Broadcasters and Hidden Influentials in Online Protest Diffusion

Joint work with
Javier Borge-Holthoefer and Yamir Moreno
(BIFI-University of Zaragoza)

Person of the Year 2011: The Protester

- The word ‘protest’ appears in newspapers exponentially more in 2011 than ever before
- Global tipping point for frustration
- SNSs did not cause the movements, but kept them alive
- Technology helped spread “the virus of protest”

Wave of Protests (2011): Timeline of Events

January: Tunisia, Algeria, Saudi Arabia, Egypt, Syria, Jordan
February: Yemen, Bahrain, Libya, Greece, Chile
May: Spain, Greece, Chile
July: Israel
August: UK
September: US
December: Russia

Diffusion and Communication Networks

Models of Diffusion

Innovation, but also other examples with network externalities and information cascades:
- peer-to-peer or media driven? (Coleman et al. 1957 vs van den Bulte et al. 2001)
- contagion, social influence, learning? (Young 2009)
- how do networks shape the process? (Watts 2002; Watts and Dodds 2007)

Networks and Collective Action

Some historical examples:
- insurgency in Paris commune in 1871 (Gould 1991)
- the 60s civil right struggles in the US (McAdam 1986)
- demonstrations in East Germany (Opp and Gern 1993; Lohman 1994)
Threshold Models of Social Influence


Threshold Models – Main Findings
- The shape of threshold distribution determines the global reach of cascades;
- Individual thresholds interact with the size of local networks;
- Critical mass depends on activating large number of low threshold actors that are well connected in the overall structure;
- Exposure to multiple sources can be more important than multiple exposures from the same source (complex contagion).

Influence in Online Networks


The Spanish ‘Indignados’ Movement


Data

#hashtags

- 15man
- 15m
- acampadasol
- spanishrevolution
- democraciarealya
- tomalacalle
- acampadabcn
- acampadasevilla
- acampadavalencia
- 15m
- nolesvotes
- democraciarealya
- 15m
- tomalacalle
- 15 May
- 5 May
- 10 May
- 15 May
- 20 May
- 25 May
The Twitter Network: Statistics

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Full Network</th>
<th>Symmetrical Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>N (# nodes)</td>
<td>87,569</td>
<td>80,715</td>
</tr>
<tr>
<td>M (# arcs)</td>
<td>6,030,459</td>
<td>2,944,367</td>
</tr>
<tr>
<td>avg deg.</td>
<td>69</td>
<td>33</td>
</tr>
<tr>
<td>C (clustering)</td>
<td>0.220</td>
<td>0.198</td>
</tr>
<tr>
<td>l path length</td>
<td>3.24</td>
<td>3.65</td>
</tr>
<tr>
<td>r (assortativity)</td>
<td>-0.139</td>
<td>-0.0344</td>
</tr>
<tr>
<td># strong components</td>
<td>5,249</td>
<td>139</td>
</tr>
<tr>
<td>N giant component</td>
<td>82,253</td>
<td>80,421</td>
</tr>
<tr>
<td>N 2nd component</td>
<td>5,373</td>
<td>5,082</td>
</tr>
<tr>
<td>max(N,in) (# following)</td>
<td>31,798</td>
<td>5,082</td>
</tr>
</tbody>
</table>

Distribution of Users in the Network by Activity

Recruitment and Activation Thresholds
- Activation time: moment when users start emitting protest messages
- $k_i/k_{ion} = 0$ → low threshold individuals (no need of “local pressure”)
- $k_i/k_{ion} = 1$ → high threshold individuals (need high “local pressure”)

Offline Media Coverage of Protests
- News Search – keywords used: "15-M" or "indignados" or "democracia real"
Distribution of Thresholds before and after 15-M

Threshold Distribution by Activation Day

Percentage of Activated Users by Type

Information Cascades

Where are Recruiters and Spreaders?

Information Cascades

‘Spike Trains’

\( t \), \( t + \Delta t \), \( t + 2\Delta t \)

(Bakshy et al. 2011)

\( k \)-shell decomposition

(Kitsak et al. 2010)
Where are the Recruiters?

Where are the Spreaders?

Where are the Spreaders?

Summary of Findings

- feedback between dynamics of recruitment and information diffusion
- being central is crucial for diffusion, not so for recruitment
- exogenous factors create random seeding in the network

Discussion

To main limitations:

- we do not control for homophily
- we do not control for exposure to offline media

so we might be overestimating influence

So Gladwell got it wrong…