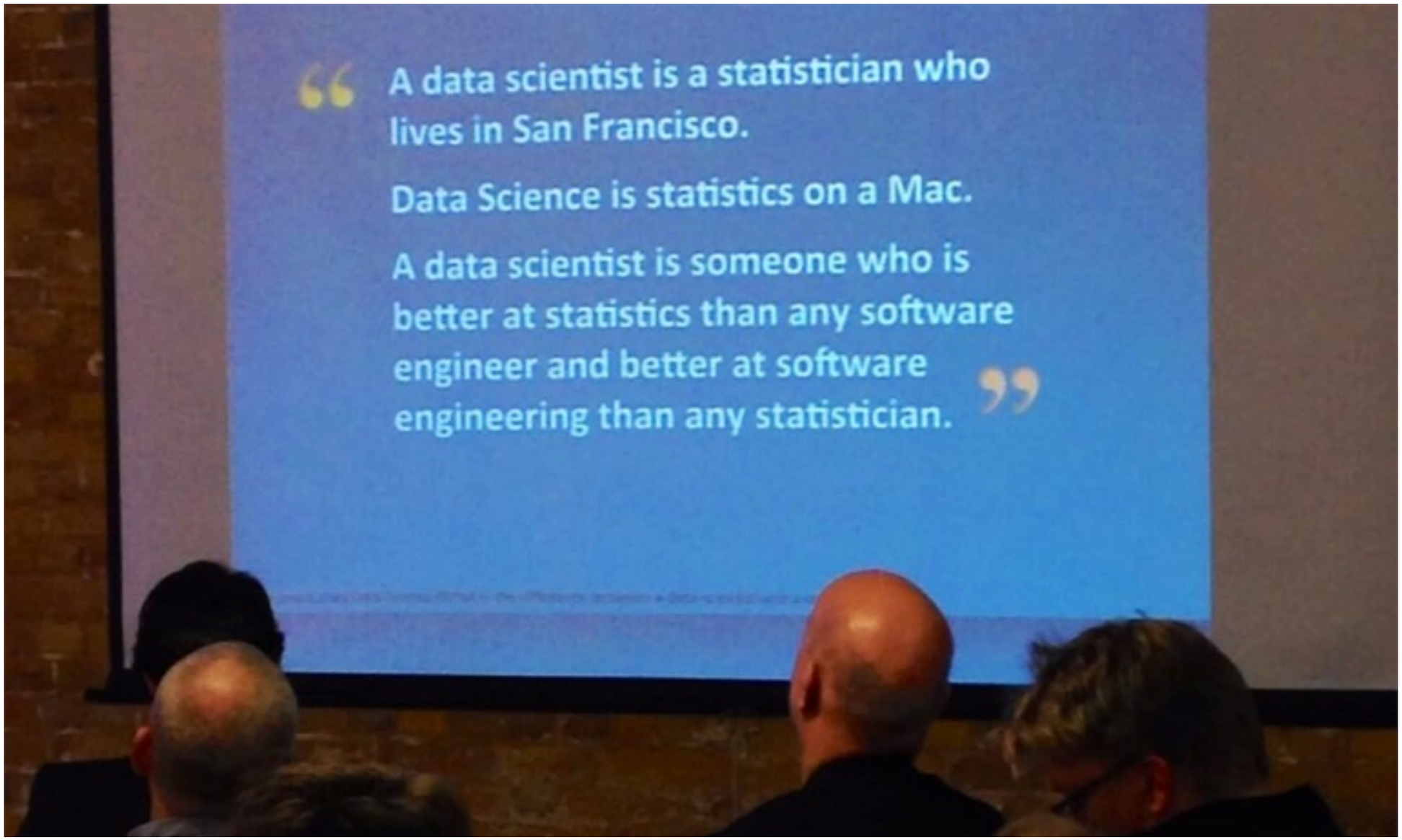
Source: Drew Conway

Data Science

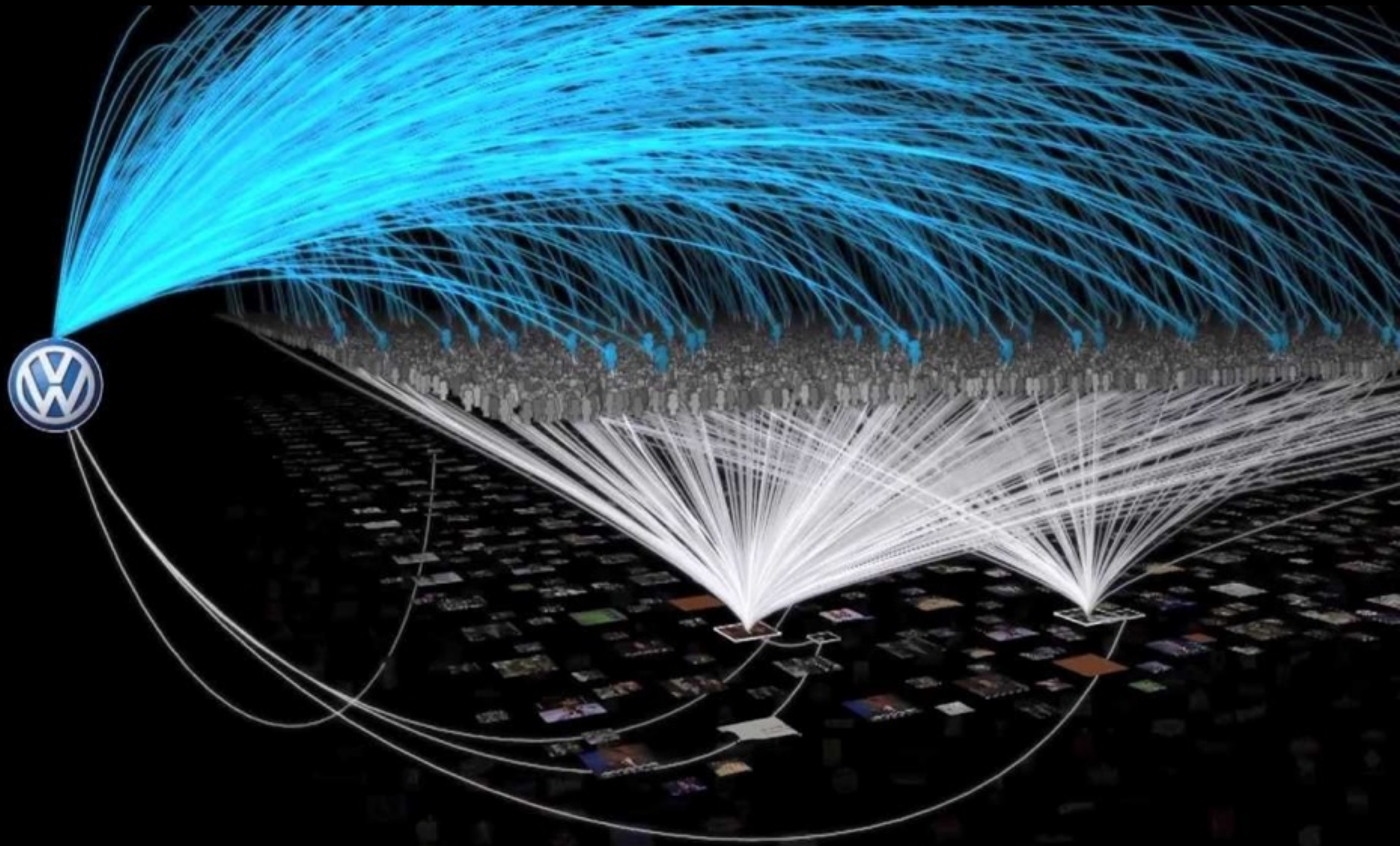
- is the **practice** of:
  - asking question (formulating hypothesis)
  - finding and collecting the data needed (often big data)
  - performing statistical and/or predictive analytics (often machine learning)
  - discovering important information and/or insights

Data Science

- the infamous definition:



Marketing



Source: Twitter Ads https://www.youtube.com/watch?v=K8KJWoNk_Rg

User Profiling

Follow

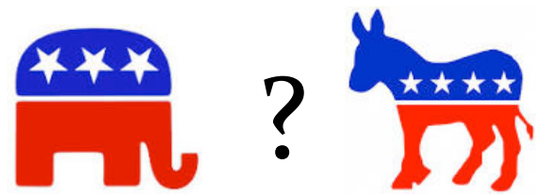
Delighted I kept my Xmas vouchers - Happy Friday to me 😊 #shopping

Follow

Yesterday's look-my new obsession is this Givenchy fur coat! Wolford sheer turtleneck, Proenza skirt & Givenchy boots

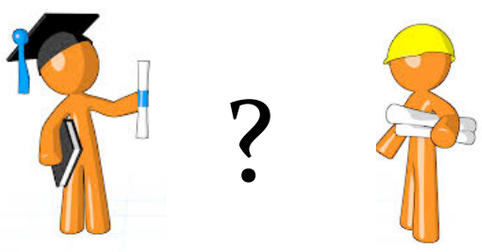
Follow

We've already tripled wind energy in America, but there's more we can do.



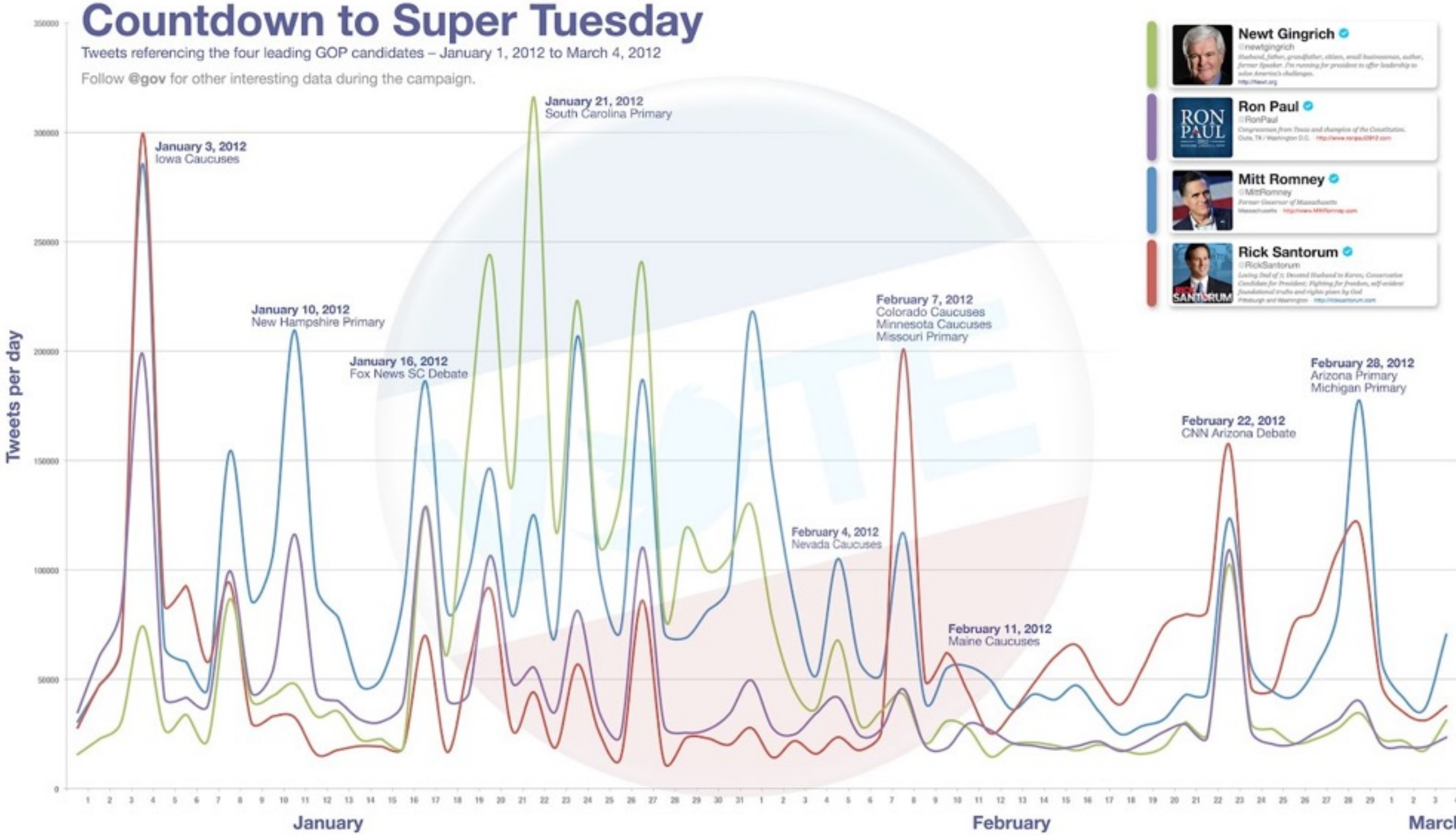
Follow

Two giant planets may cruise unseen beyond Pluto - space - June 2014 - New Scientist: newscientist.com/article/dn2571



Source: Volkova, Van Durme, Yarowsky, Bachrach "Tutorial on Social Media Predictive Analytics" NAACL 2015

Politics



Source: Twitter Blog

Political Polarization

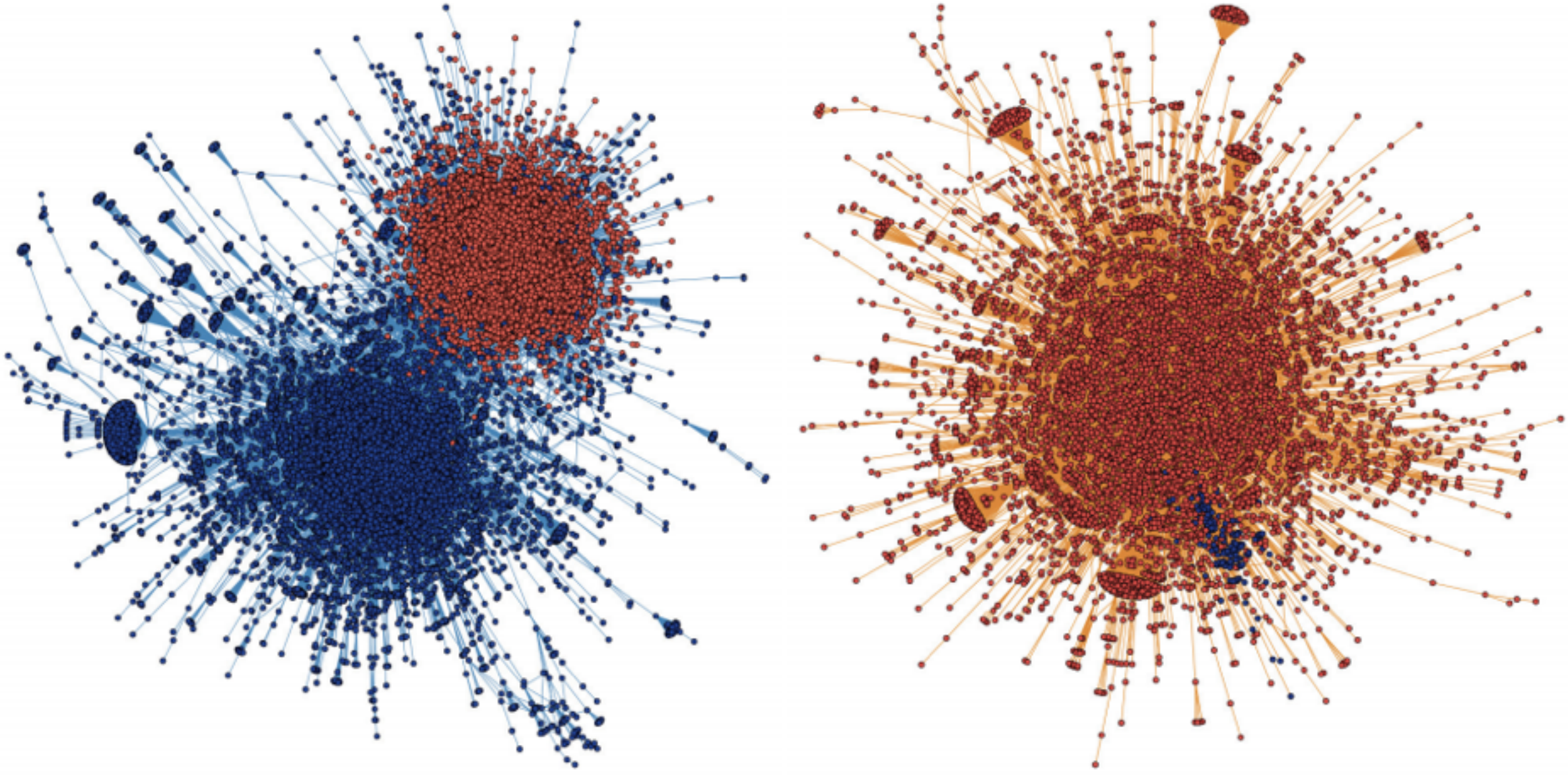


Figure 1: The political retweet (left) and mention (right) networks, laid out using a force-directed algorithm. Node colors reflect cluster assignments (see § 3.1). Community structure is evident in the retweet network, but less so in the mention network. We show in § 3.3 that in the retweet network, the red cluster A is made of 93% right-leaning users, while the blue cluster B is made of 80% left-leaning users.

Source: Conover, Francisco, Flammini, Flammini. "Political Polarization on Twitter" ICWSM 2011

Movie Sales

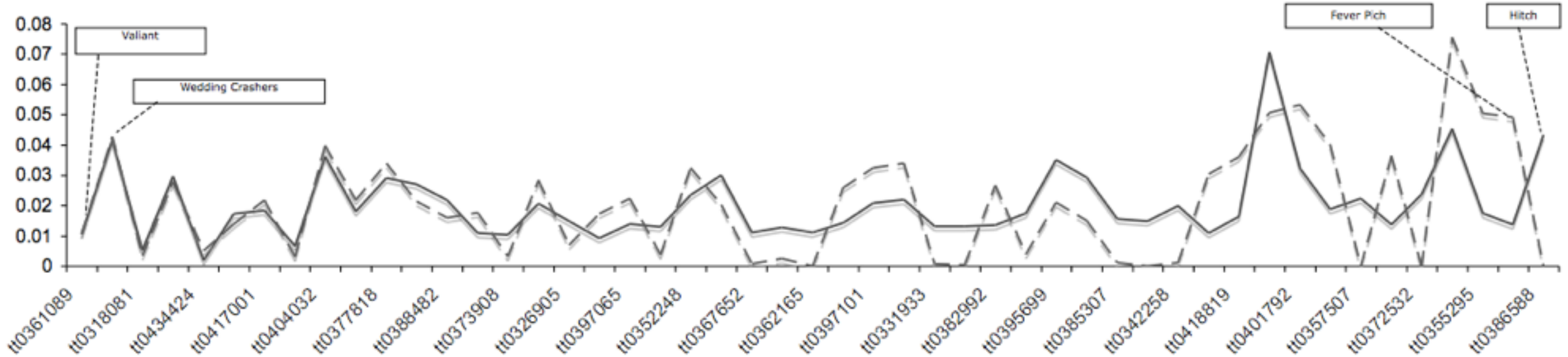
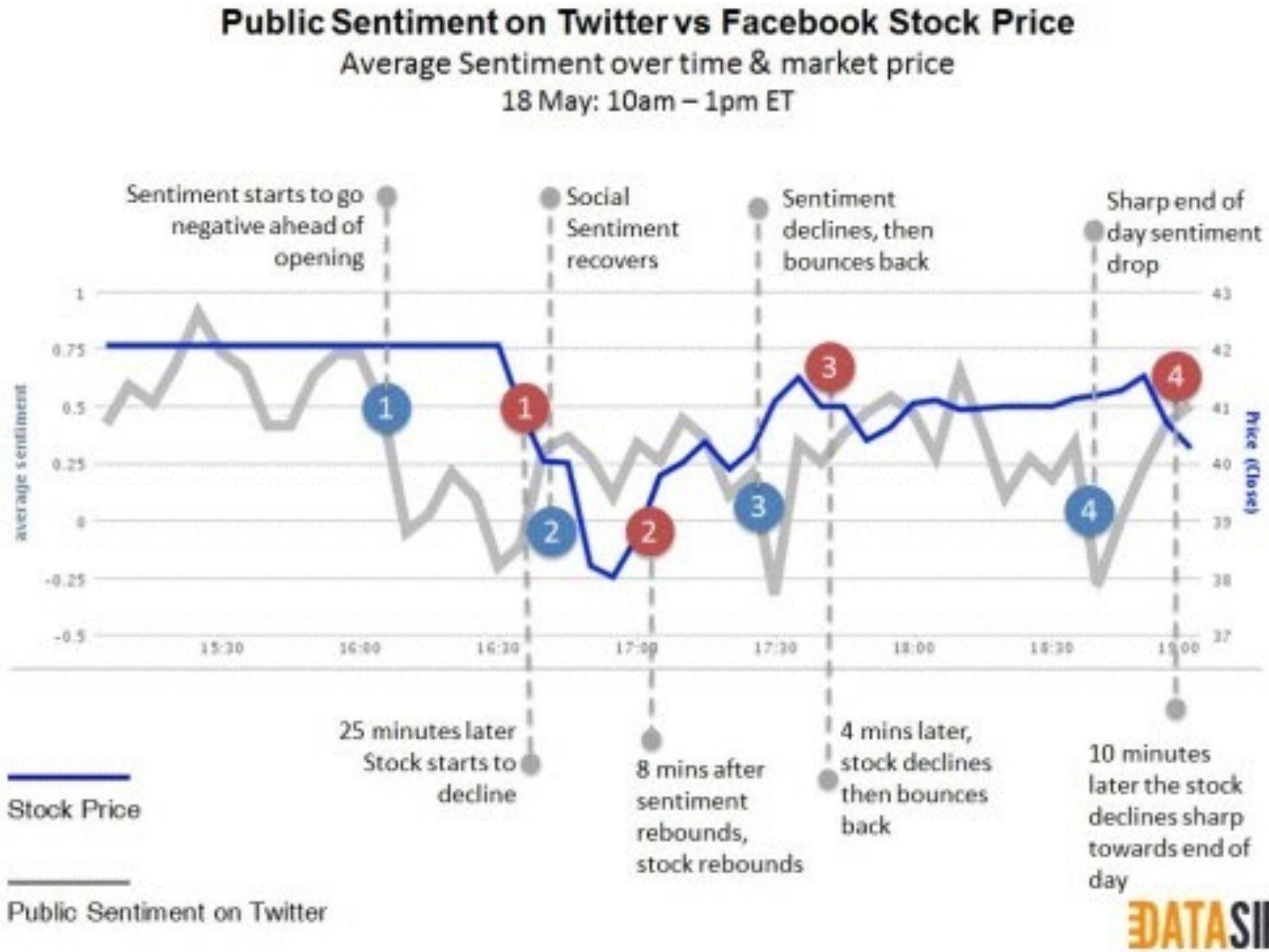


Figure 2: Per-movie comparison of income per screen (blue, continuous line) and positive references (green, dashed line), sorted by degree of correlation. For space reasons, the X-axis shows only the movie IMDB ID.

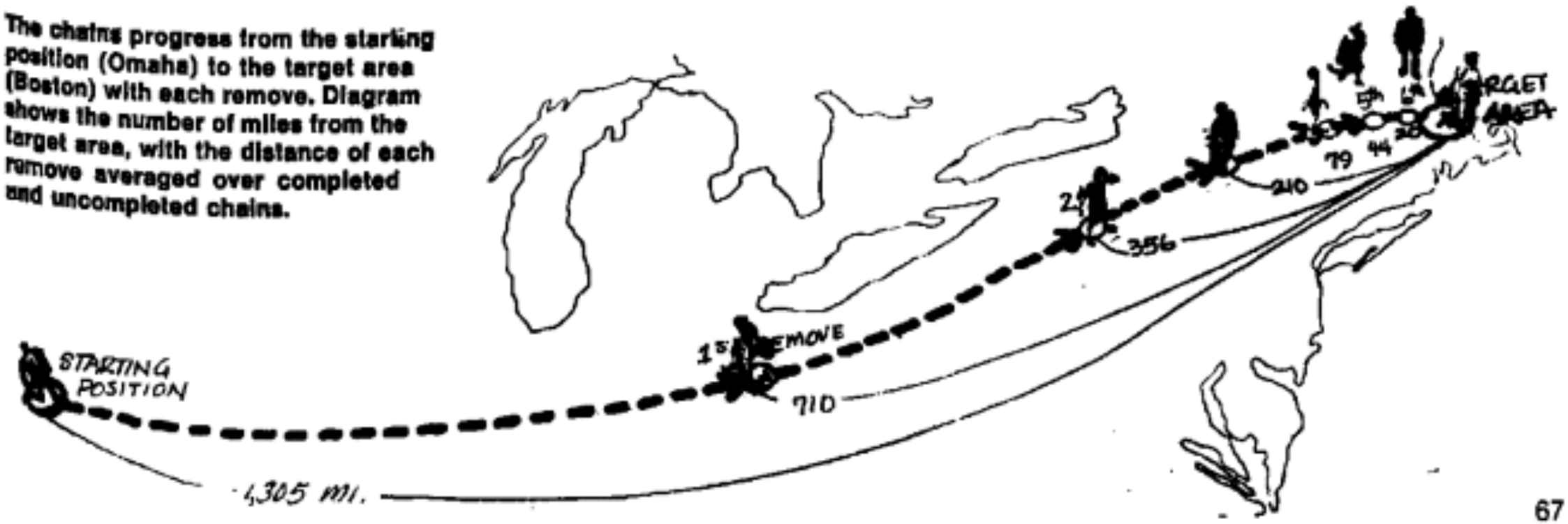
Source: Mishne G, Glance N. "Predicting Movie Sales from Blogger Sentiment" AAAI 2006

Finance


Public Sentiment on Twitter vs Facebook Stock Price
Average Sentiment over time & market price
18 May: 10am – 1pm ET
Sentiment starts to go negative ahead of opening
Social Sentiment recovers
Sentiment declines, then bounces back
Sharp end of day sentiment drop
average sentiment
Price (Close)
25 minutes later Stock starts to decline
8 mins after sentiment rebounds, stock rebounds
4 mins later, stock declines then bounces back
10 minutes later the stock declines sharp towards end of day
Stock Price
Public Sentiment on Twitter
DATASIFT

Socialization

The chains progress from the starting position (Omaha) to the target area (Boston) with each remove. Diagram shows the number of miles from the target area, with the distance of each remove averaged over completed and uncompleted chains.



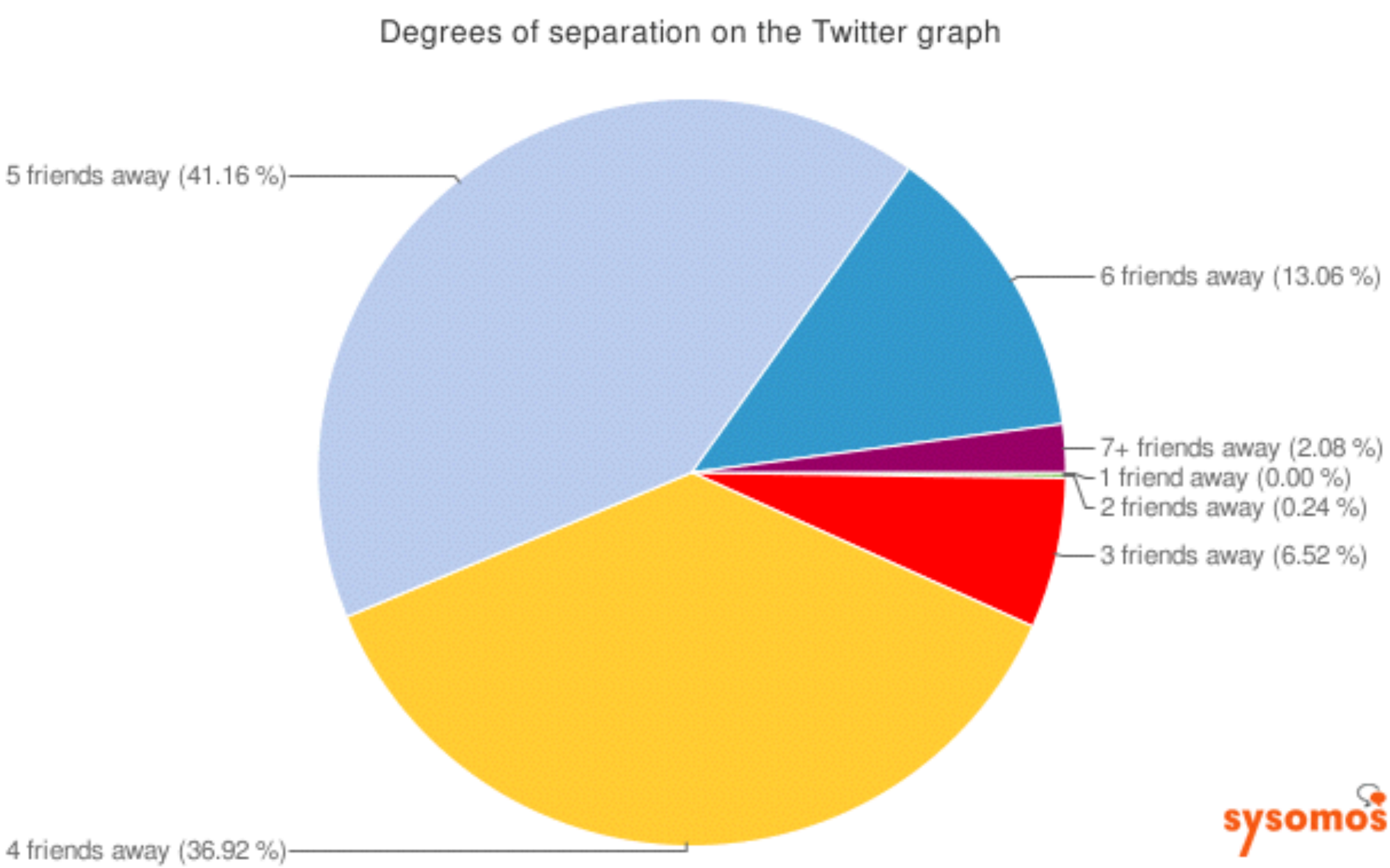
Source: Stanley Milgram. "The Small World Problem" Psychology Today, 1967

Socialization

- “six degrees of separation” theory
  - originally presented by Hungarian author, Frigyes Karinthy, in 1929
  - first tested by psychologist Stanley Milgram in 1967 (a self-selected group of about 300)
- Twitter shows it’s 4.67 degrees of separation in 2010 (5.2m relationships)
- Facebook proves it’s 4.74 steps (4.37 for US) in 2011 (721m users)

Source: http://barnraisersllc.com/2012/04/studies-social-media-6-degrees-of-separatio/

Socialization



Source: http://barnraisersllc.com/2012/04/studies-social-media-6-degrees-of-separatio/

Politeness

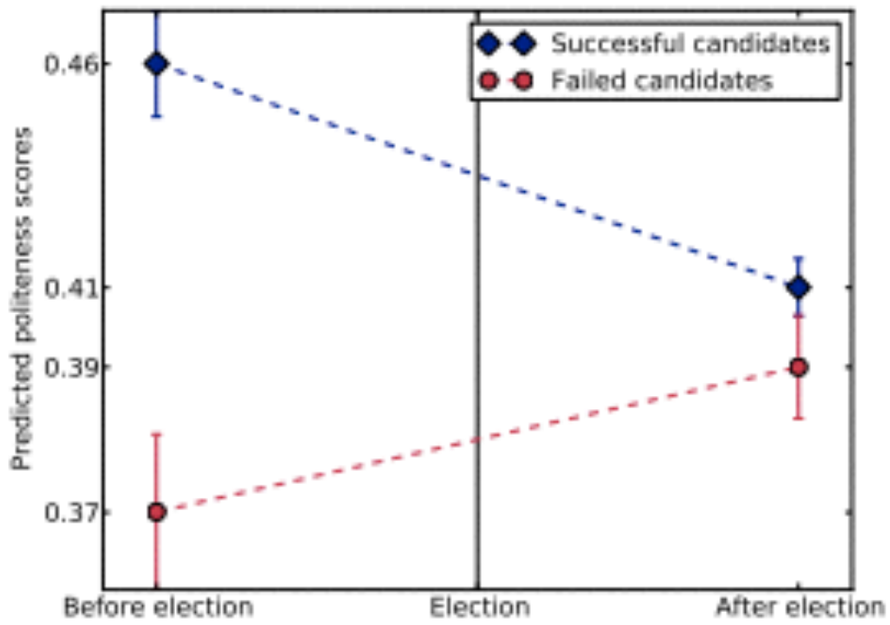


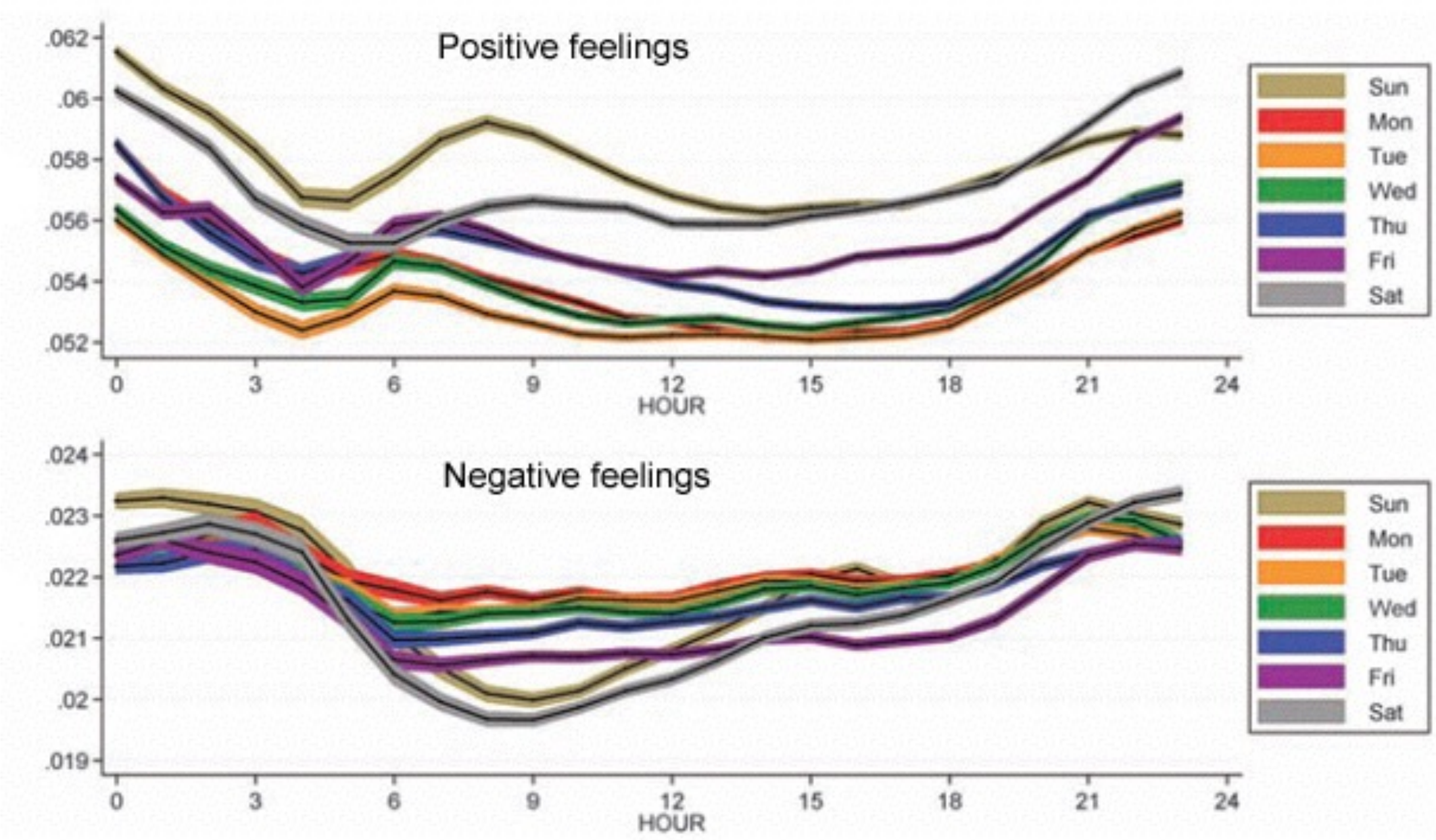
Figure 3: Successful and failed candidates before and after elections. Editors that will eventually succeed (diamond marker) are significantly more polite than those that will fail (circle markers). Following the elections, successful editors become less polite while unsuccessful editors become more polite.

Role	Politeness	Top quart.
Question-asker	0.65^{***}	$32\%^{***}$
Answer-givers	0.52^{***}	$20\%^{***}$

Table 6: Politeness and dependence. Requests made in comments posted by the question-asker are significantly more polite than the other requests. Analysis conducted on 181k requests (106k for question-askers, 75k for answer-givers).

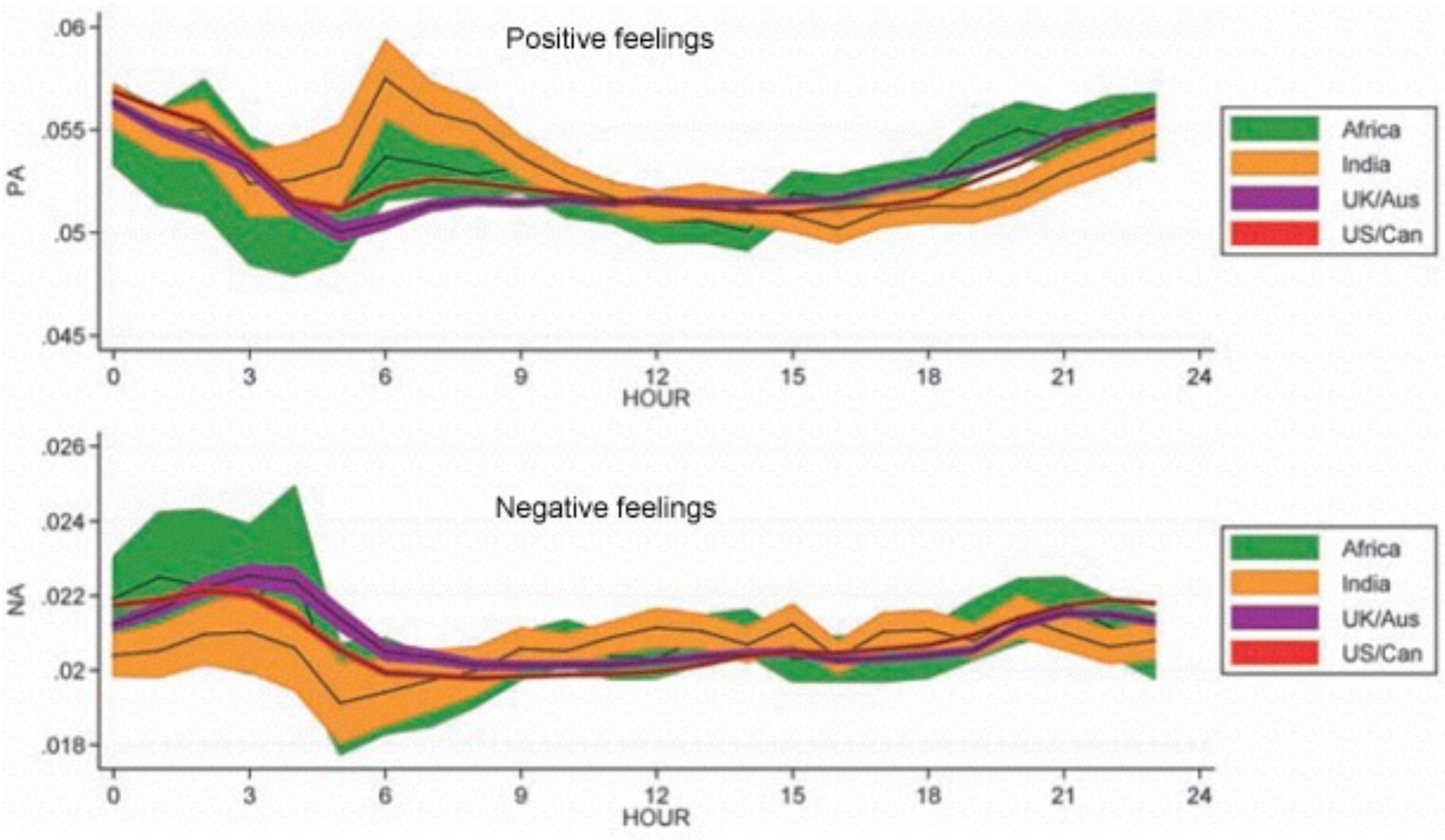
Source: Danescu-Niculescu-Mizil et al.
"A Computational Approach to Politeness with Application to Social Factors" ACL 2013

Mood



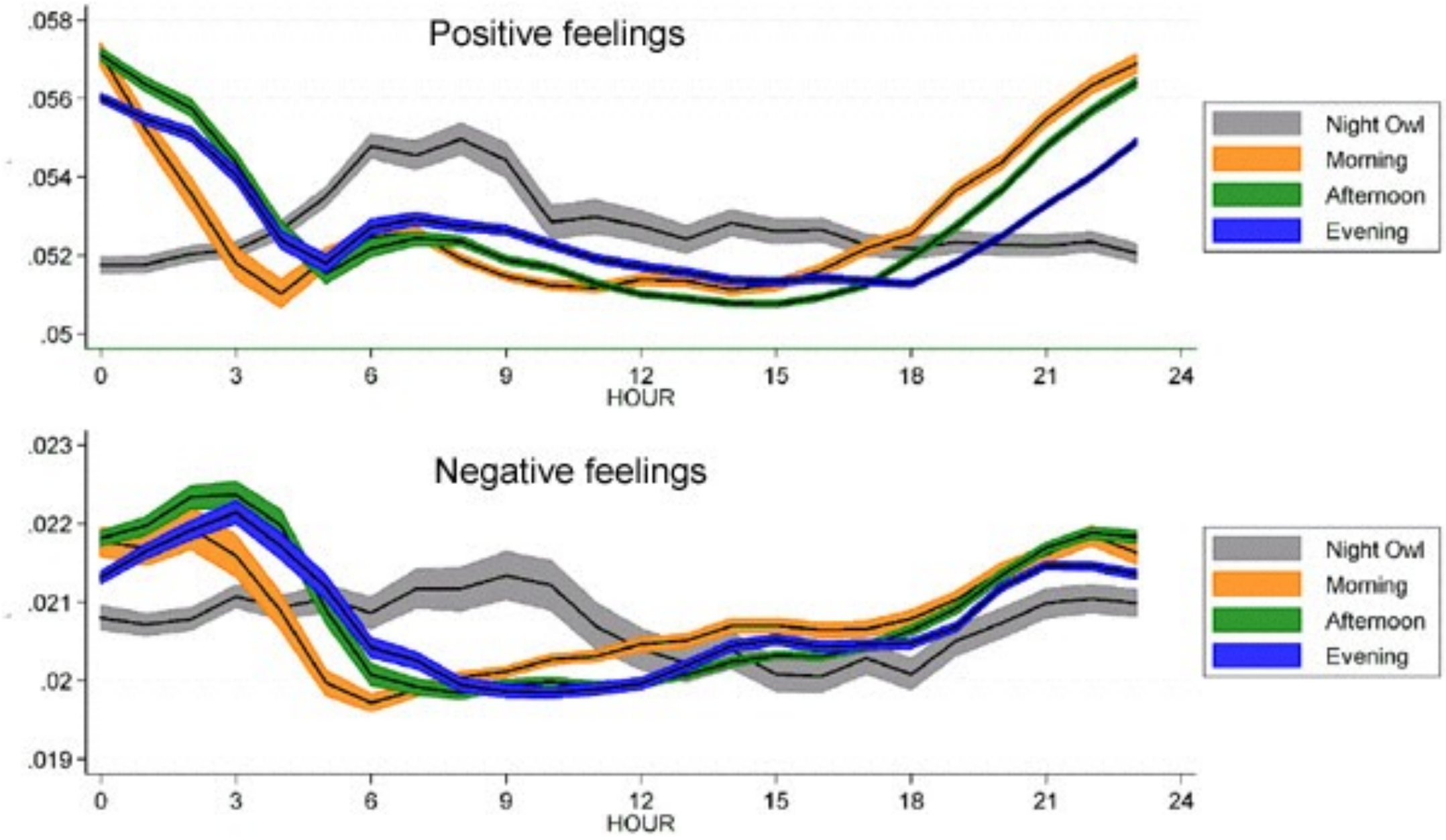
Source: Golder & Macy. "Diurnal and Seasonal Mood Vary with Work, Sleep, and Daylength Across Diverse Cultures" Science 2011

Mood



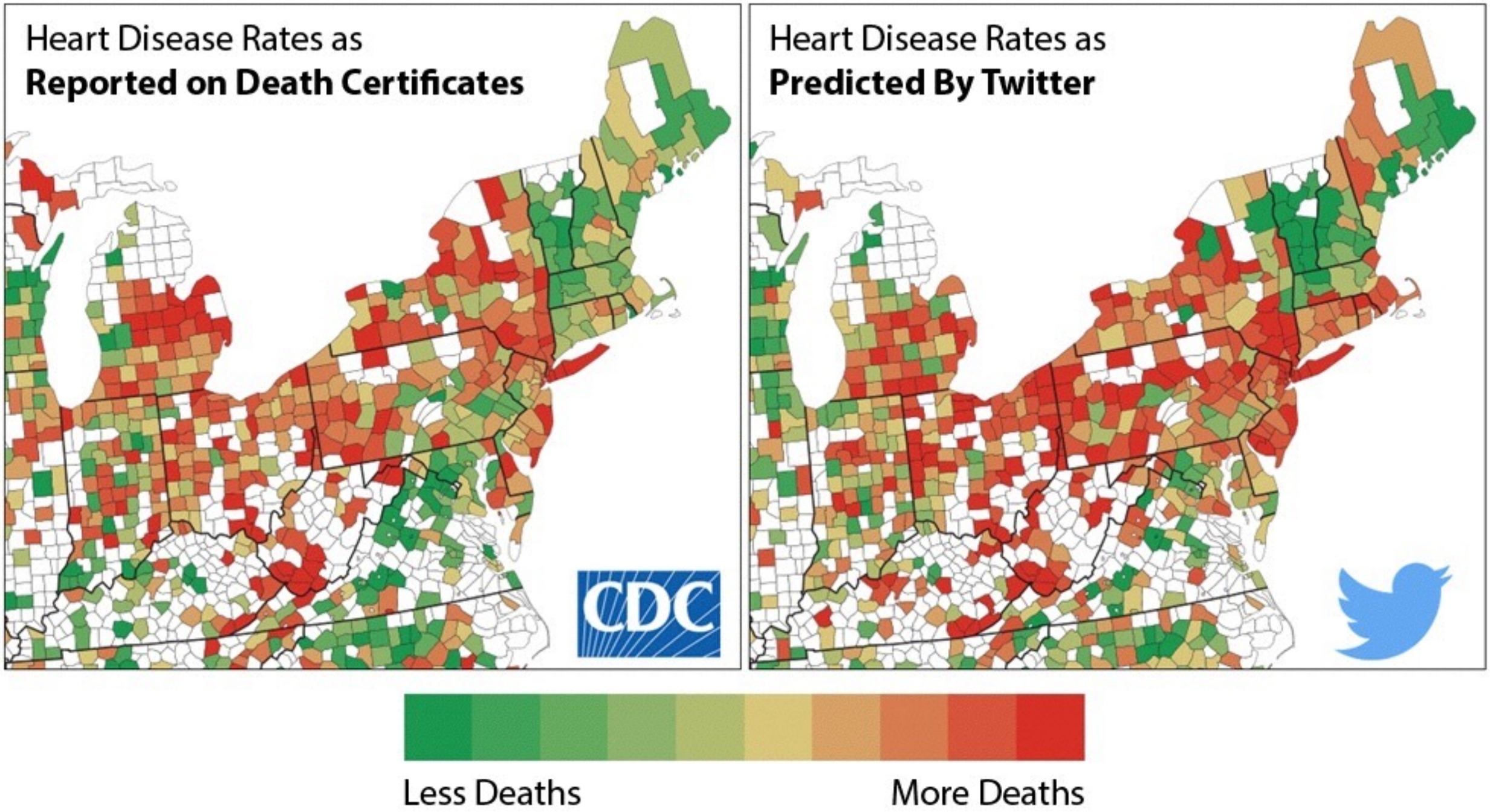
Source: Golder & Macy. "Diurnal and Seasonal Mood Vary with Work, Sleep, and Daylength Across Diverse Cultures" Science 2011

Mood



Source: Golder & Macy. "Diurnal and Seasonal Mood Vary with Work, Sleep, and Daylength Across Diverse Cultures" Science 2011

Health



Source: World Well-Being Project @ UPenn

Big Data → Real Data

- marketing, finance, politics
  - targeted users (customers, voters …)
  - polling
- human behavior, health, emotions
  - not reported after the fact
  - not prompted by an experimenter
  - not a small sample
- human language
  - not limited to edited text or small amount

Privacy & Ethics

- Facebook's controversial "emotional contagion" study

However

Most research to date on social media has used very shallow text processing.

(We will discuss this point in more details later in the course.)

Thank You!

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Instructor: Wei Xu

www.cis.upenn.edu/~xwe/

Course Website: socialmedia-class.org