The topology of a discussion:
The #occupy case
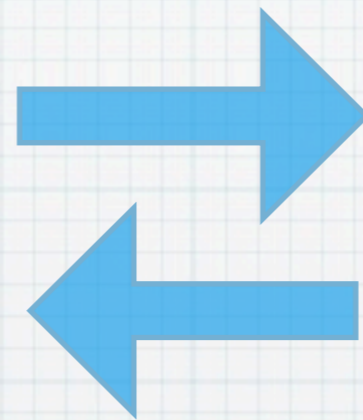
J. Bindi, F. Gargiulo, A. Apolloni

The general framework

HUMAN COMMUNICATION PATTERNS:

* Opinion dynamics
*Temporal activity
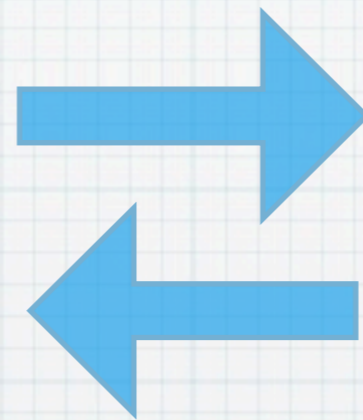* Interaction rules

SEMANTIC CONTENT OF A DISCUSSION:

* Topic of discussion
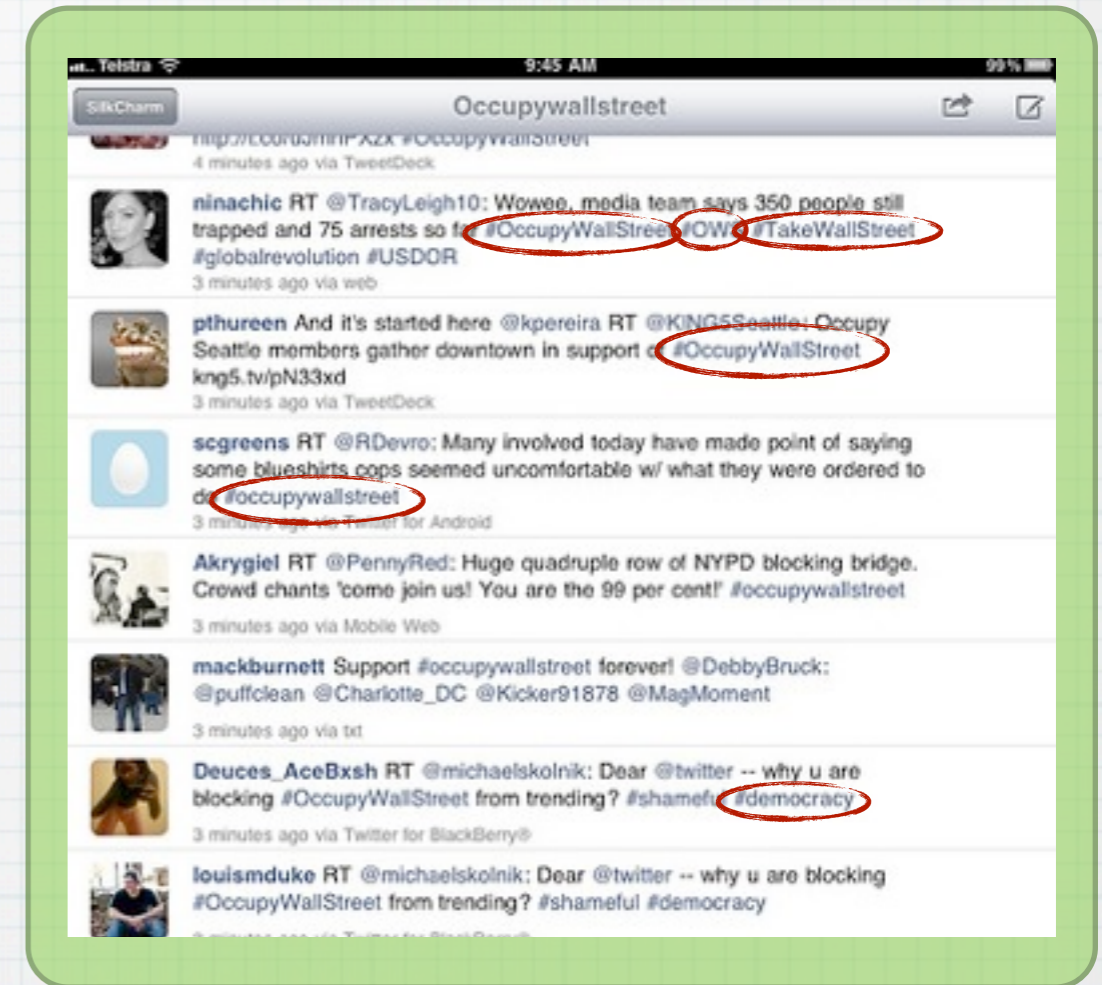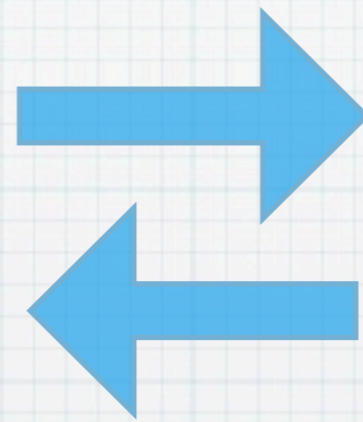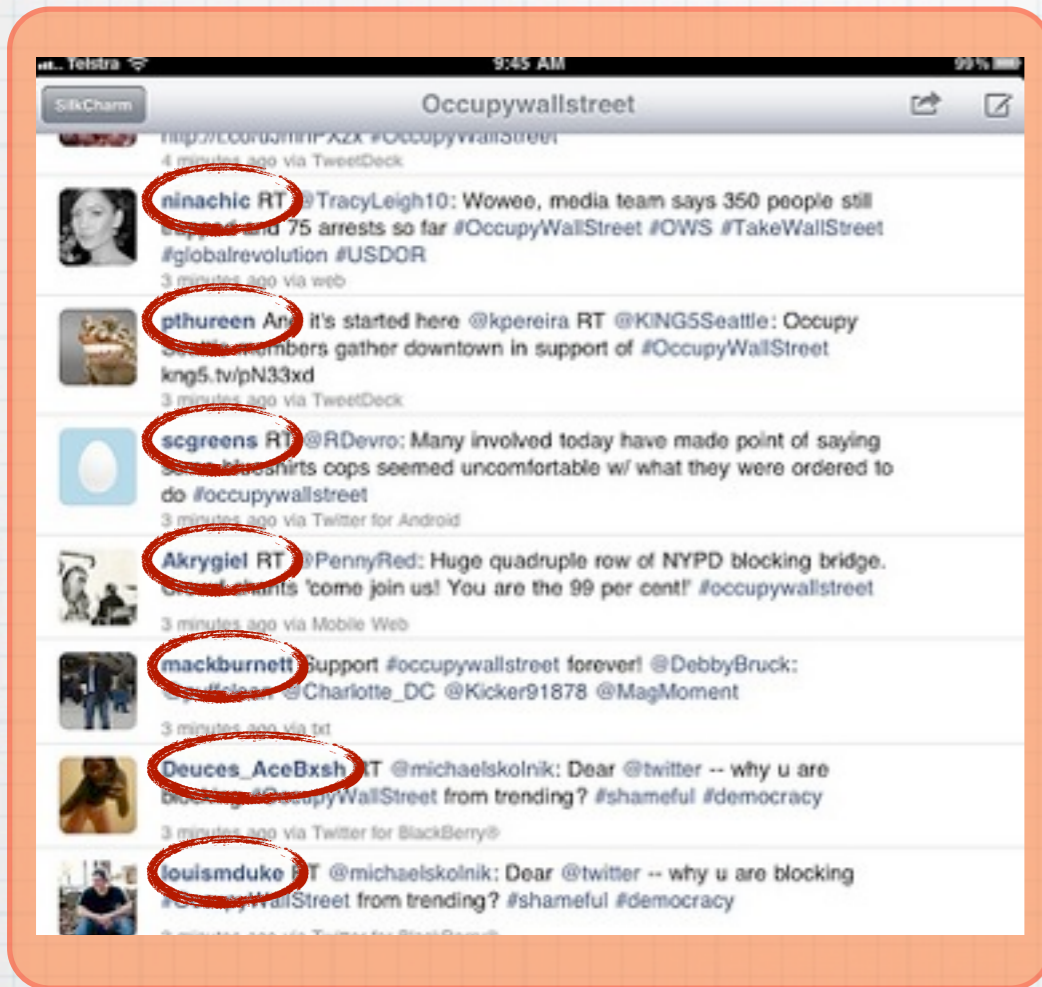* Interest peaks

HUMAN COMMUNICATION PATTERNS:

* Opinion dynamics
*Temporal activity
* Interaction rules

SEMANTIC CONTENT OF A DISCUSSION:

* Topic of discussion
* Interest peaks

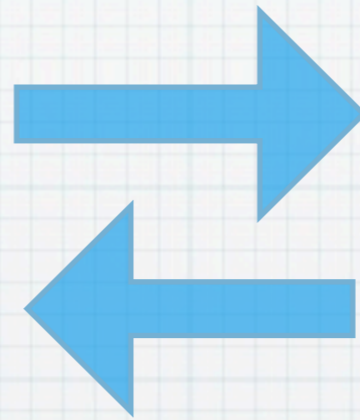# The Twitter platform

The Twitter platform

@USERS ⇄ **#HASHTAGS**

The Twitter platform

Social movements 2.0

we are the 99%

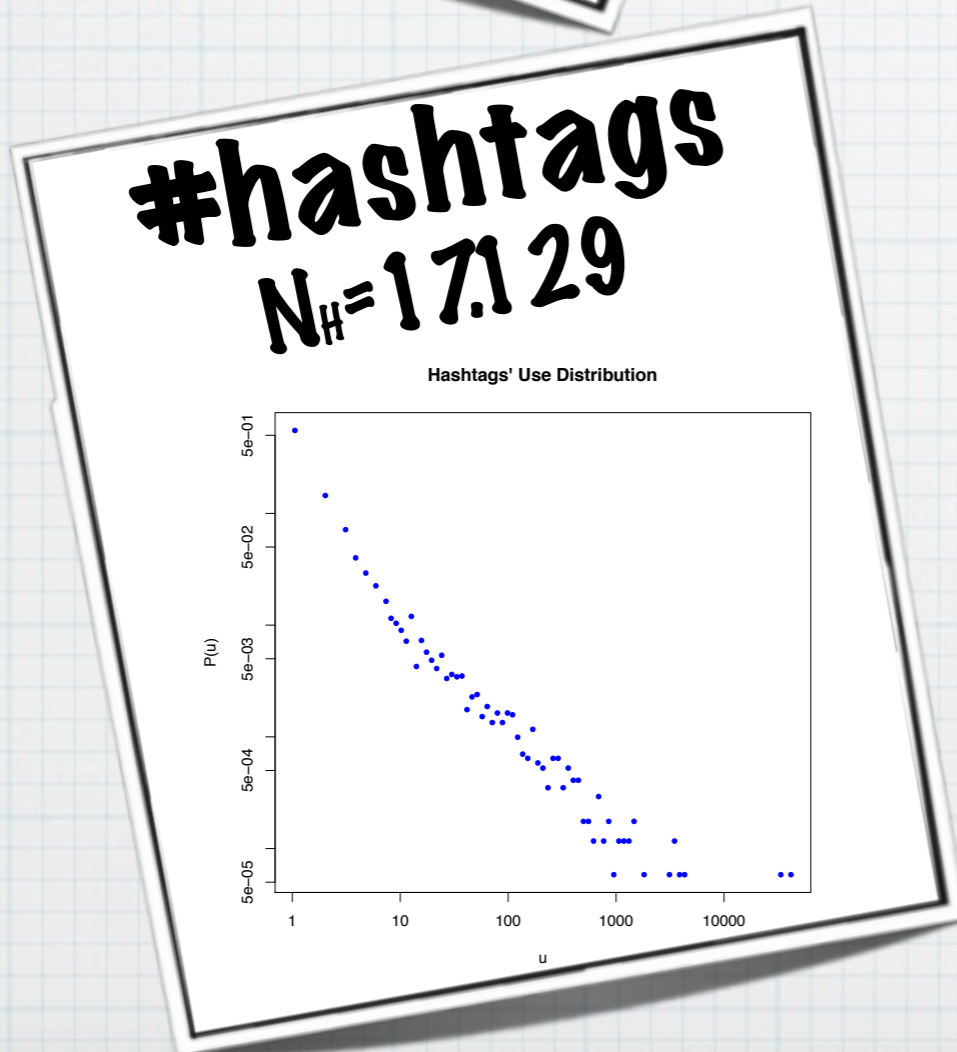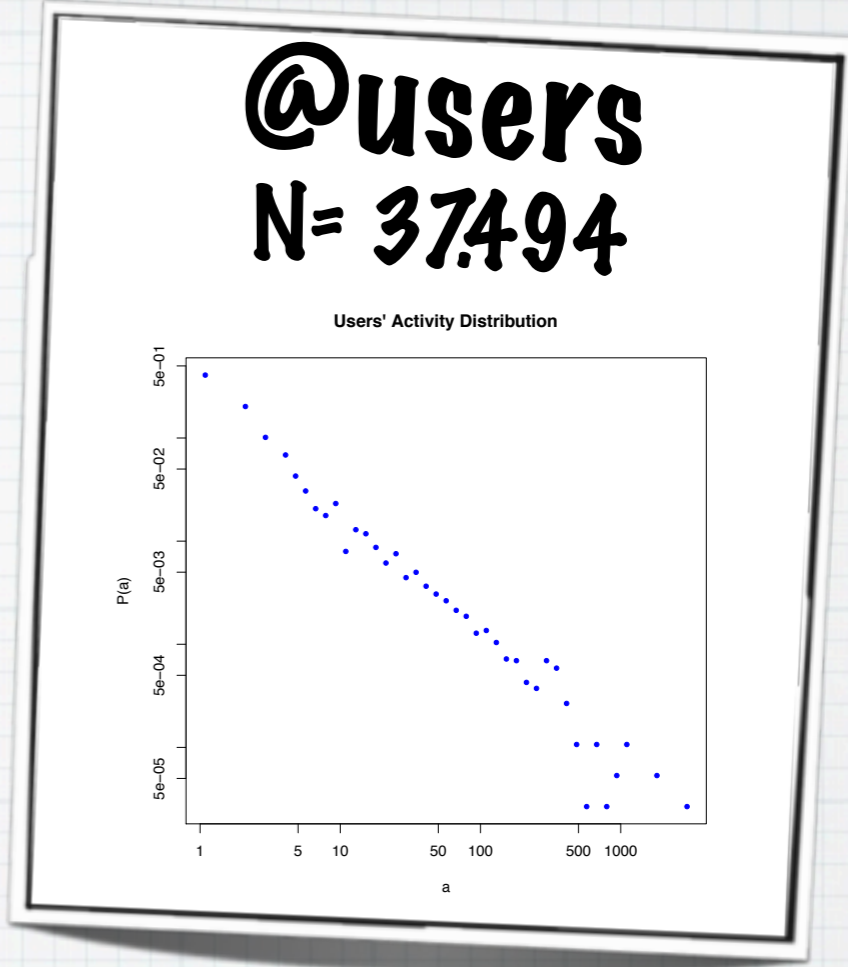|		
The arab spring	18-12-2010	
15-M Indignados (Spain)	15-05-2011	
Occupy Wall Street	17-09-2011	
...		

* Spread all around the world

* Individual participation (no political organizations)

* Virtual squares on social networks (coordination and discussion)

The dataset

Number of Tweets 180.888
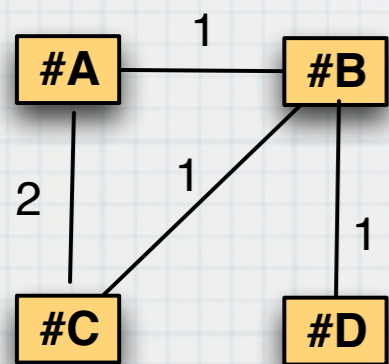
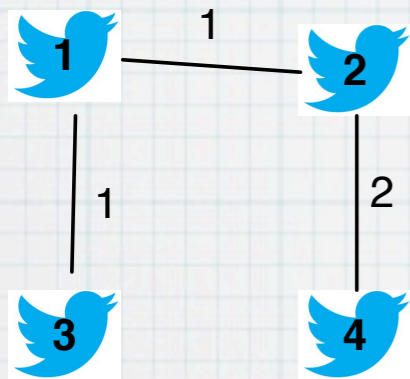**Dates: 26-10-2011 18-04-2012**

175 days

@users N= 37.494

Users' Activity Distribution

#hashtags $N_H=17.129$

Hashtags' Use Distribution

600 Tweets with geographical information

Occupy Research Collective

Network Structures

Bipartite graph

Social Network

Semantic Network

Network Topology (1)
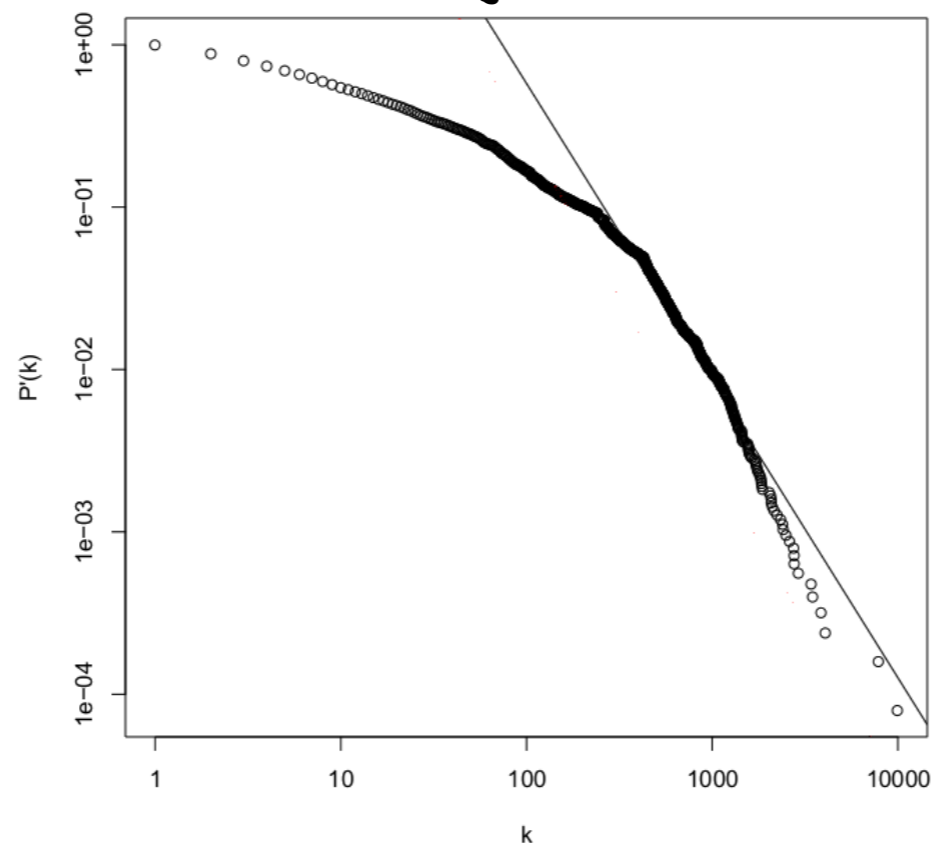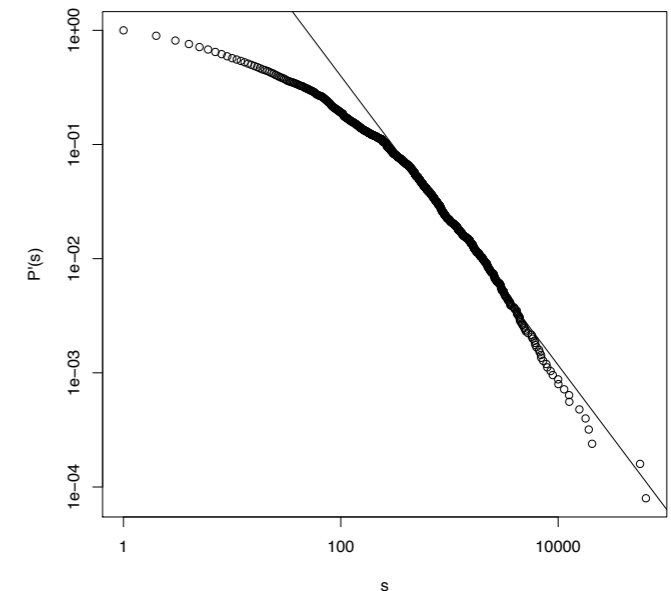
Social Network

Semantic Network

nodes =17.129
links = 497.054

$\langle k \rangle = 79.19$
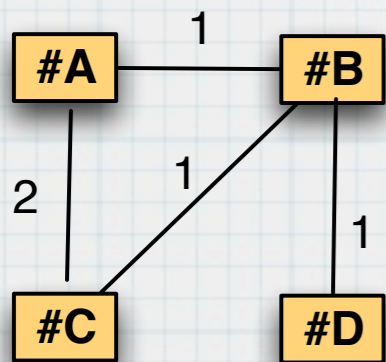$k_{MAX} = 9952$
$\langle l \rangle = 2.21$

Degree

Strength

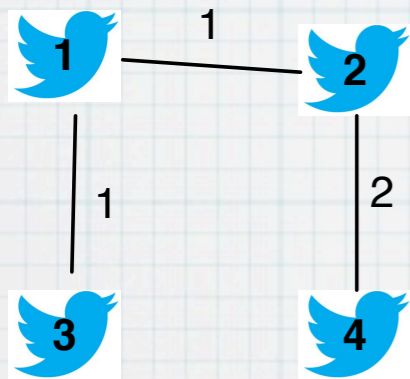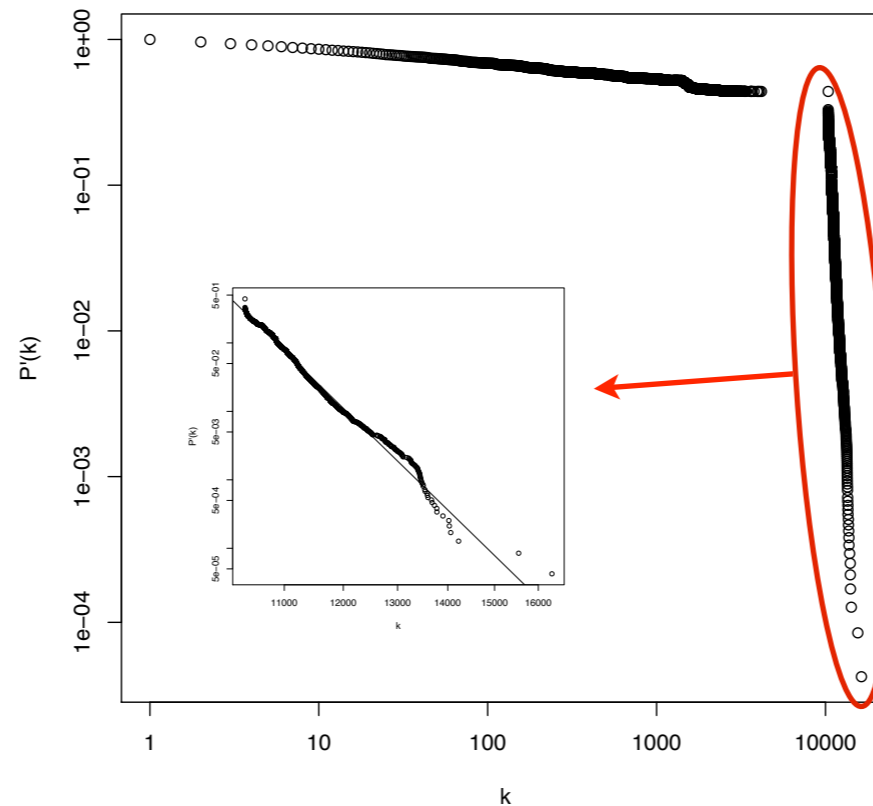# Network Topology (1)

Social Network

Semantic Network
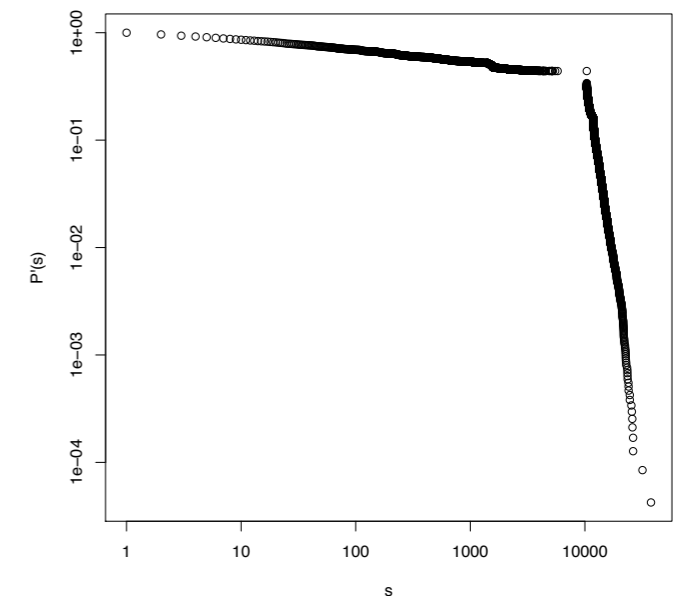
nodes = 37494
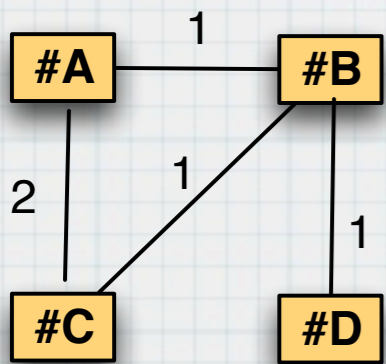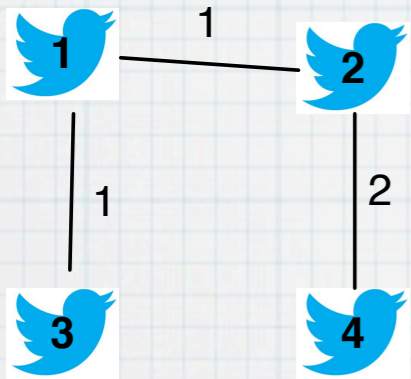links = 58.062.071

$<k>$=4919
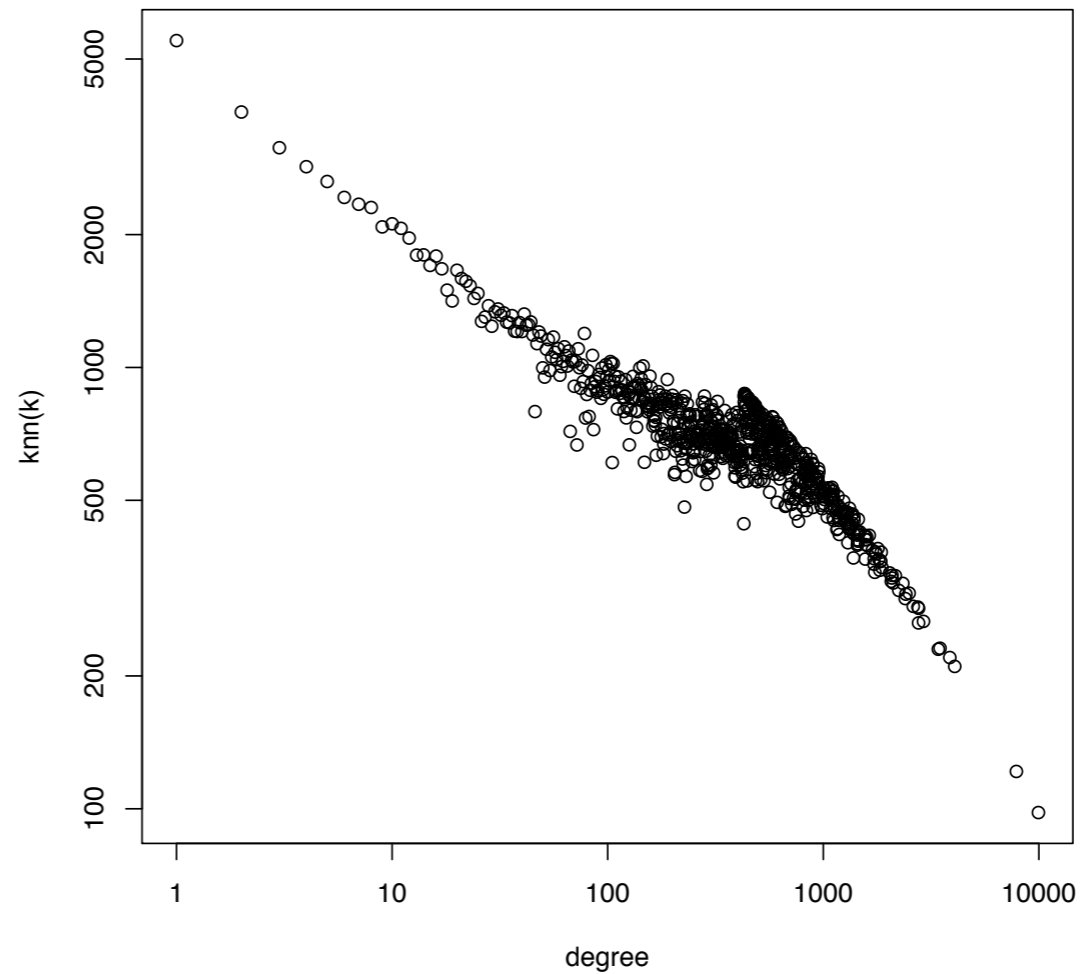k_{MAX}=16.325
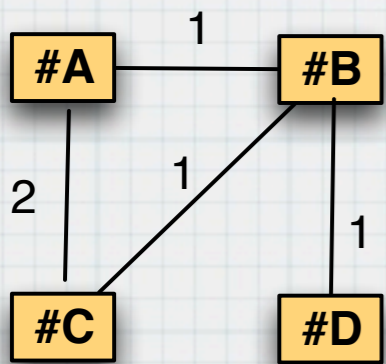$<l>$=1.9

Degree

Strength
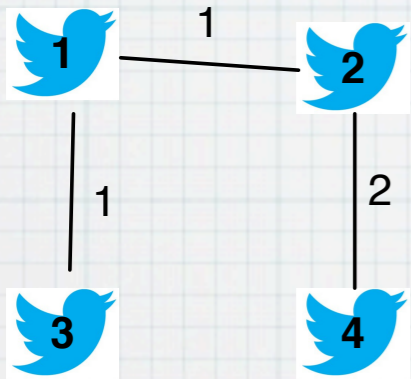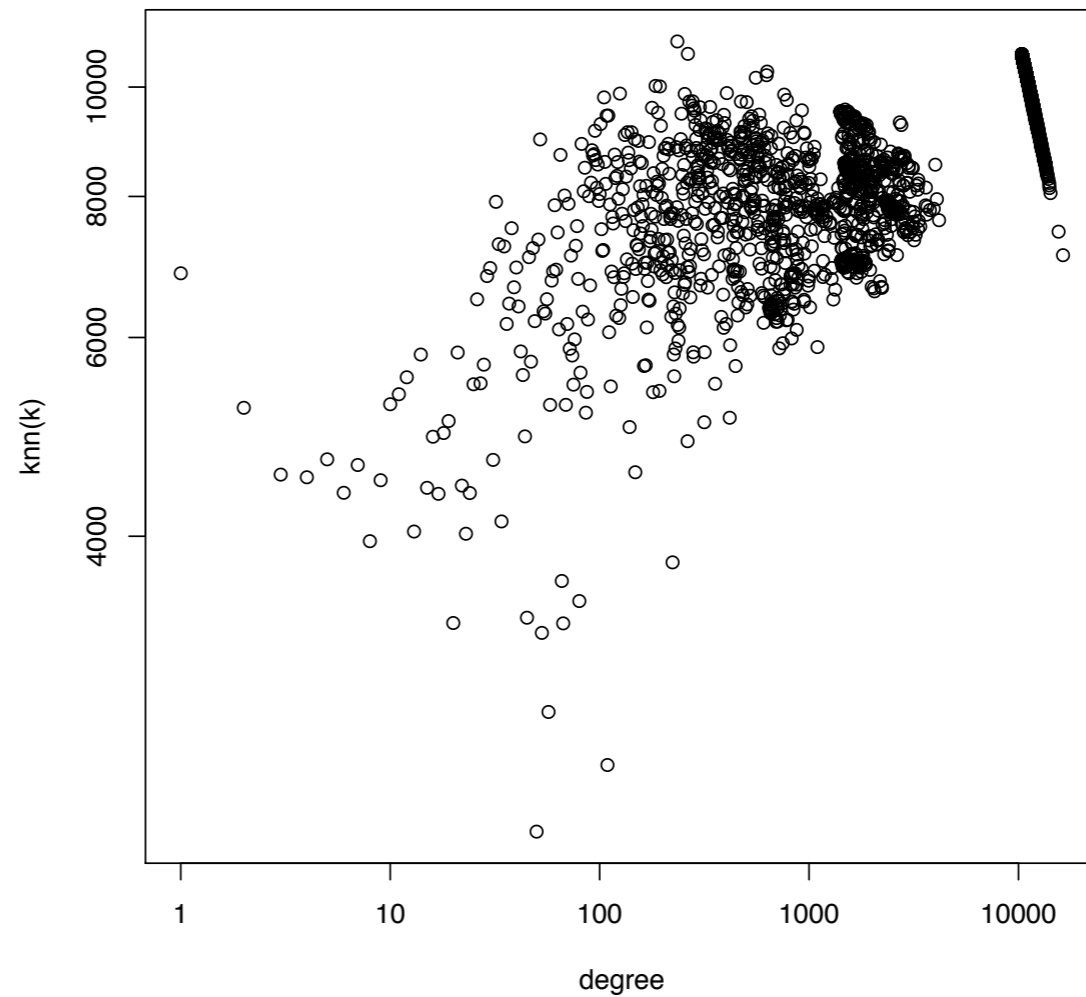
Network Topology (2)

Social Network

Semantic Network

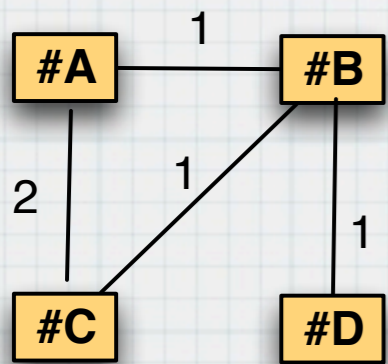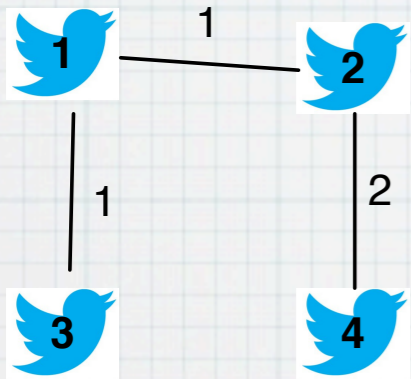### Degree Assortativity

Network Topology (2)

Social Network

1 —1— 2

1

2

3   4

Degree Assortativity

Semantic Network
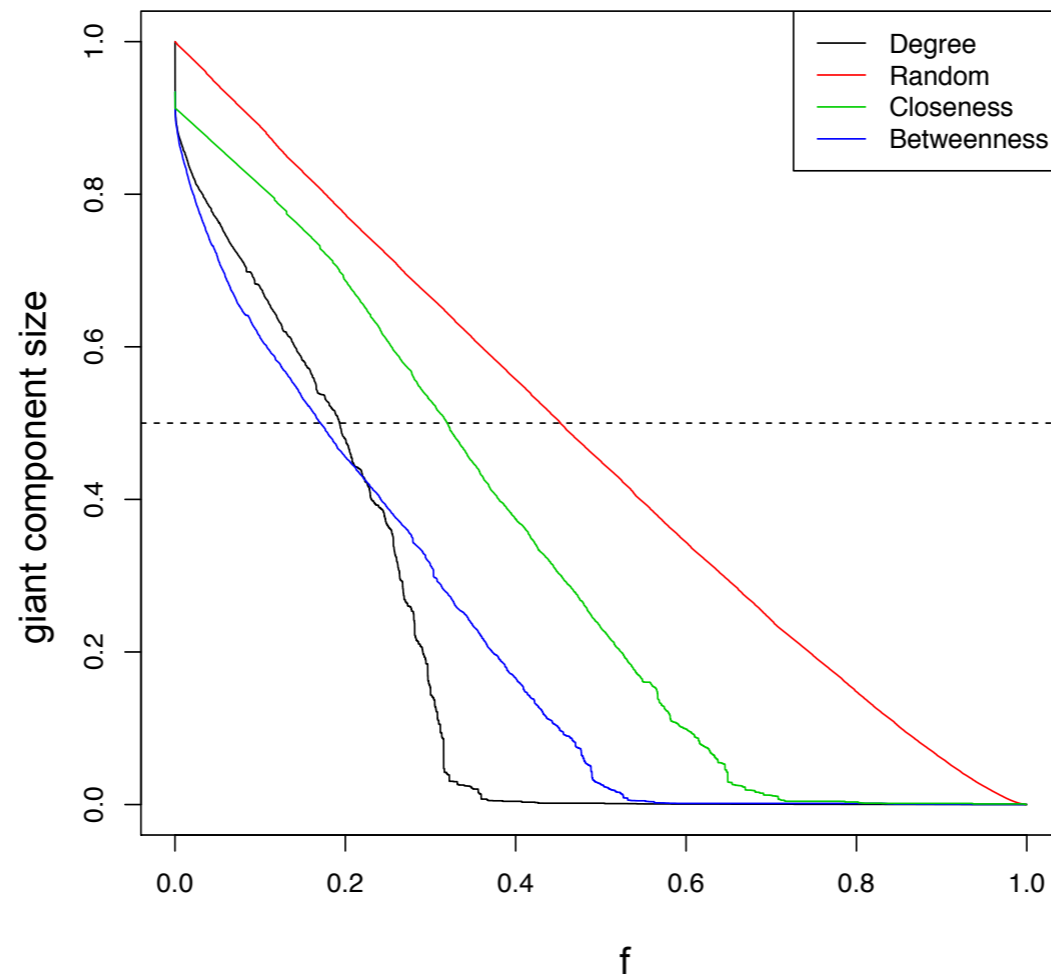
#A —1— #B

2

1

1

#C   #D

Network robustness

Social Network

Semantic Network

How many hashtags should be censored to break discussion?

Random damage

$$f_c = 0.995 \pm 0.002$$

$$\approx$$
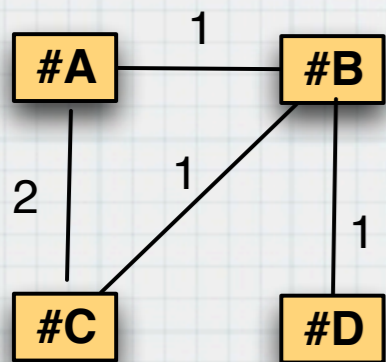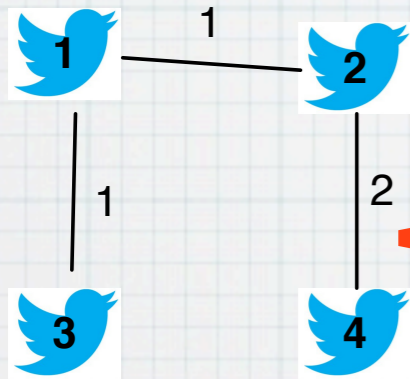
$$f_c^t = 0.998 \pm 0.001$$

Degree preferential damage

$$f_c = 0.664 \pm 0.009$$

$$\gg$$

$$f_c^t = 0.037 \pm 0.006$$

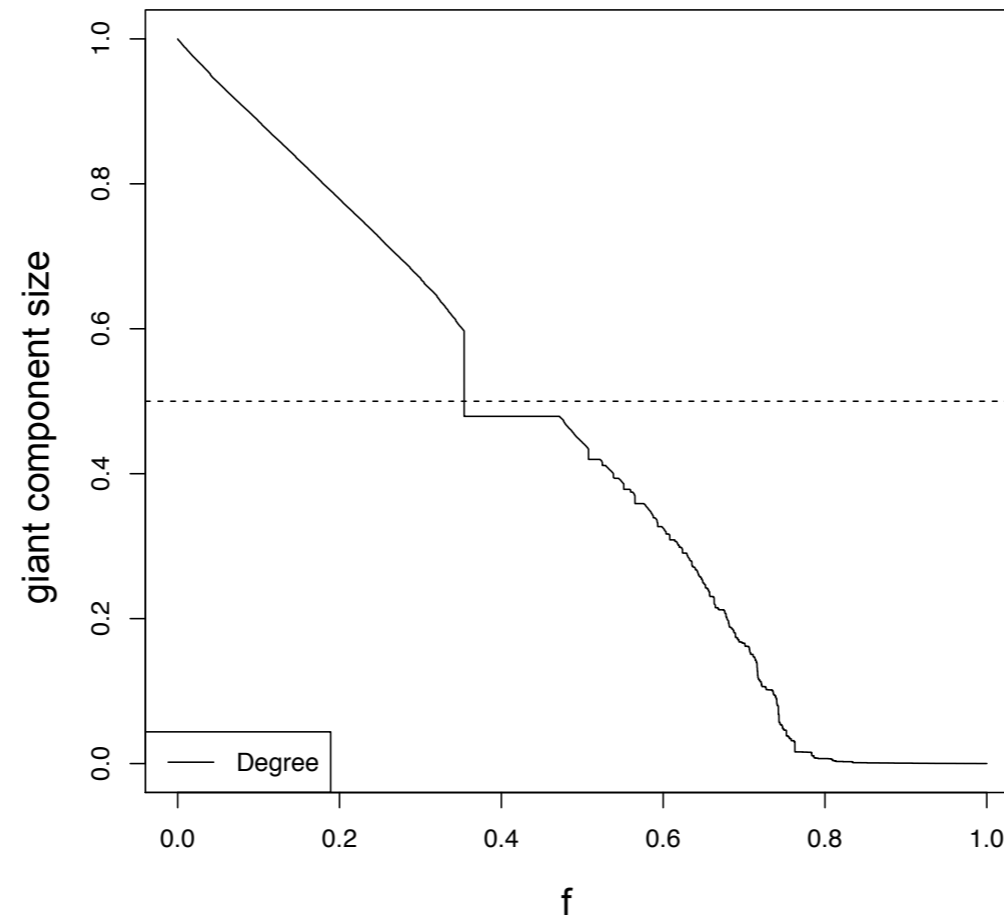# Network robustness

Social Network

How many account should be blocked to stop the communication?

$f_c = 0.948 \pm 0.001$
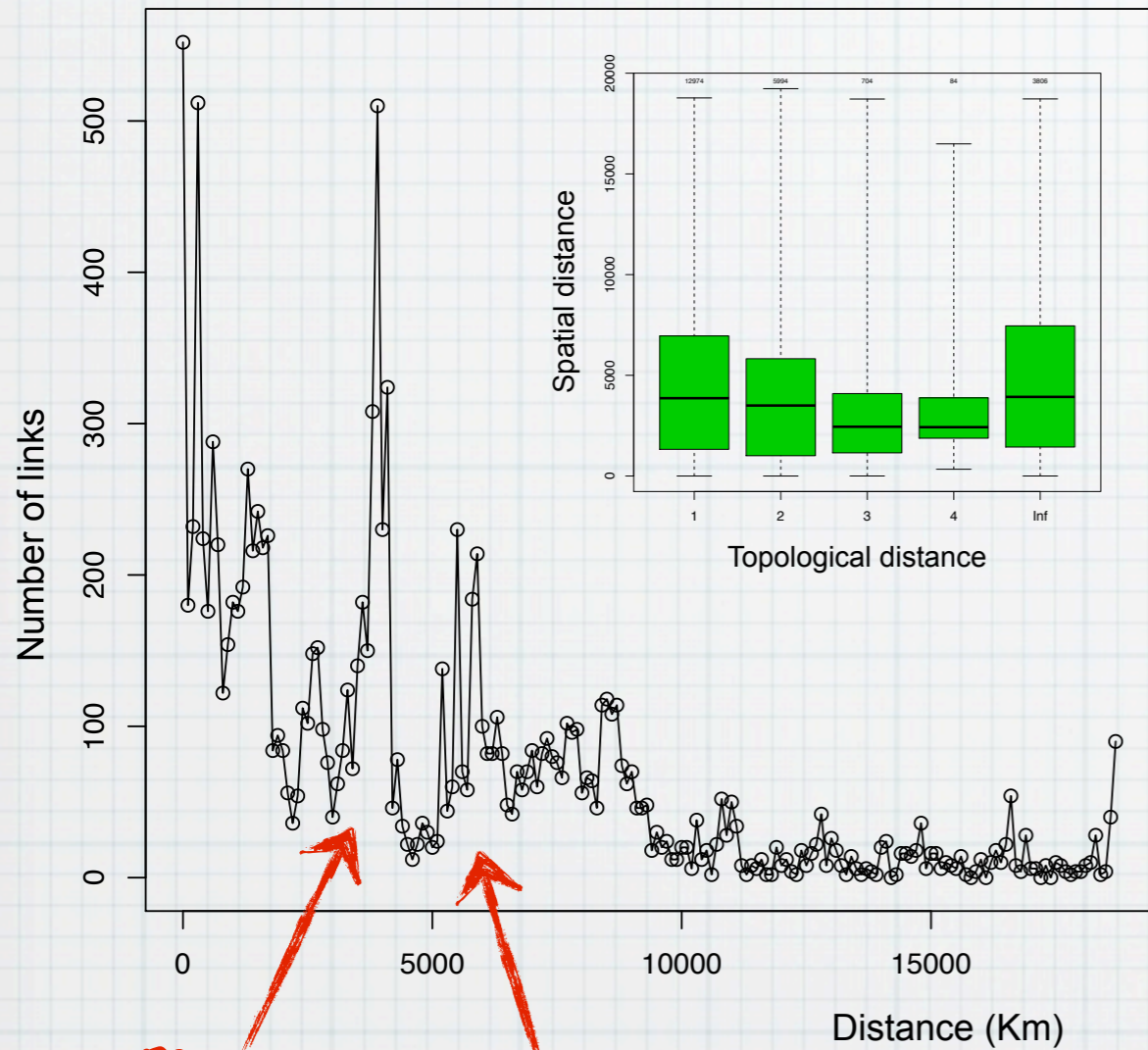
Extremely robust due to redundancy of hubs

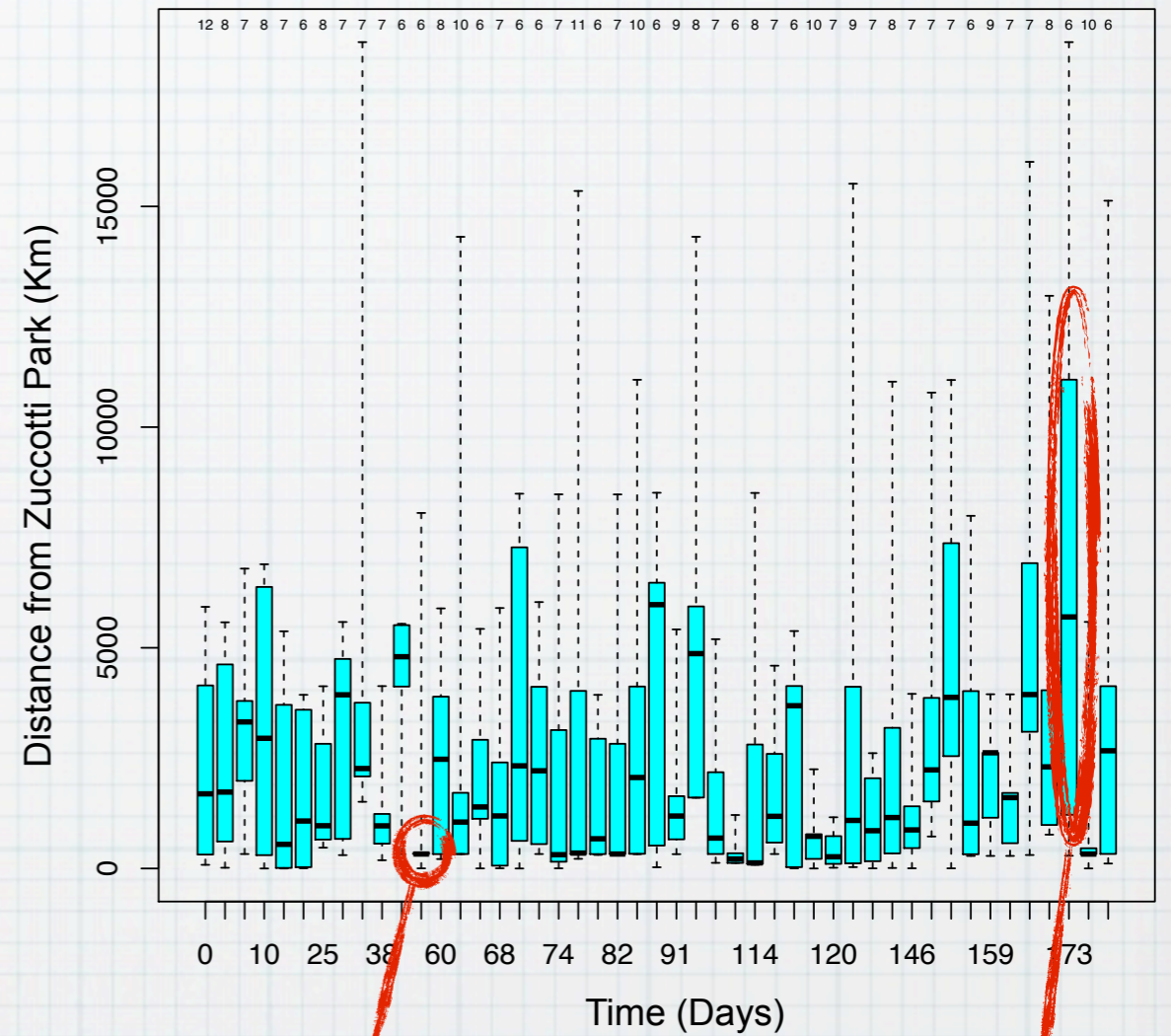The two groups
k<4177
k>10380
break separately

Semantic Network

Spatial features

lunedì 8 luglio 13

Users' Activities

@u=redostoneage
(professional blogger)

@u=topman52001

Users' Activities

@u=redostoneage
(professional blogger)

Hashtag Frequency

Hashtag

@u=topman52001

Hashtag Frequency

Hashtag

Shannon entropy

$$H_{user} = - \sum_{HT} p_{HT} \log p_{HT}$$

Limits:

$H_{user} = 0$ → Strong Hashtag preference

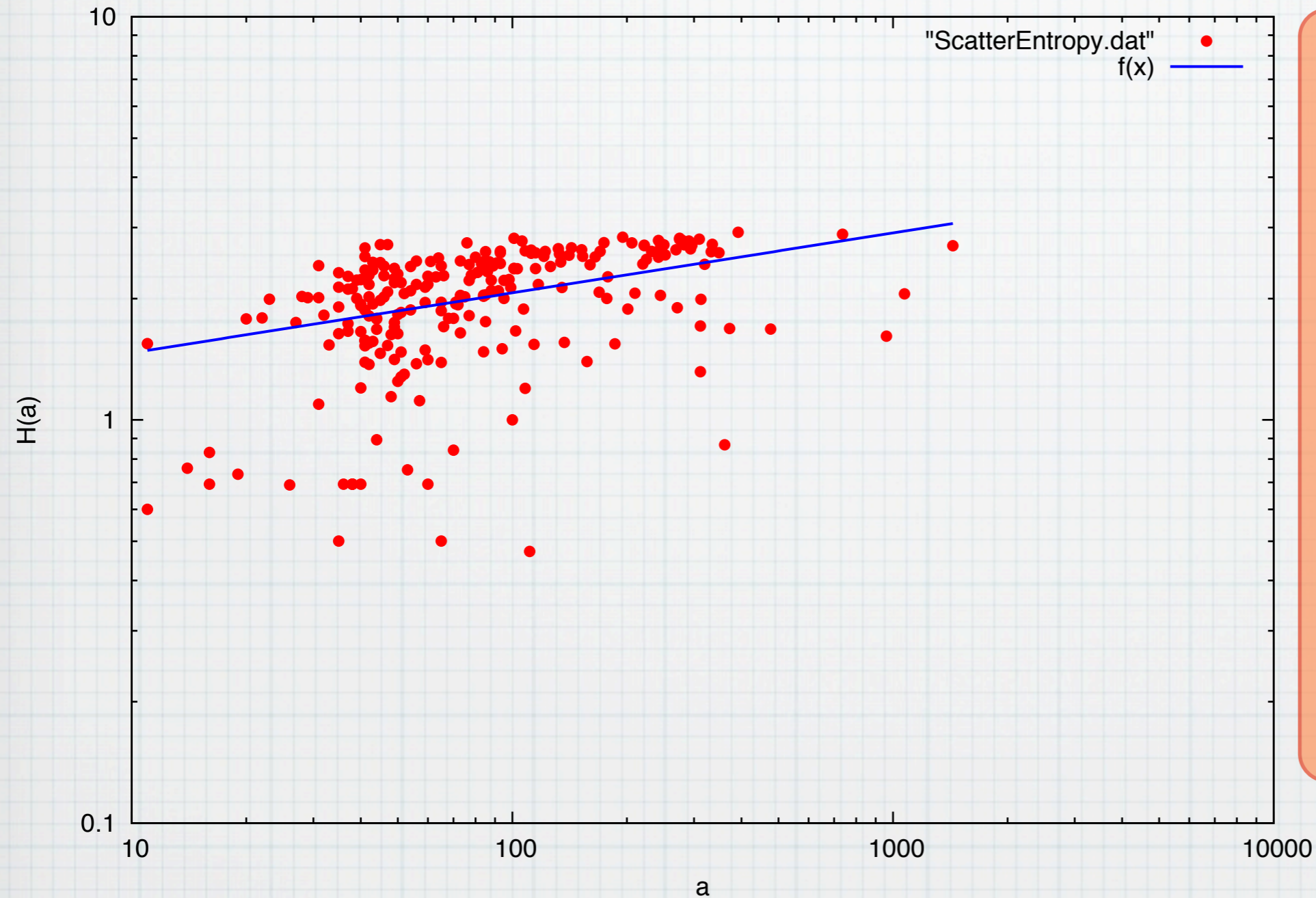$H_{user} = log(N_{HT})$ → Uniform Hashtag use

Users' Activities

Shannon entropy

$$H_{user} = -\sum_{HT} p_{HT} \log p_{HT}$$

Limits:

$H_{user} = 0$ → Strong Hashtag preference

$H_{user} = log(N_{HT})$ → Uniform Hashtag use

Next steps...

* Mutual information rate (communication patterns)

* Temporal behaviour:
  Temporal networks
  Historical series

* More geographical data

* Motifs in temporal network (opinion paths)

* Bias in data collection