Using Exact Sciences Models for Understanding Social Phenomena Session 7 – On Bursts and Outliers

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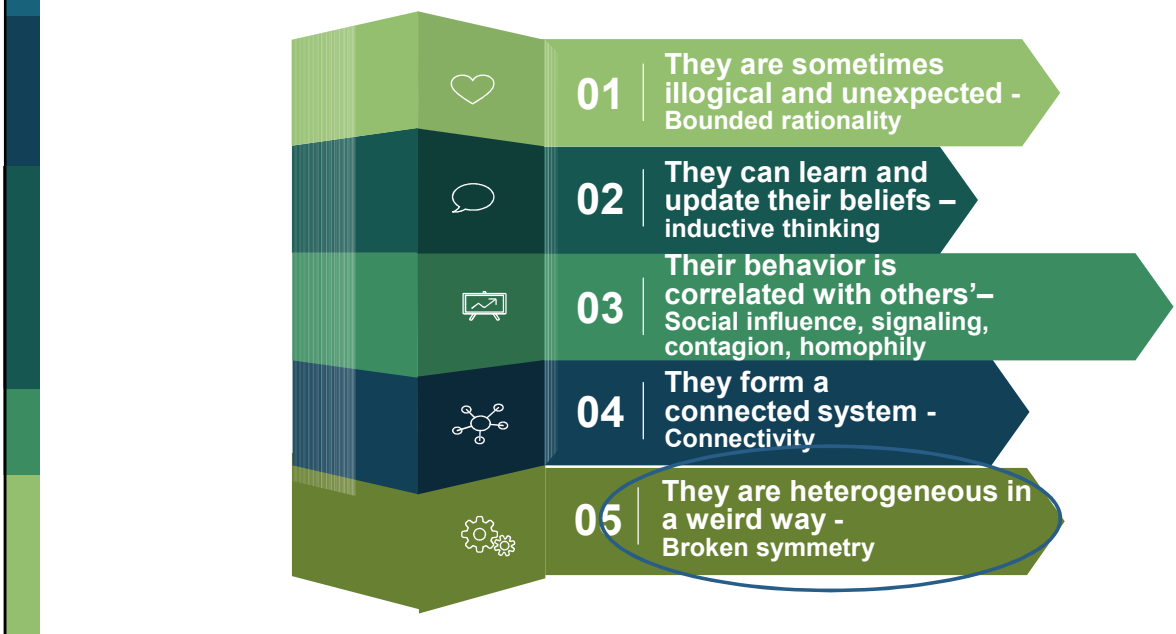
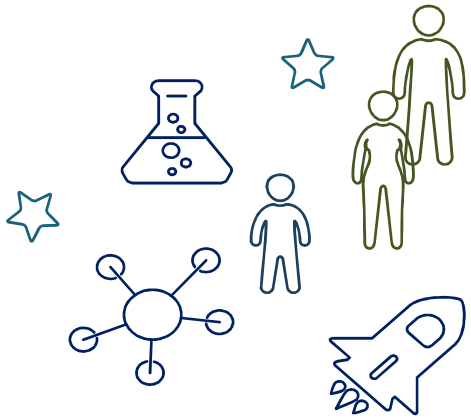
Course # 55772



Social events do not occur in a constant rate over time



Riots

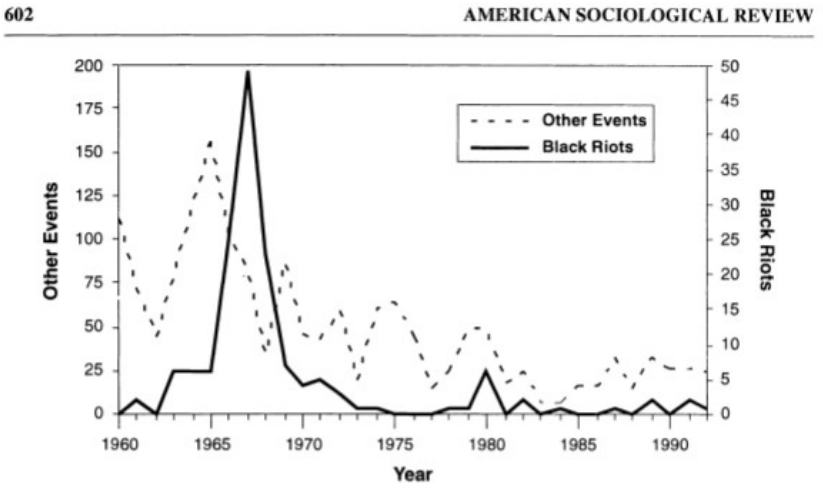


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Figure 1. Black Riots and Other Forms of Racial and Ethnic Collective Action Occurring in 55 SMSAs: 1960 to 1993

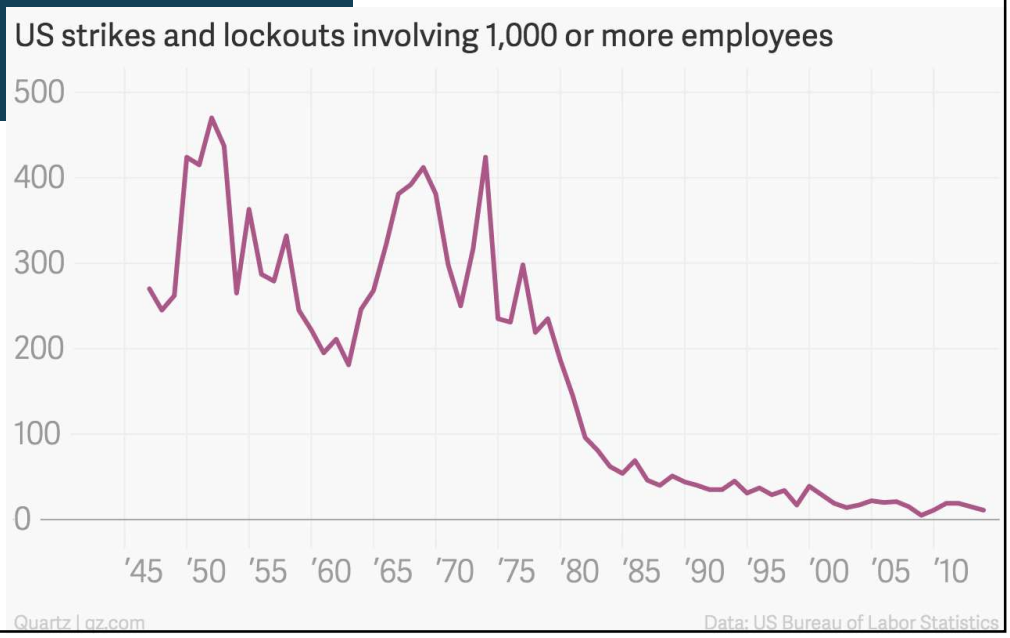
Note: This figure is based on the 1,770 events reported in *The New York Times* from 1960 to 1993: 154 of these were riots by Blacks; the remaining 1,616 were other racial or ethnic events.

Olzak, Susan, Suzanne Shanahan, and Elizabeth H. McEneaney. "Poverty, segregation, and race riots: 1960 to 1993." *American Sociological Review* (1996): 590-613.

Table 2. Frequency Distributions of Descriptive Characteristics of 154 Race Riots with Predominantly Black Participants in 55 SMSAs: 1960 to 1993

Riot Characteristic	Frequency	Percent
Number of Participants		
Less than 50	9	5.8
50 to 499	87	56.5
500 to 1,000	28	18.0
More than 1,000	30	19.5
Levels of Violence in Riots		
No weapons nor injuries reported	3	1.9
Fire, sticks, guns, or bottles reported	17	11.0
Sniping, firebombs, gunshots reported	69	44.8
Property damage and/or personal injuries	31	20.0
Participants, bystanders, or police killed	34	22.0
Levels of Police Response		
Small numbers arrive after riot begins	3	1.9
Local police officers present at riot	62	40.3
Police from local and neighboring towns	49	31.8
Local and state police	5	3.3
Local, state police and National Guard	30	19.5
Local police, Army, and National Guard units	5	3.3
Targets of Riot		
The "system" or racism	85	55.2
Police actions or police property	41	26.6
White Groups or storeowners	21	13.6
Local community event or issue	4	2.6
Group of Jews or Jewish leaders	2	1.3
Mixed ethnic group target	1	.6

Strikes



More Strike data

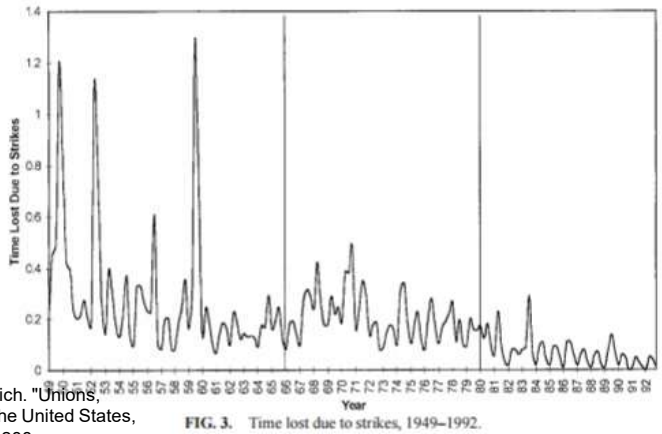


FIG. 3. Time lost due to strikes, 1949–1992.

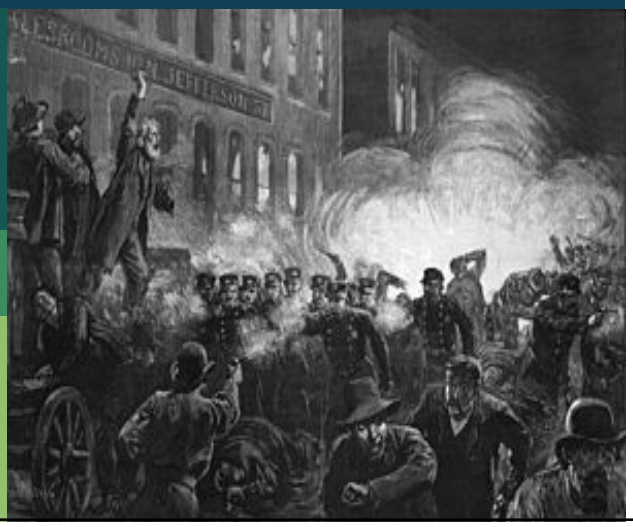
Wallace, Michael, Kevin T. Leicht, and Lawrence E. Raffalovich. "Unions, strikes, and labor's share of income: A quarterly analysis of the United States, 1949–1992." *Social Science Research* 28, no. 3 (1999): 265-288.

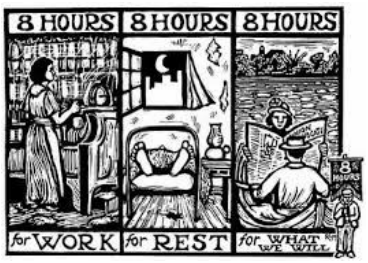
A Strike wave

A year when the number of striking workers and the frequency of strikes both exceed the average of the preceding five years by at least 50%, all within the boundaries of a national state.

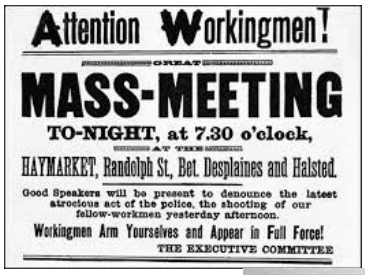
Shorter and Tilly (1974, pp. 106–7)

Example Chicago 1886





Haymarket affair


Attention Workingmen!

GREAT

MASS-MEETING

TO-NIGHT, at 7.30 o'clock,

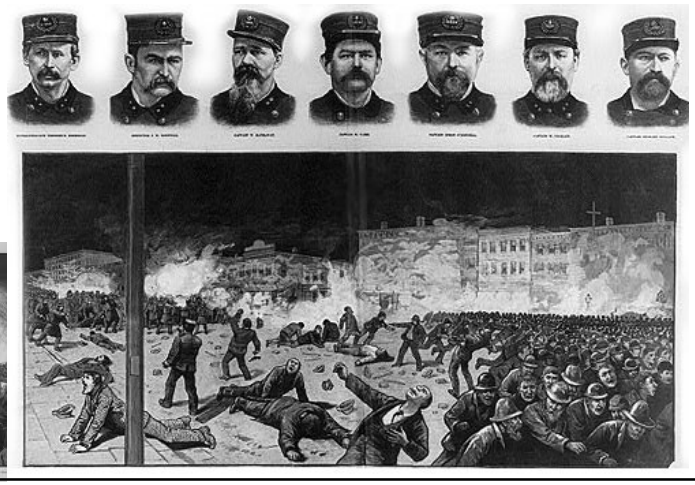
AT THE

HAYMARKET, Randolph St., Bet. Desplaines and Halsted.

Good Speakers will be present to denounce the latest atrocious act of the police, the shooting of our fellow-workmen yesterday afternoon.

Workingmen Arm Yourselves and Appear in Full Force!

THE EXECUTIVE COMMITTEE



Meme tracking

Figure 5: Temporal dynamics of top threads as generated by our model. Only two ingredients, namely imitation and a preference to recent threads, are enough to qualitatively reproduce the observed dynamics of the news cycle.

Leskovec, Backstrom, Kleinberg (2009)

Crimes

Voting

Riots

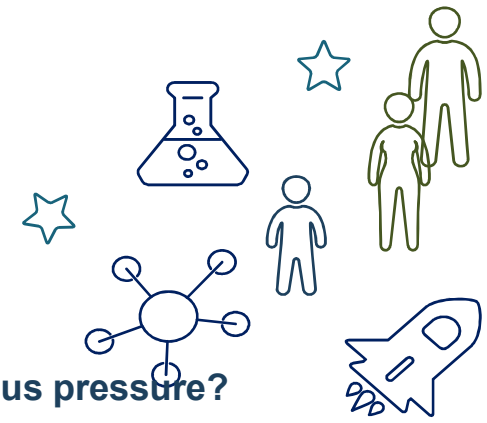
Strikes

Crusades

Migration

Bubbles

Why?



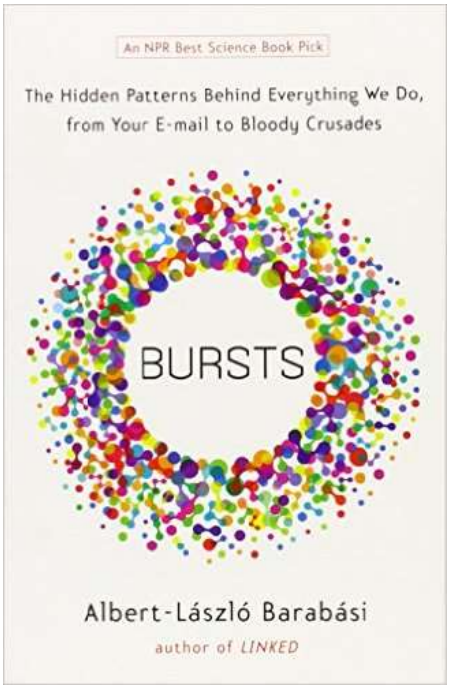
Are they all responding to an exogenous pressure?

Can we come up (similar to the previous cases we discussed) with an explanation that is more self-emergent from the dynamics of the population?

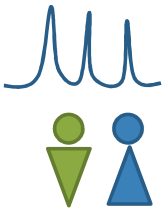
1

Individual prioritization

Barabasi 2005



Spikes are generated through prioritization and repetition

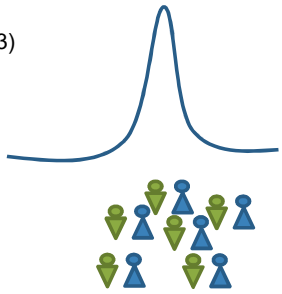


Barabasi (2005)
Individual time dynamics in performing tasks is spiky

Oliviera and Vazquez (2009)
especially in interactive tasks

Spontaneous internal activity.
Enhanced due to the repetition effect,
(Cacioppo and Petty 1979; Campbell and Keller 2003)
but short term (Singh et al. 1994)

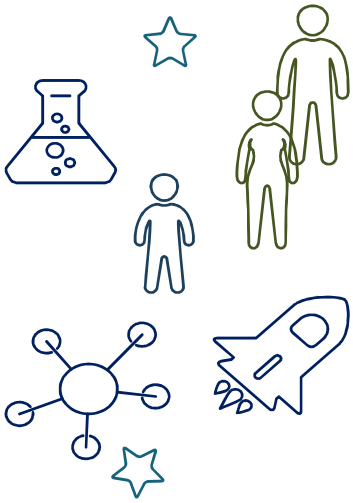
External event
(trailer, press conference)



A spike in aggregate behavior –
A high priority task for many individuals

Pros? Cons?

What is missing?



2

Variation in action thresholds

Granovetter 1978

Individuals have a personal Threshold for action

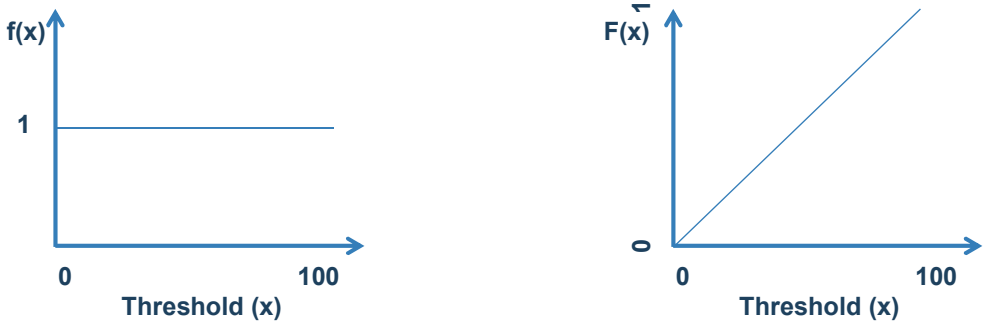
Different individuals require different levels of safety before acting (e.g. entering a riot) and also vary in the benefits they derive from rioting.

Every person has a threshold which is the proportion of the group she would have to see join before she would do so.

“Radicals”= low threshold “Conservatives”= high threshold

Variation in threshold

More formally



r(t) = number of people who have joined by time t.
Equilibrium in r(t) = 100 people.

For a general F(x)

$r(t+1)=F(r(t))$

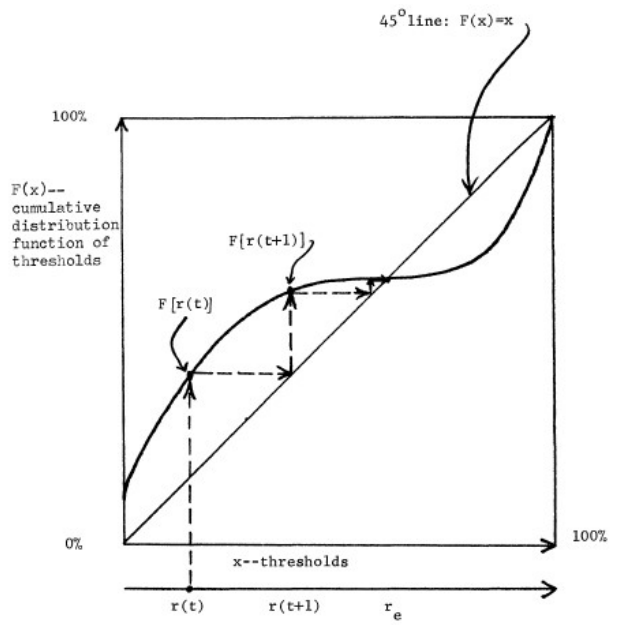


FIG. 1.—Graphical method of finding the equilibrium point of a threshold distribution. $r(t)$ = proportion having rioted by time t.

For a normal distribution with mean=25

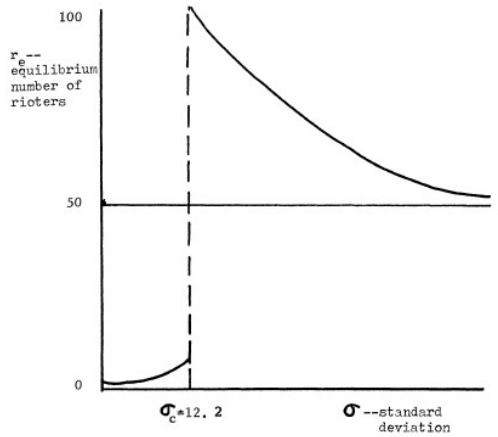
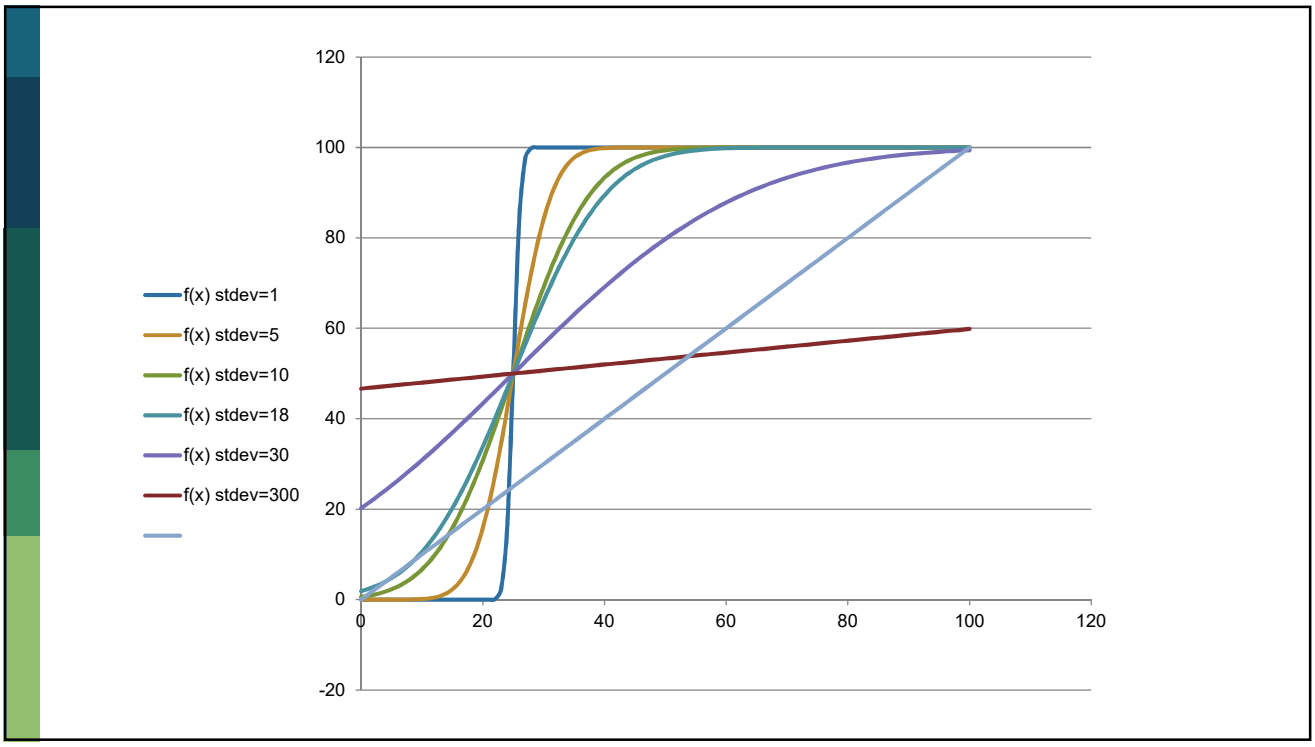


FIG. 2.—Equilibrium number of rioters plotted against standard deviation of normal distributions of thresholds with mean = 25, N = 100.

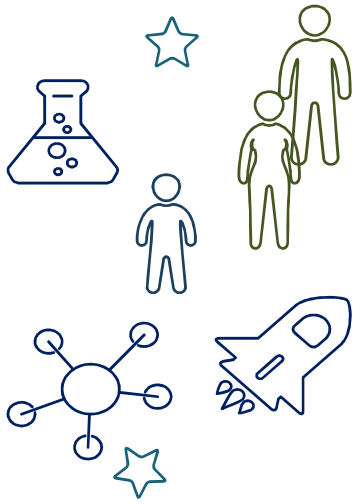


The main claim

The distribution is perturbed and slightly fluctuates over time. Therefore, similar situations will generate spikes of different magnitudes (if at all).

Pros? Cons?

What is missing?

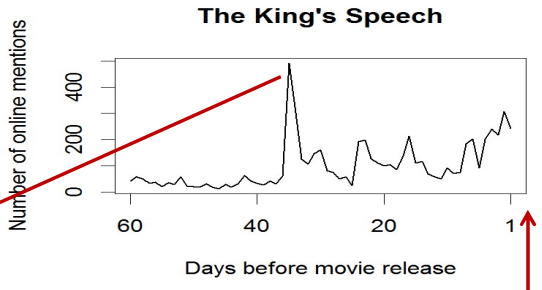


3

Positive feedback and Recency

Gelper, Peres and Eliashberg 2017

The context: Spikes in Pre-release WOM



88 – The King's Speech

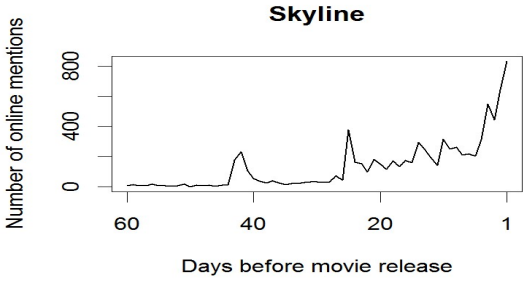
— OCTOBER 22, 2010

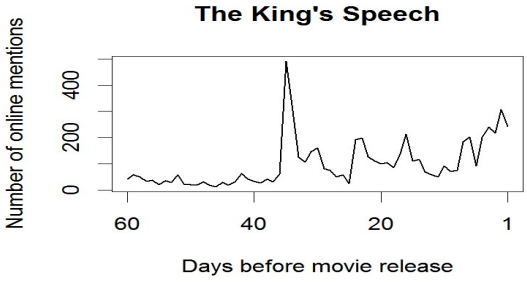
I haven't seen the movie yet but the trailer is so promising and I don't think Colin can do wrong. I can't remember seeing him in a bad movie and lately he seems to get amazing roles. So I for an example can't wait to see this one – I love myself some Colin as a king!

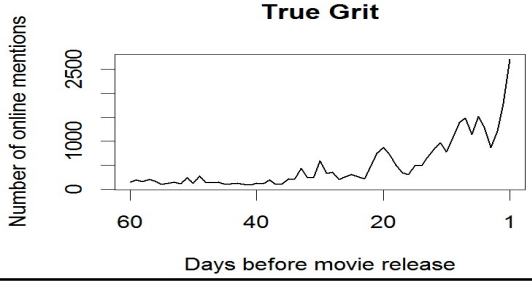
Release date: ovember 26, 2010

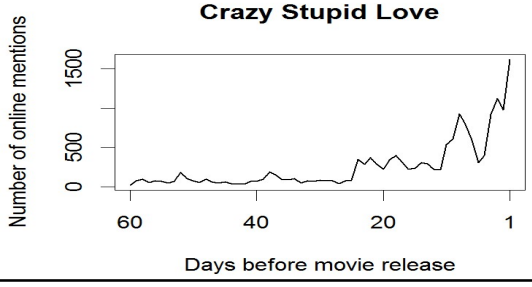
Spikes in Pre-release WOM

Increasing trend towards release + WOM spikes







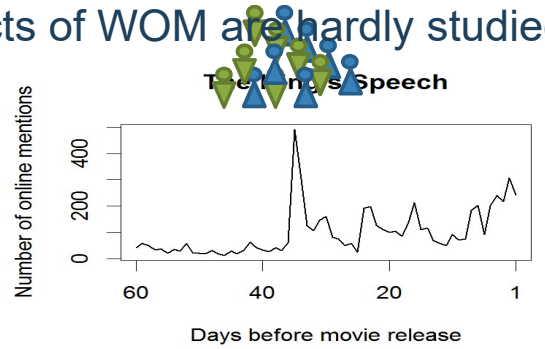


Why are WOM spikes interesting?

A focused burst of interest and communication among consumers.

Associated with sales.

Dynamical aspects of WOM are hardly studied.



Theory: ignition, positive feedback, recency

Spontaneous internal activity
Myers, Zhu, and Leskovec (2012) ; Crane and Sornette (2008) ; Strogatz (2004)

External event
(trailer, press conference)
(Shi et al 2013)

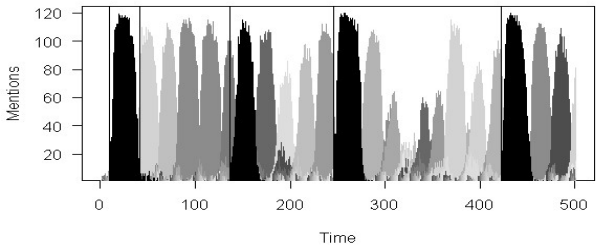
Positive feedback
Biggs (2003); Bikhchandani, Hirshleifer and Welch (1992)

Shift of focus to more **Recent** topics
Myers, Zhu, and Leskovec 2012

A simple agent-based model

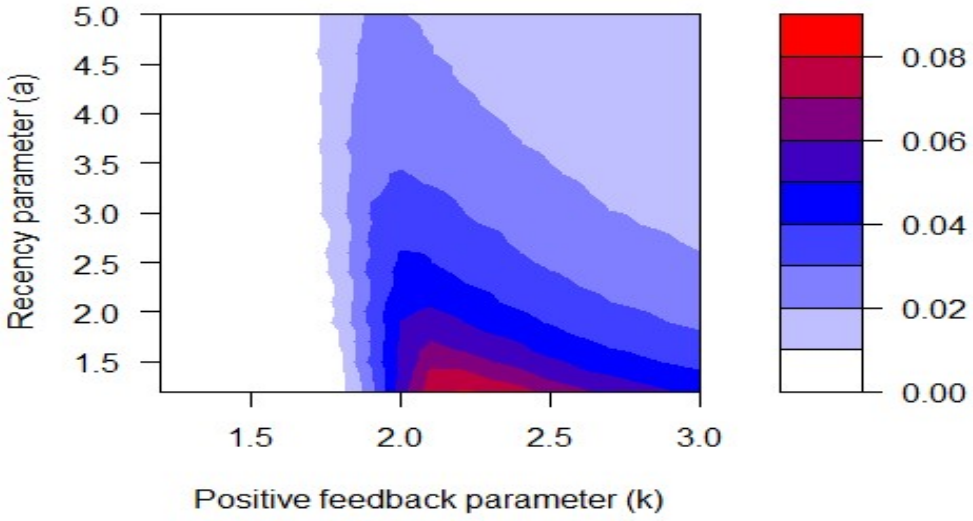
Pr. Communicate(topic *j*, time *t*)=
f(number of mentions↑) * r(time since the topic initiated ↓)

If no external event happens (probability 1- P_{event})	If an external event happens (probability P_{event})
An individual chooses an existing topic *j* at time *t* with probability $\frac{f(n_{tj})r(t-t_j)}{\sum_{d=1}^{N+t-1} f(n_{td})r(t-t_d)+f(0)r(0)}$	An individual chooses an existing topic *j* at time *t* with probability $\frac{f(n_{tj})r(t-t_j)}{\sum_{d=1}^{N+t-1} f(n_{td})r(t-t_d)}(1-P_{new})$
An individual choose the new topic at time *t* with probability $\frac{f(0)r(0)}{\sum_{d=1}^{N+t-1} f(n_{td})r(t-t_d)+f(0)r(0)}$	An individual choose the new topic at time *t* with probability P_{new}



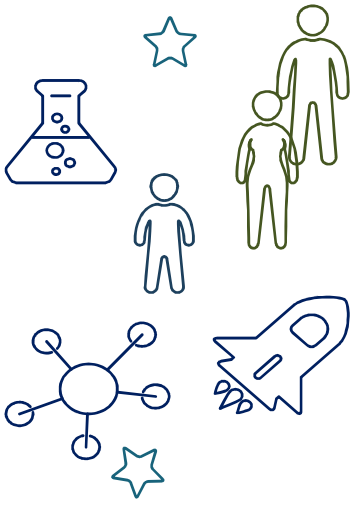
N=120, *T*=500, P_{event}=0.01, P_{new}=*0.2*, *f(n)=100+n^k* and *r(t)=1/exp(t)^1/a*. Larger values of *k* indicate a stronger positive feedback, while smaller values of *a* indicate a stronger preference for recent topics.

Spikes – medium positive feedback and low recency



Pros? Cons?

What is missing?



5

Hardship vs Legitimacy of a central authority

Epstein 2002

Let's discuss

What is missing?