Social Networks
Triggering Dynamics
Human Economics of Time
Emotions and Politeness

Course 3

Open Collaboration and Peer Production
(i290m)

“What gets measured gets managed”

i.a. Lord Kelvin

“6 Course” Menu

Predicting social ties

Social factors of politeness

Time critical mobilization

Viral epidemics in social networks and open collaboration

Economics of time

Predicting positive (negative) social links

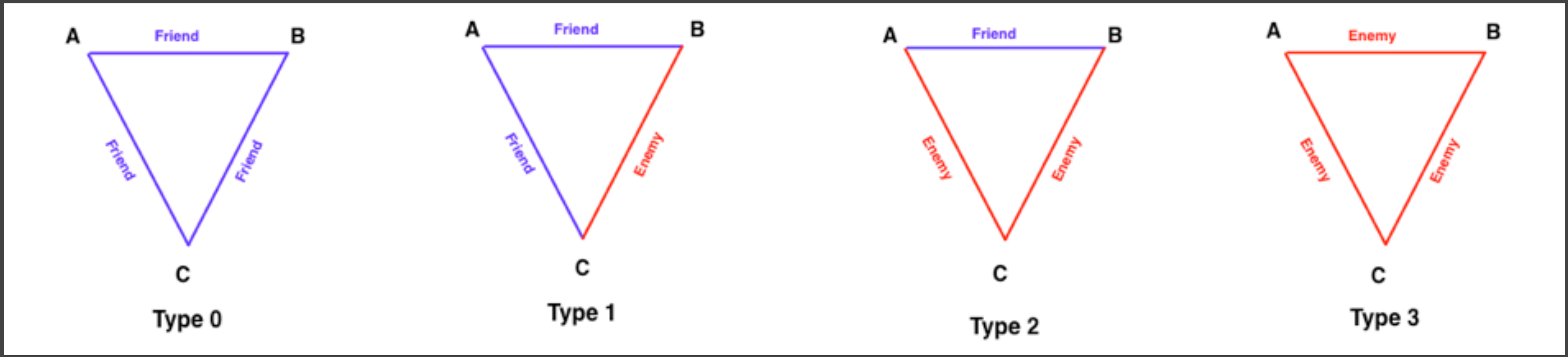
Two major social theories on test bed

balance theory

"the enemy of my friend is my enemy," "the friend of my enemy is my enemy,"

status theory

a positive *(u, v) link indicates that u considers v to have higher status*



Leskovec, J., Huttenlocher, D. & Kleinberg, J. Predicting positive and negative links in online social networks. In Proceedings of the 19th international conference on World wide web, WWW '10, 641-650 (ACM, New York, NY, USA, 2010)

Predicting positive (negative) social links

Machine Learning

- 7 network features

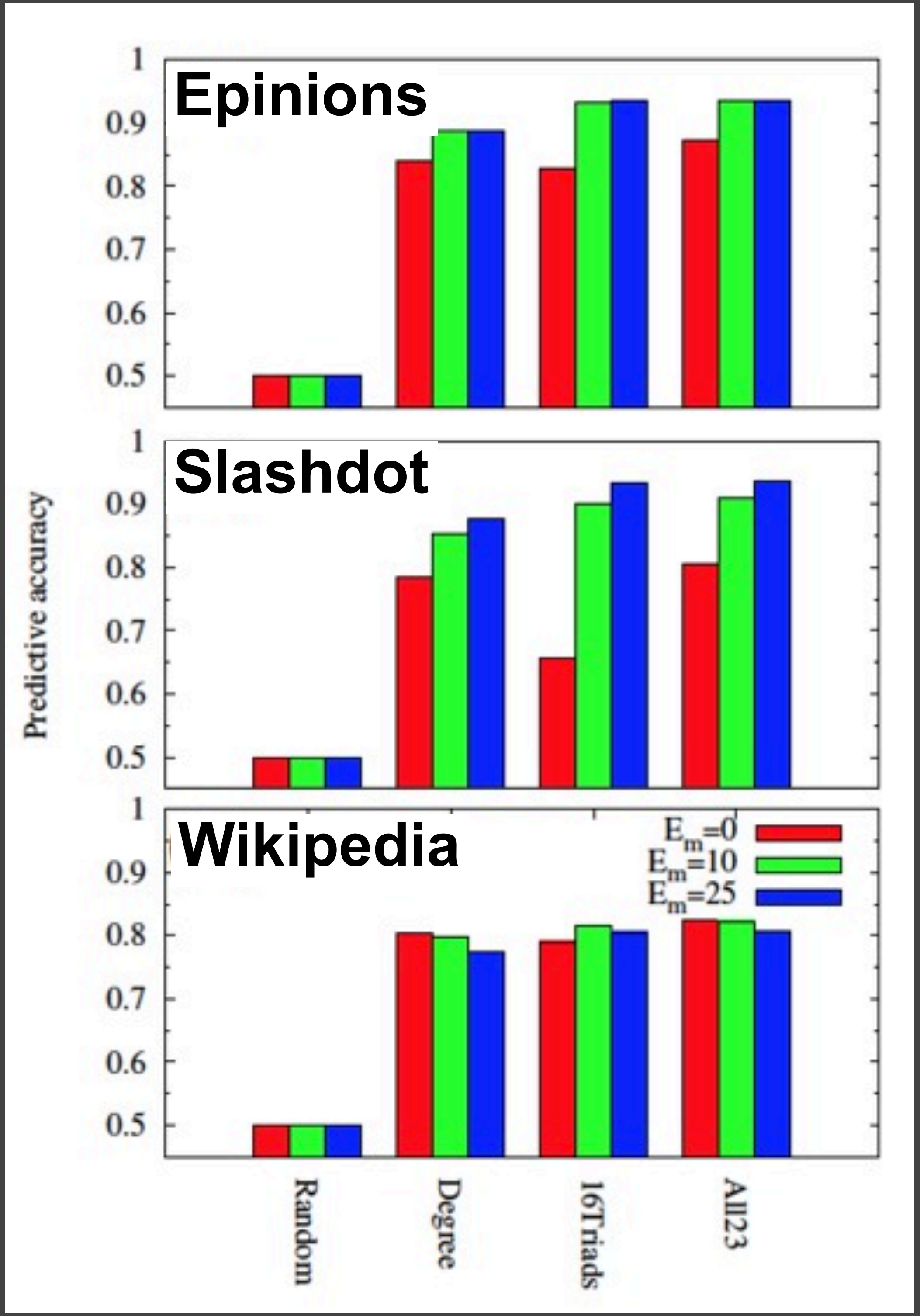
number of common neighbors w of u and v

+ and - directed edges (in- & out-degree)

- 16 distinct triad types

Logistic regression model

$$P(+|x) = \frac{1}{1 + e^{-(b_0 + \sum_i^n b_i x_i)}}$$



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Predicting positive (negative) social links

Feature	Balance theory	Epinions	Slashdot	Wikipedia
const	0	0.4321	1.4973	0.0395
pp	1	0.0470	0.0395	0.0553
pm	-1	-0.1154	-0.2464	-0.1632
mp	-1	-0.2125	-0.3476	-0.1432
mm	1	-0.0149	-0.0262	-0.0465

Feature	Status theory	Epinions	Slashdot	Wikipedia
const	0	-0.6873	-1.3915	-0.3039
$u < w < v$	1	0.1165	0.0463	0.0258
$u > w > v$	-1	-0.1002	-0.114	-0.1941
$u < w > v$	0	0.0572	0.1558	0.0300
$u > w < v$	0	-0.0064	0.0382	0.0543

Leskovec, J., Huttenlocher, D. & Kleinberg, J. Predicting positive and negative links in online social networks. In Proceedings of the 19th international conference on World wide web, WWW '10, 641-650 (ACM, New York, NY, USA, 2010)

Politeness in open collaboration

Detect and measure politeness (& rudeness)

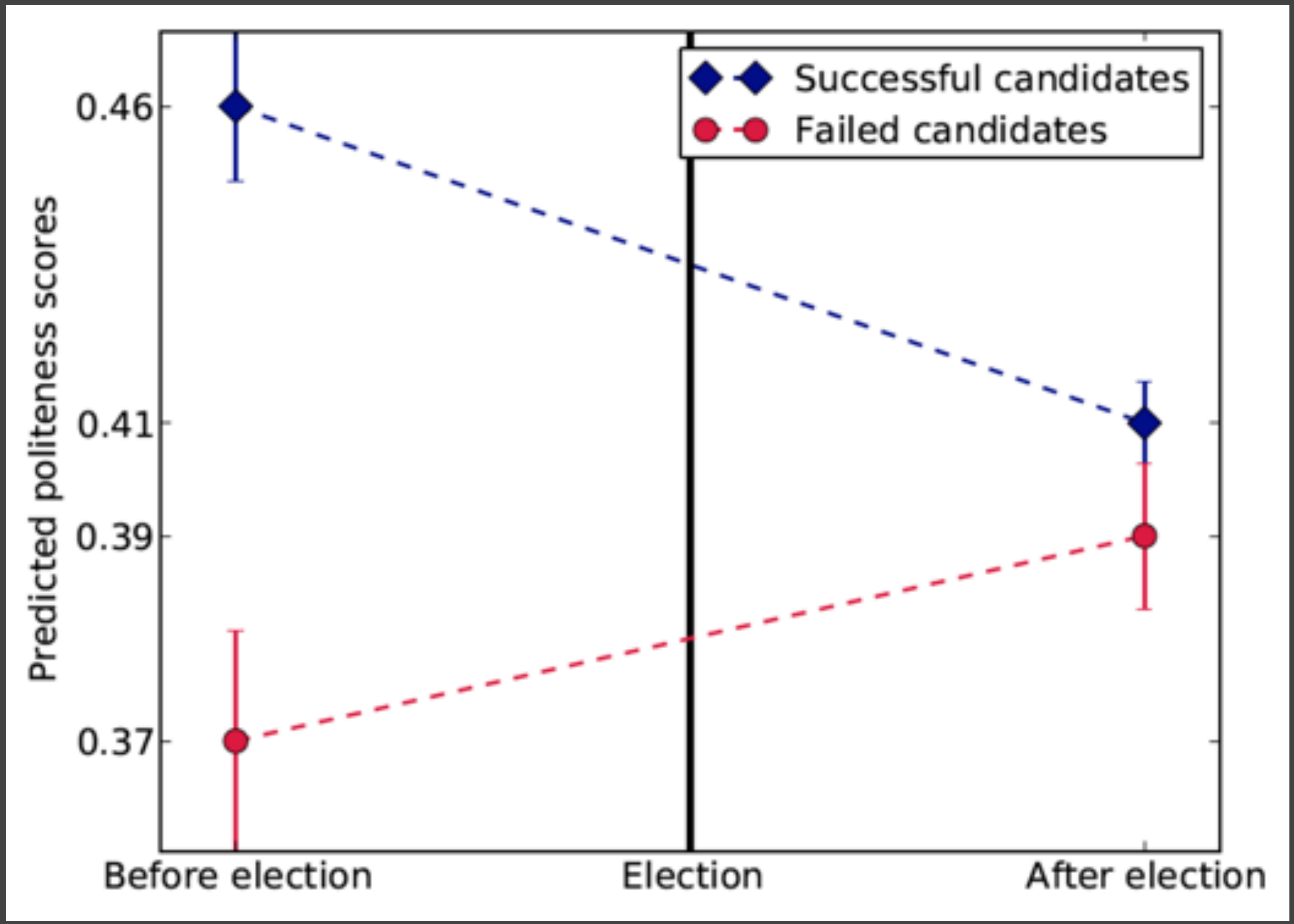
Refine sociolinguistic theories of politeness

Relation between politeness and social factors

PL name	Politeness	Top quartile
Python	0.47^{***}	23%
Perl	0.49	24%
PHP	0.51	24%
Javascript	0.53^{**}	$26\%^{**}$
Ruby	0.59^{***}	$28\%^{*}$

Danescu-Niculescu-Mizil, C., Sudhof, M., Jurafsky, D., Leskovec, J. & Potts, C. A computational approach to politeness with application to social factors. In Proceedings of ACL (2013).

Politeness & power



Danescu-Niculescu-Mizil, C., Sudhof, M., Jurafsky, D., Leskovec, J. & Potts, C. A computational approach to politeness with application to social factors. In Proceedings of ACL (2013).

Politeness & power

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

Reputation level	Politeness	Top quart.
Low reputation	0.68^{***}	$27\%^{***}$
Middle reputation	0.66^{***}	25%
High reputation	0.64^{***}	$23\%^{***}$

Danescu-Niculescu-Mizil, C., Sudhof, M., Jurafsky, D., Leskovec, J. & Potts, C. A computational approach to politeness with application to social factors. In Proceedings of ACL (2013).

Time Critical Social Mobilization

- MIT Red Balloon Challenge Team

http://archive.darpa.mil/networkchallenge/

California Proposition 30 (Nov 2012) Awareness

Be One of the 50 Most Influential People

California Prop 30: Temporary Taxes for Education

Everyone in California, from students to CEO's, should know about Proposition 30 on the November 2012 Ballot. If passed, Prop 30 will increase sales tax by 0.25% and incrementally increase income tax on households earning more than $250,000. If not passed, a multi-billion dollar cut in state funding to education at all levels will be triggered automatically.

Can you be one of the most influential people in spreading awareness on this important issue? Enter your email address to participate in this research study - we'll send you a custom web link to this page to share with your friends and family. *You can always check on your progress by resubmitting your email.*

About this project and privacy policy

Be One of the 50 Most Influential People

Email Address | I'm Aware

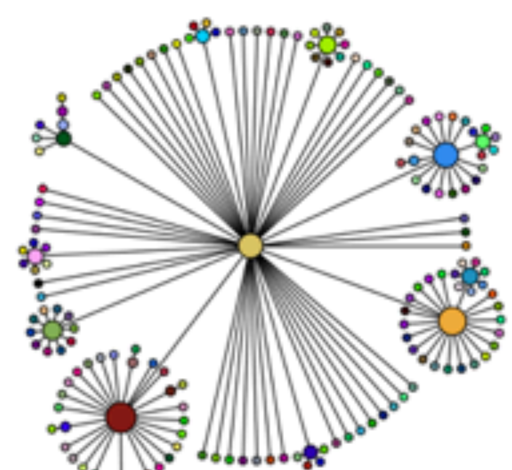
890 participants so far!

Clicking confirms that you are over 18 years old. We won't share your email with anyone and will only send you one email if you are among the 50 Most Influential People by the date of the election.

Learn More

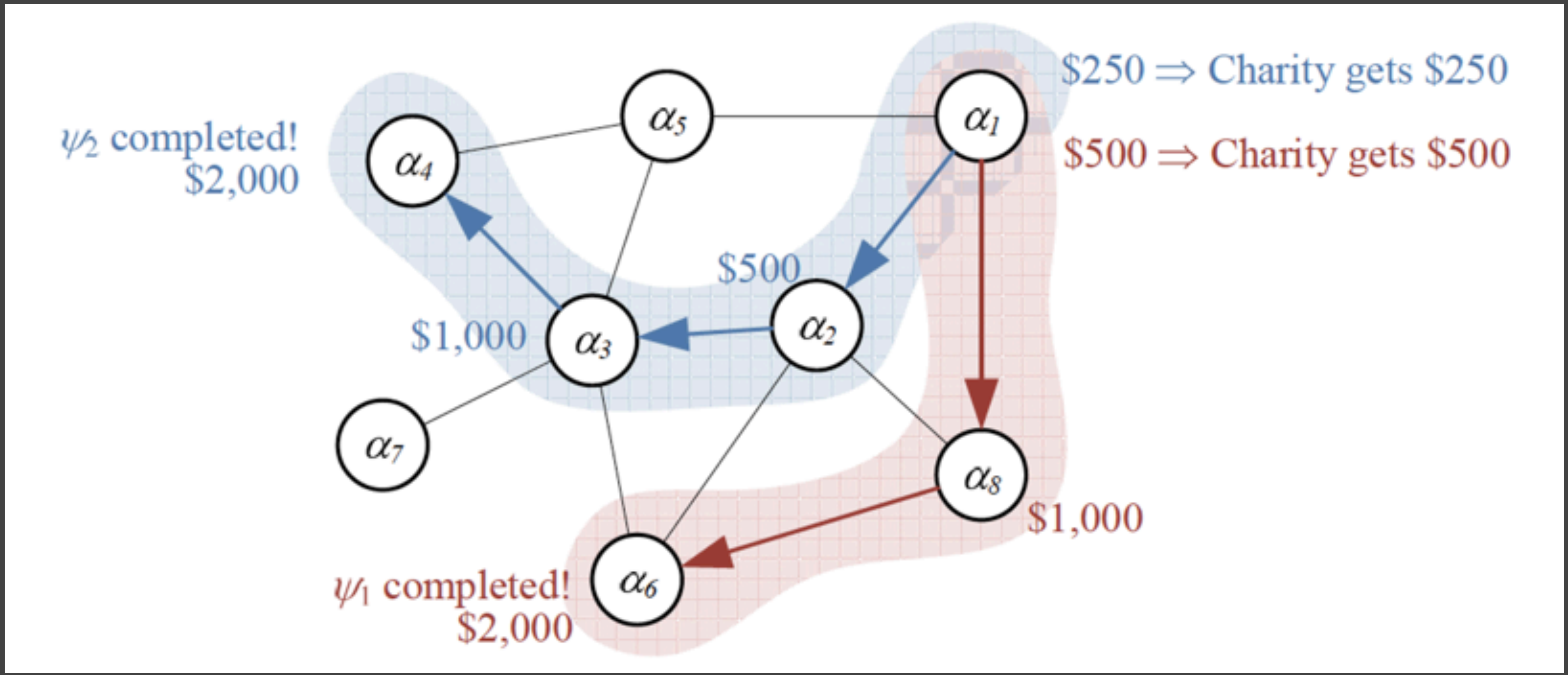
- Summary and Analysis
- Arguments and Rebuttals
- Ballotpedia article
- MapLight, Voter's Edge California
- Yes on Prop 30
- Stop Prop 30
- Join the Discussion on Prop 30
- About this project

You can visualize your influence on an anonymous graph



http://opinion.berkeley.edu/ca-prop-30-awareness/

Time critical social mobilization

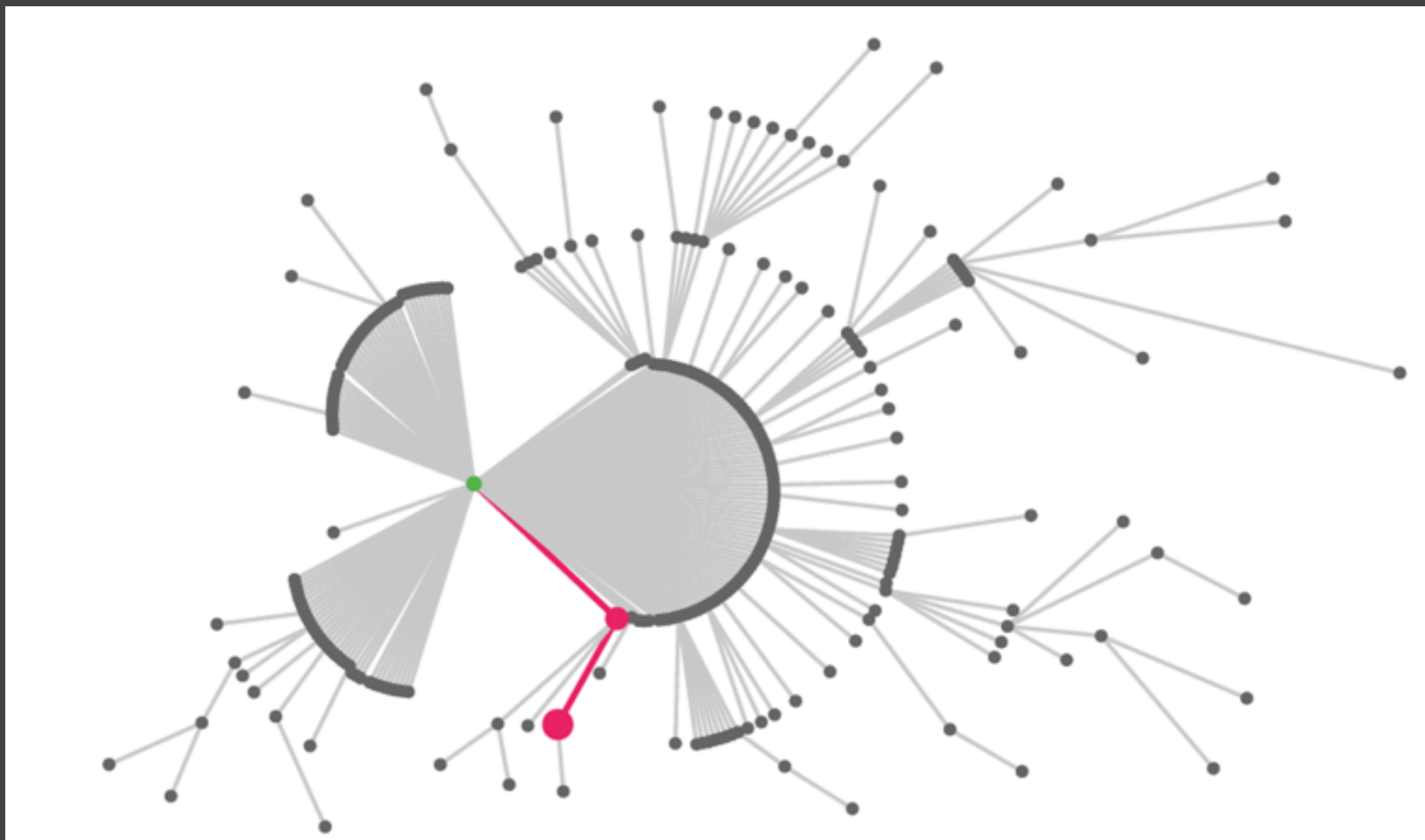


recursive incentive network
always within budget :-)

NB: Game theoretical demonstration for the success of the model in supplementary online material (SOM)

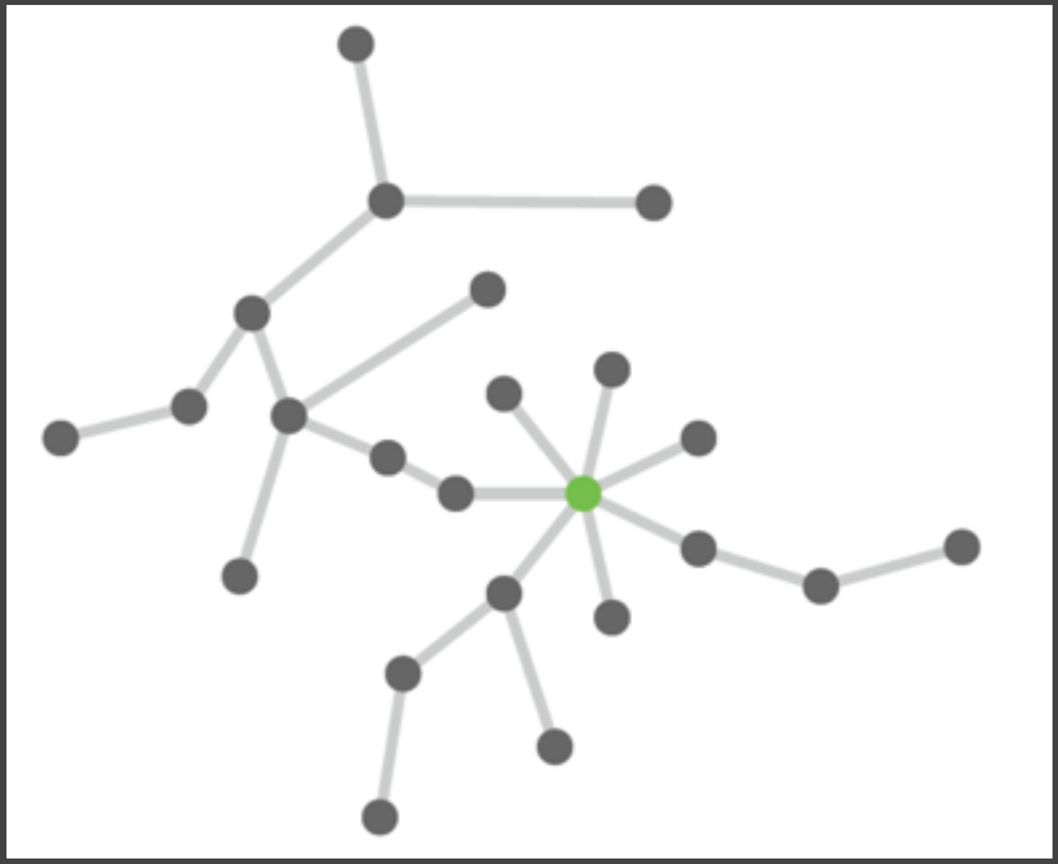
Pickard, G. et al. Time-Critical social mobilization. Science 334, 509-512 (2011).

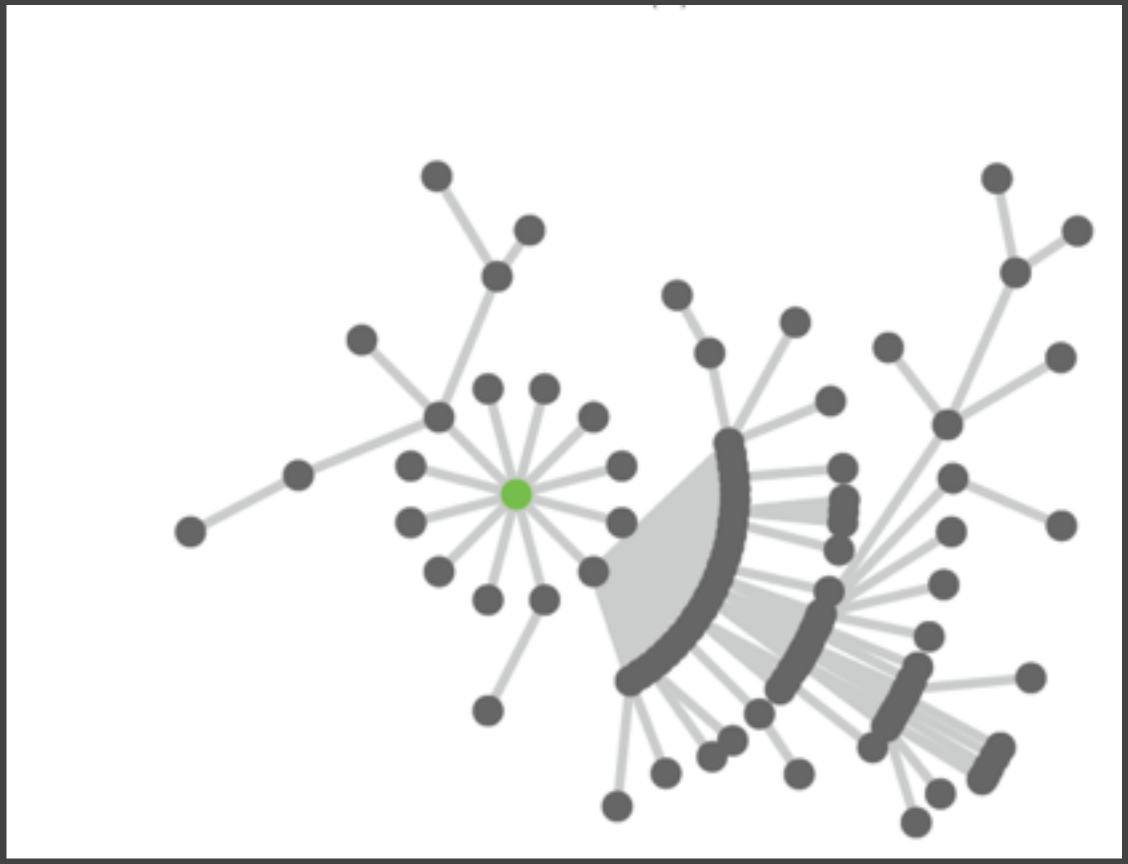
Successful Cascade



Pickard, G. et al. Time-Critical social mobilization. Science 334, 509-512 (2011).

Unsuccessful cascades





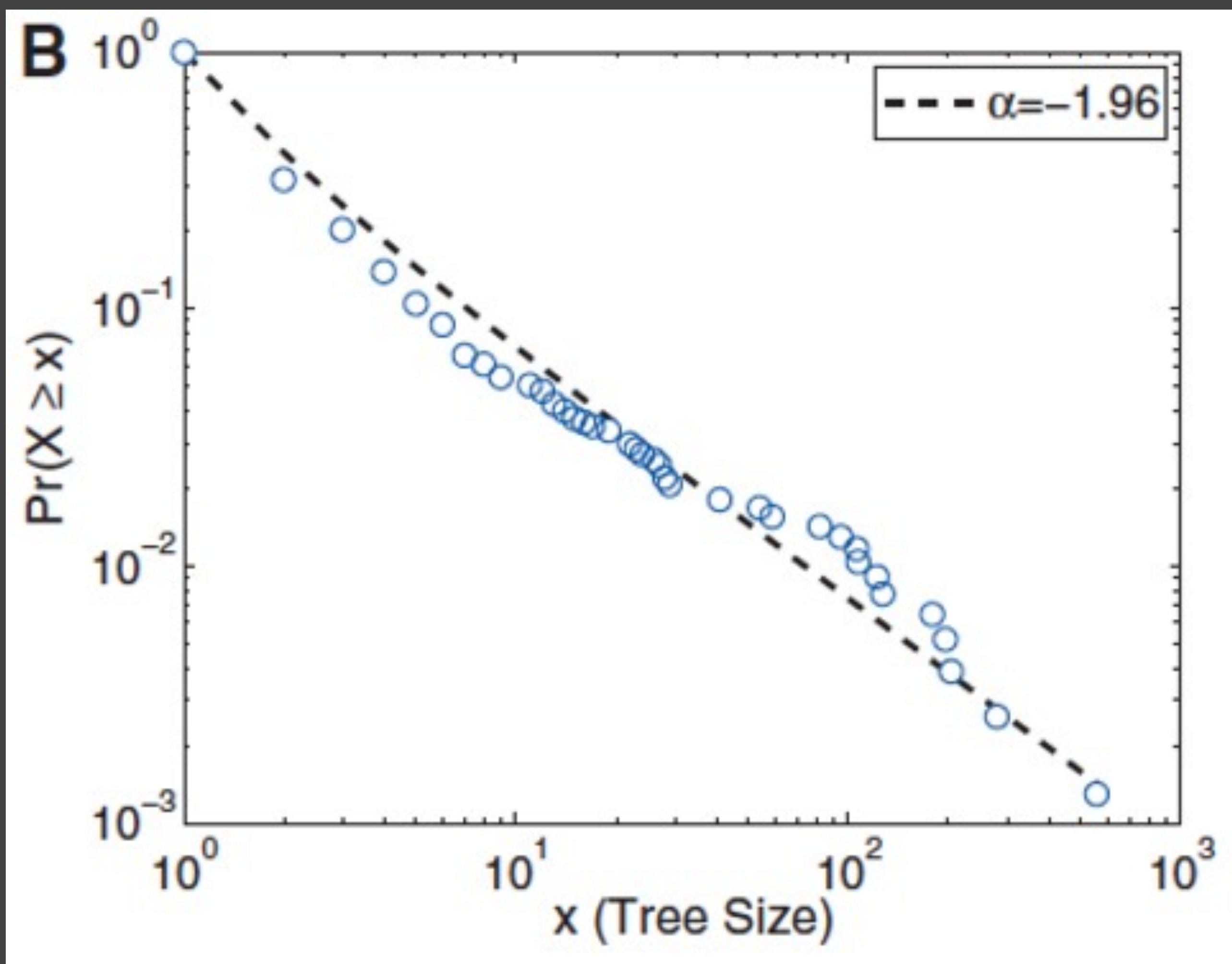
Pickard, G. et al. Time-Critical social mobilization. Science 334, 509-512 (2011).

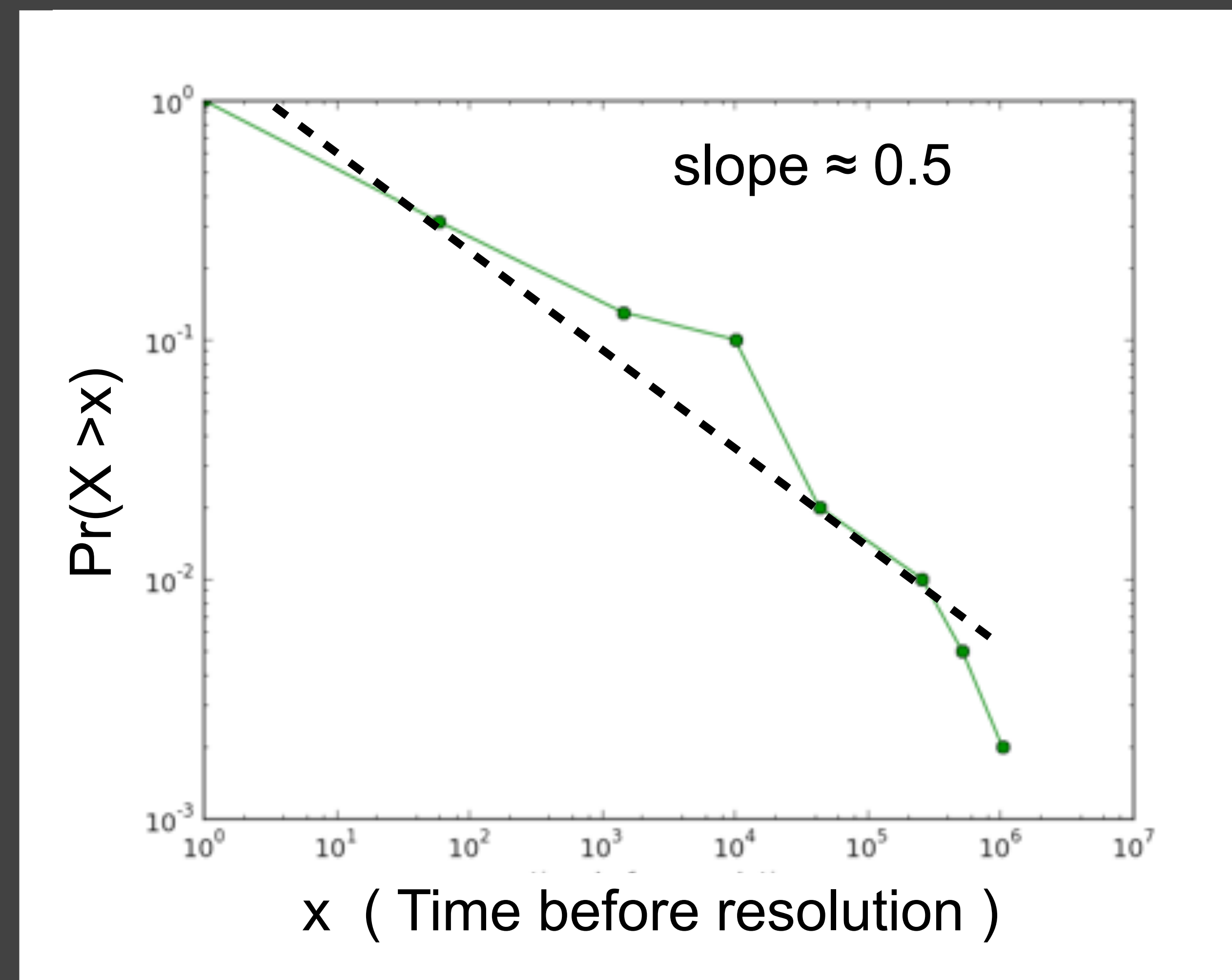
The (*~~music~~*) sound

of

social epidemics

Cascades size as a measure of success

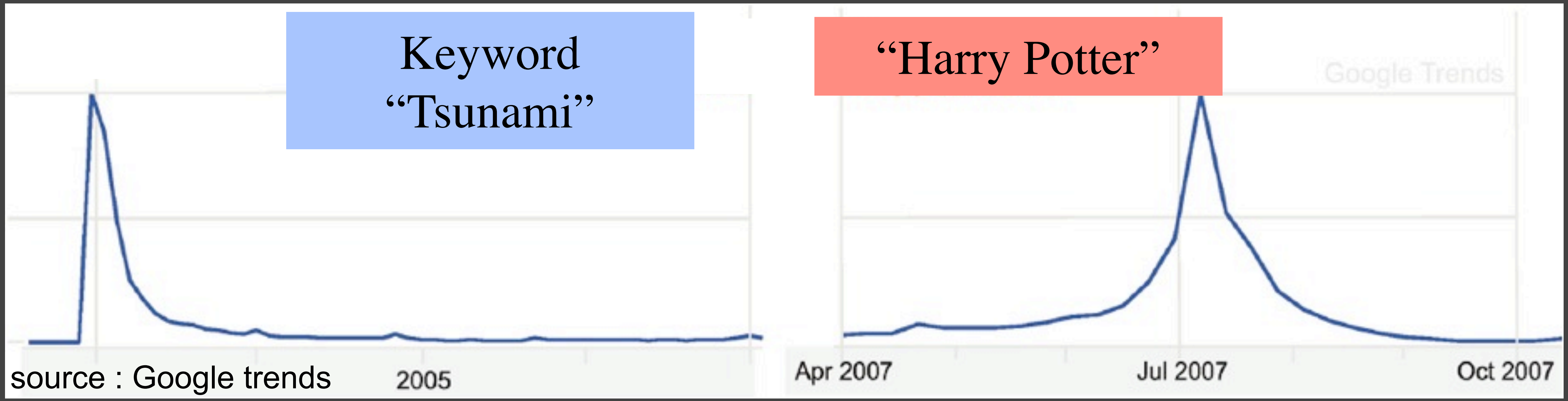




MIT Red Balloon Challenge Team

Stackoverflow

Social epidemics



Crane, R. & Sornette, D. Robust dynamic classes revealed by measuring the response function of a social system. Proceedings of the National Academy of Sciences 105, 15649-15653 (2008).

Social epidemics

Triggering model

$$\boxed{\lambda(t)} = \boxed{V(t)} + \boxed{\sum_{i,t_i \leq t} \mu_i \phi(t - t_i)}$$

Total Activity

Exogenous Activity

Endogenous Activity

Crane, R. & Sornette, D. Robust dynamic classes revealed by measuring the response function of a social system. Proceedings of the National Academy of Sciences 105, 15649-15653 (2008).

Social epidemics

Key results

exogenous shock

$$A_{\text{bare}}(t) \approx \frac{1}{(t - t_c)^{1+\theta}}.$$

exogenous shocks

close or at criticality $\langle\mu\rangle \approx 1$

$$A_{\text{ex}-c}(t) \approx \frac{1}{(t - t_c)^{1-\theta}}.$$

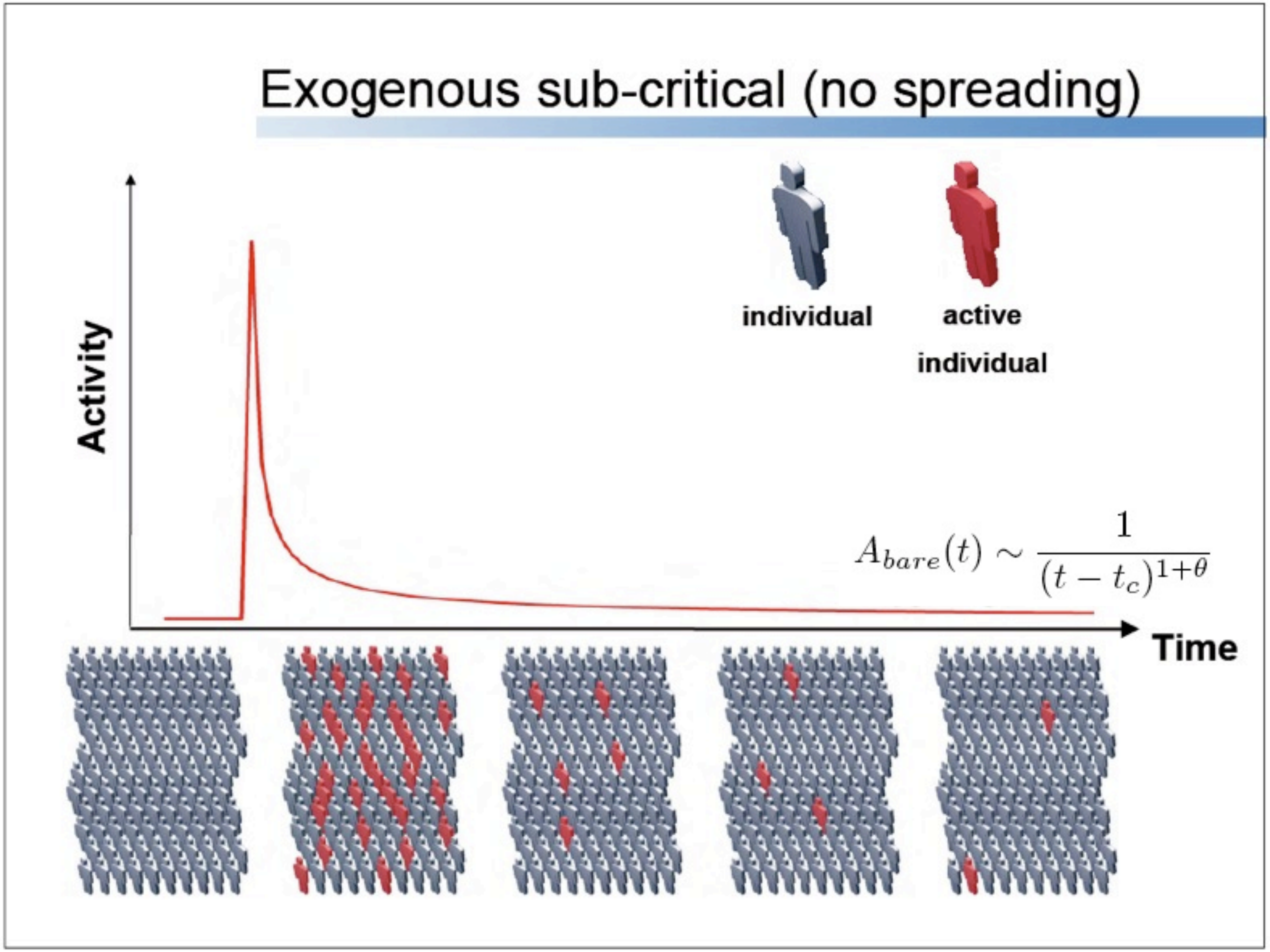
endogenous shocks

close or at criticality $\langle\mu\rangle \approx 1$

$$A_{\text{en}-c}(t) \approx \frac{1}{|t - t_c|^{1-2\theta}}.$$

Crane, R. & Sornette, D. Robust dynamic classes revealed by measuring the response function of a social system. Proceedings of the National Academy of Sciences 105, 15649-15653 (2008).

Ordinary Priority Queueing



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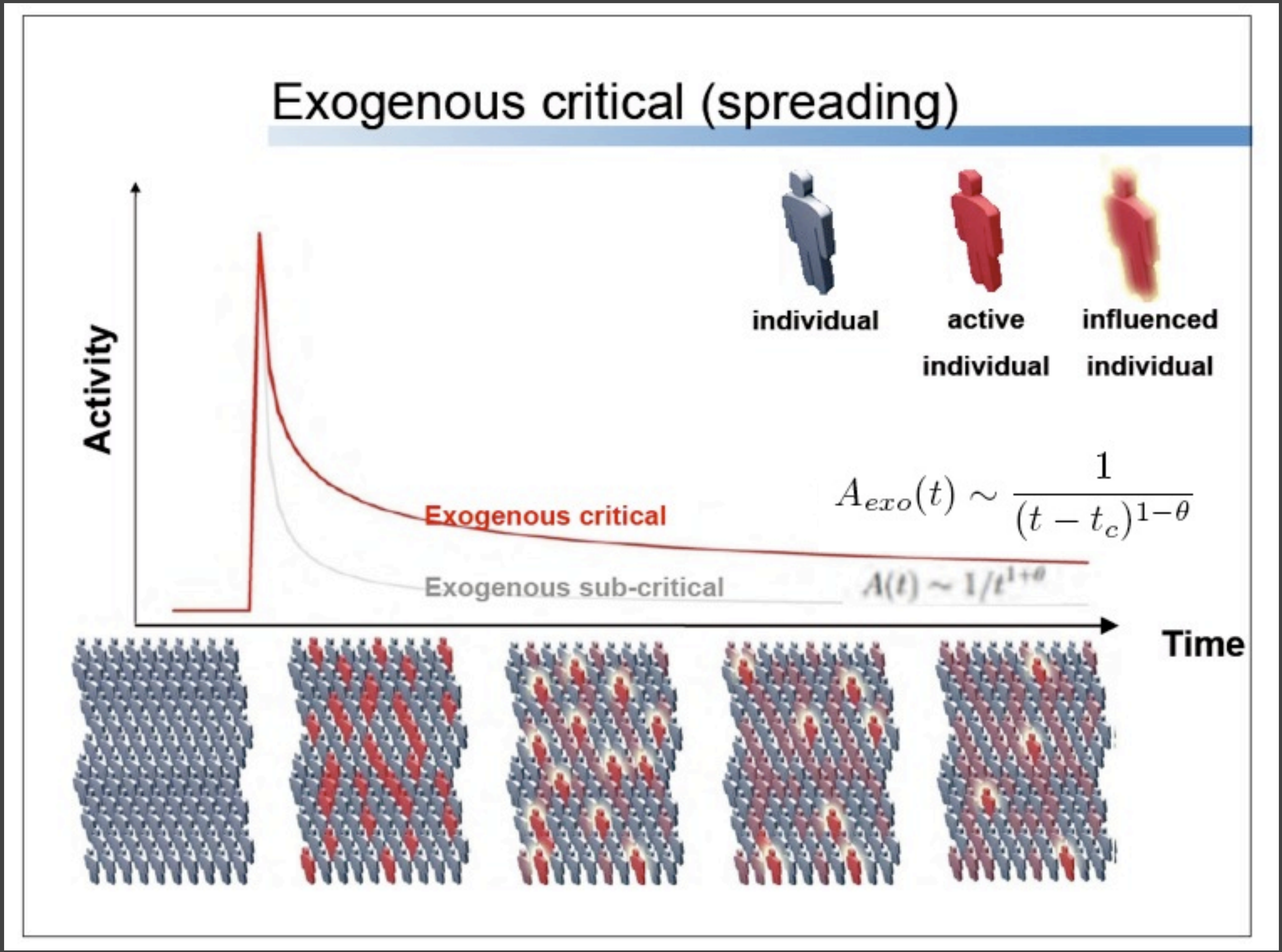

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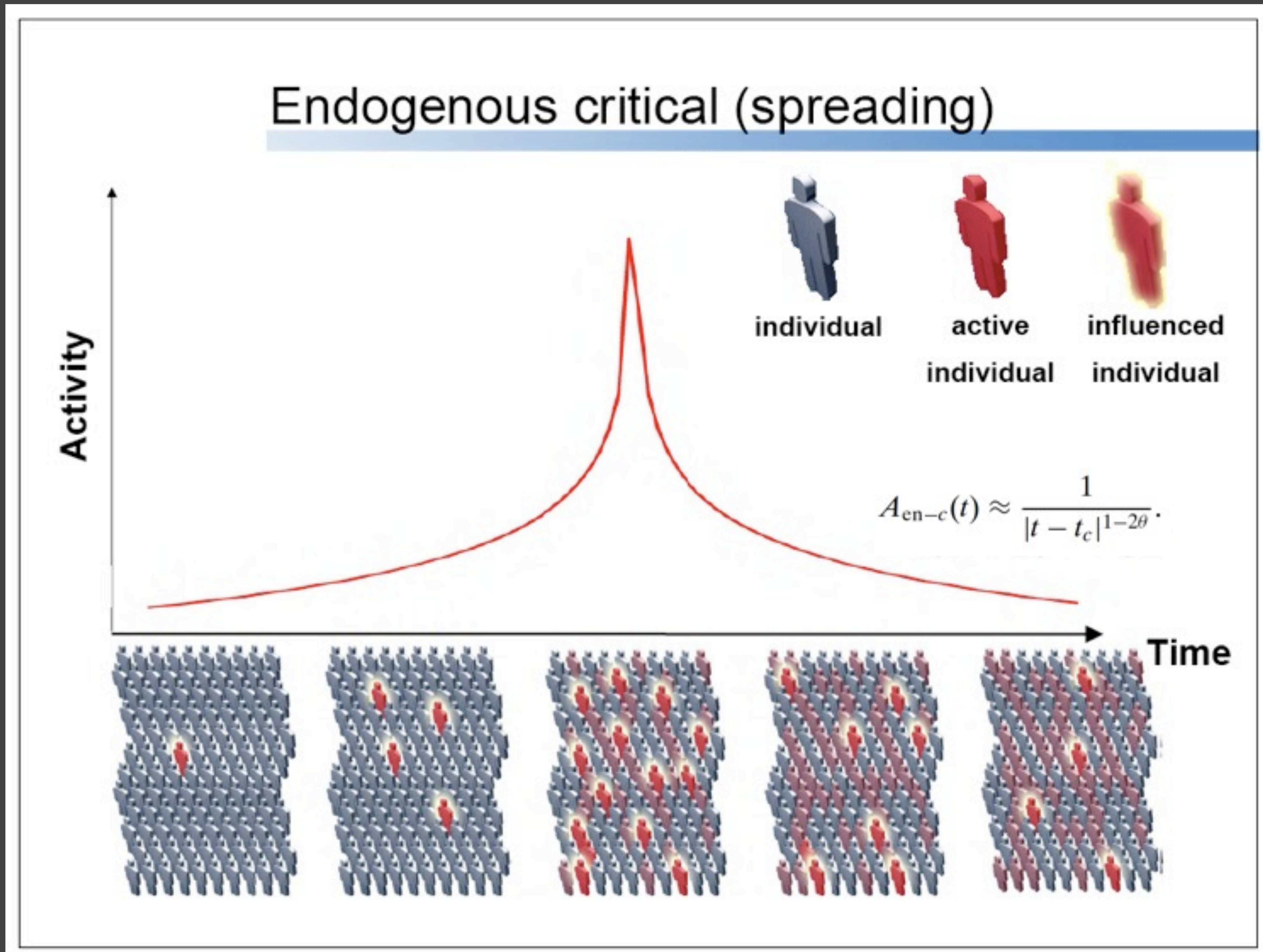
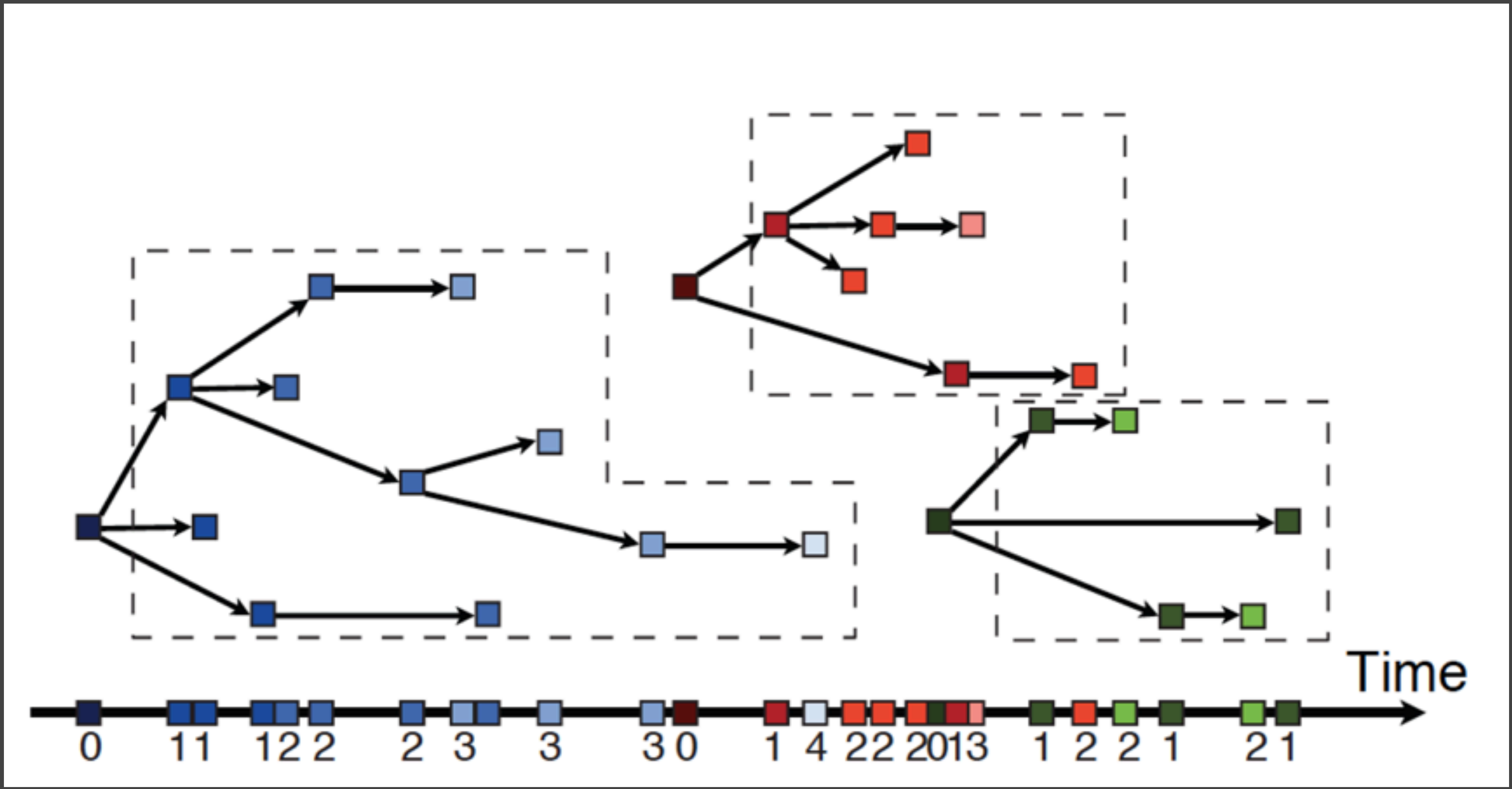


Crane, R. & Sornette, D. Robust dynamic classes revealed by measuring the response function of a social system. Proceedings of the National Academy of Sciences 105, 15649-15653 (2008).

Cascades size as a measure of success

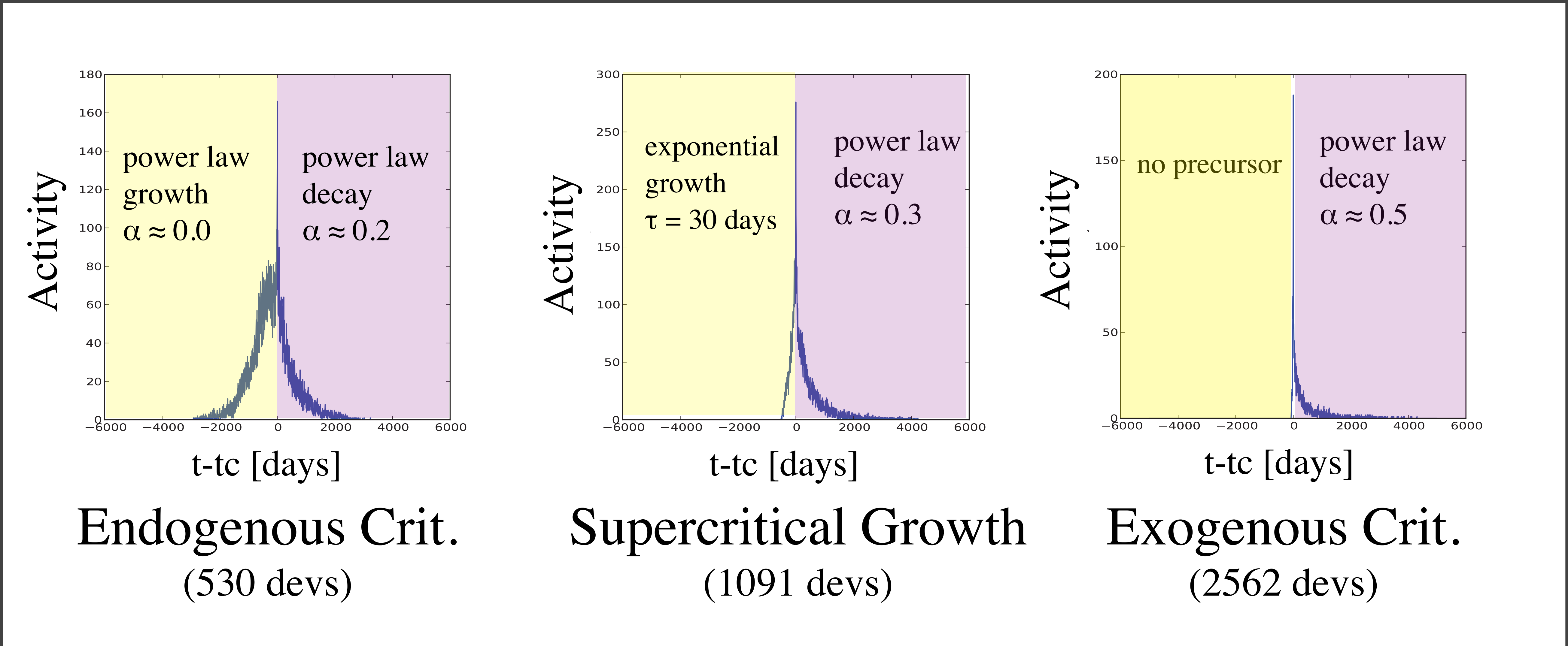


borrowed from Filiminov and Sornette (2013)

It’s complicated :-(

Why do we care ?

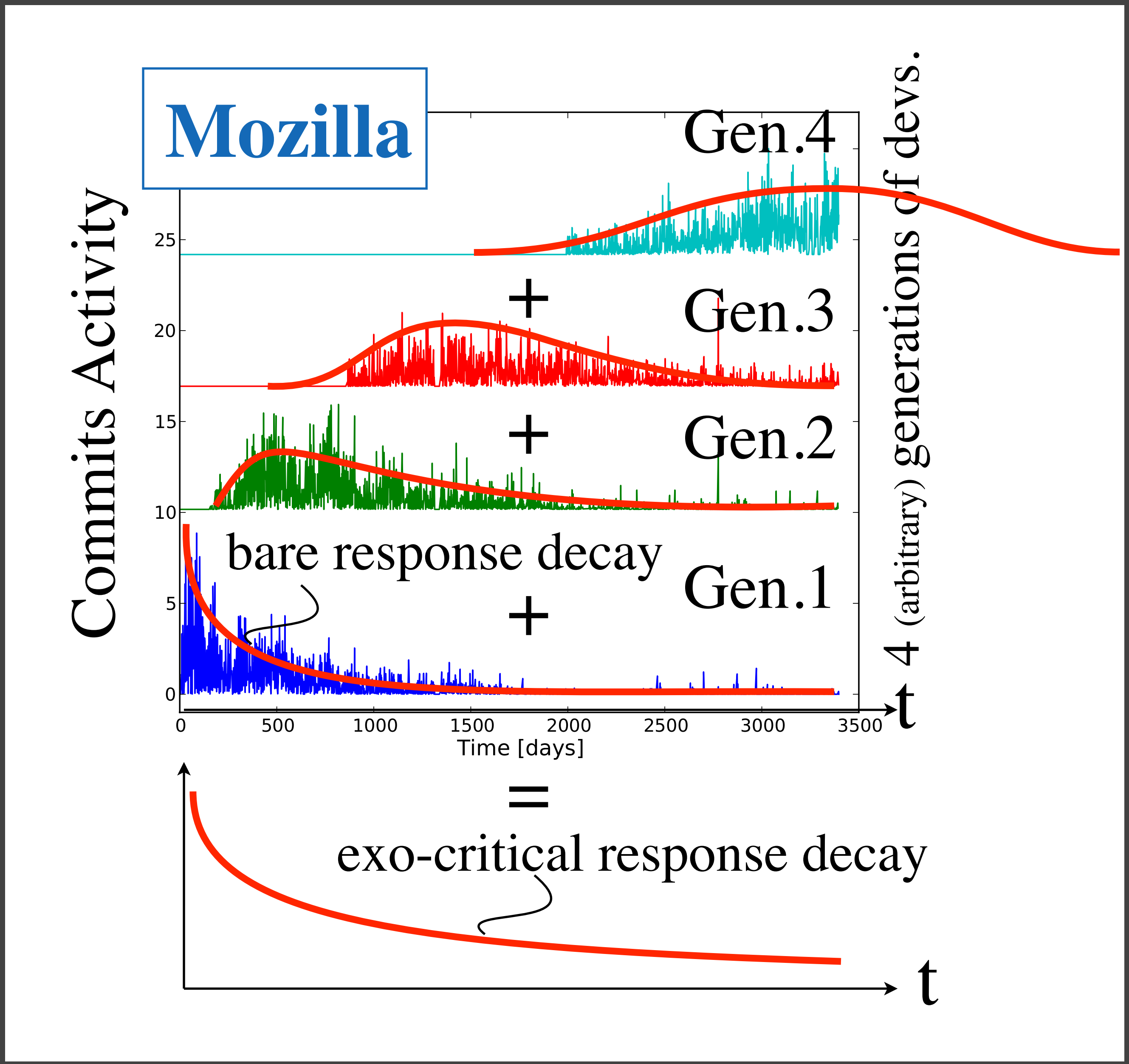
Social epidemics in open collaboration

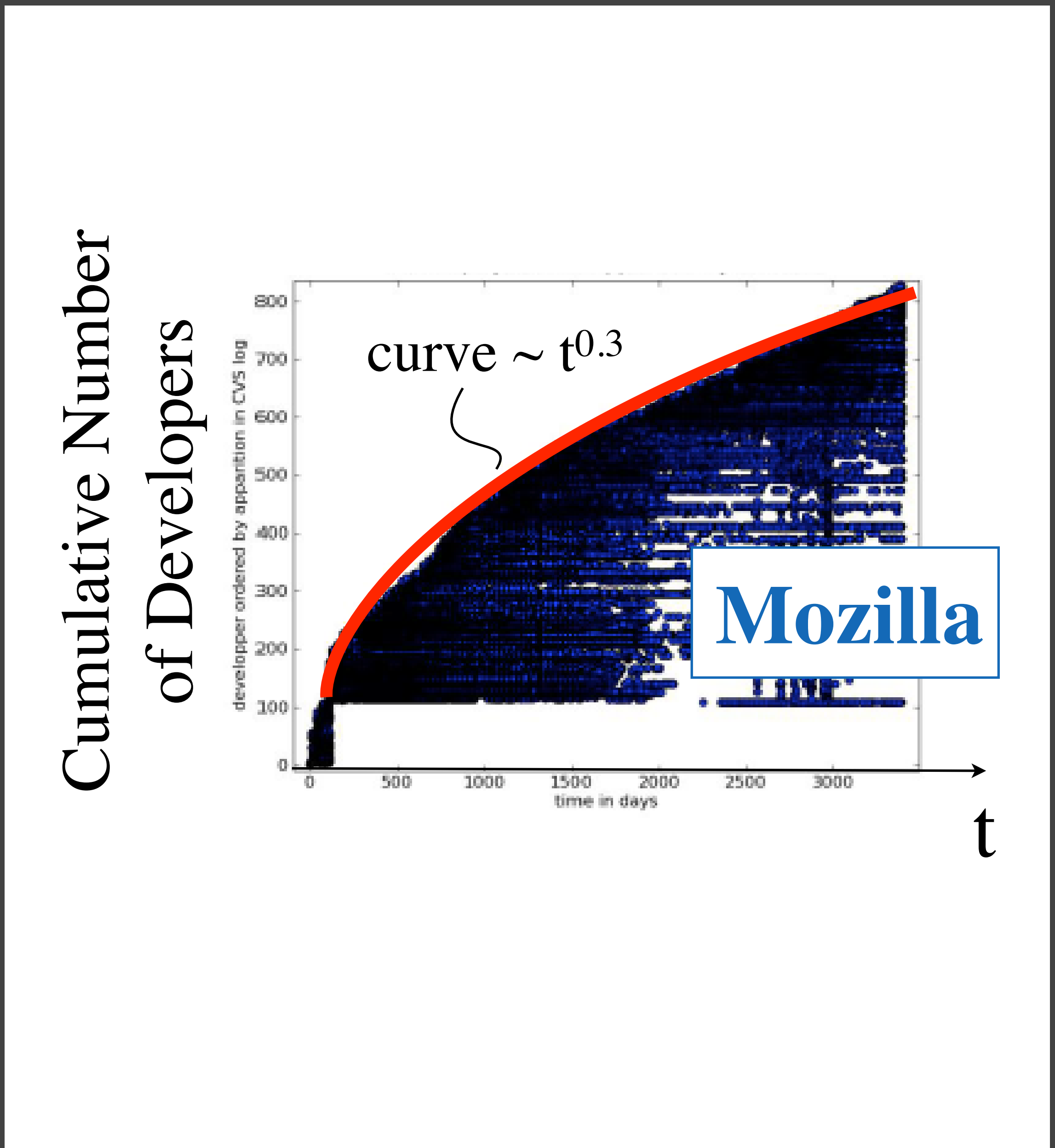


Classification of developers

by their exo/endogenous (critical) contributions

Social epidemics in open collaboration

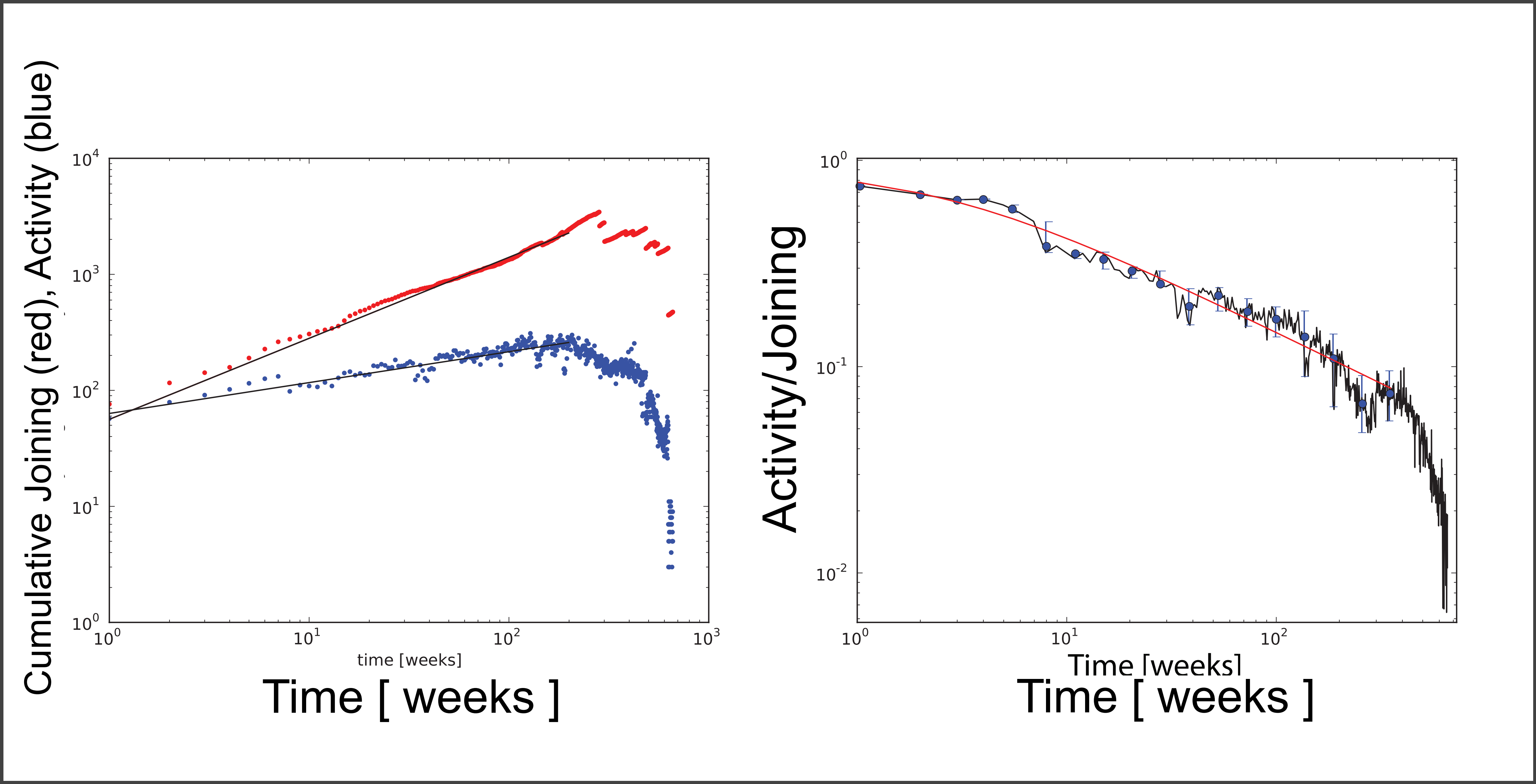




Prediction of coarse grained

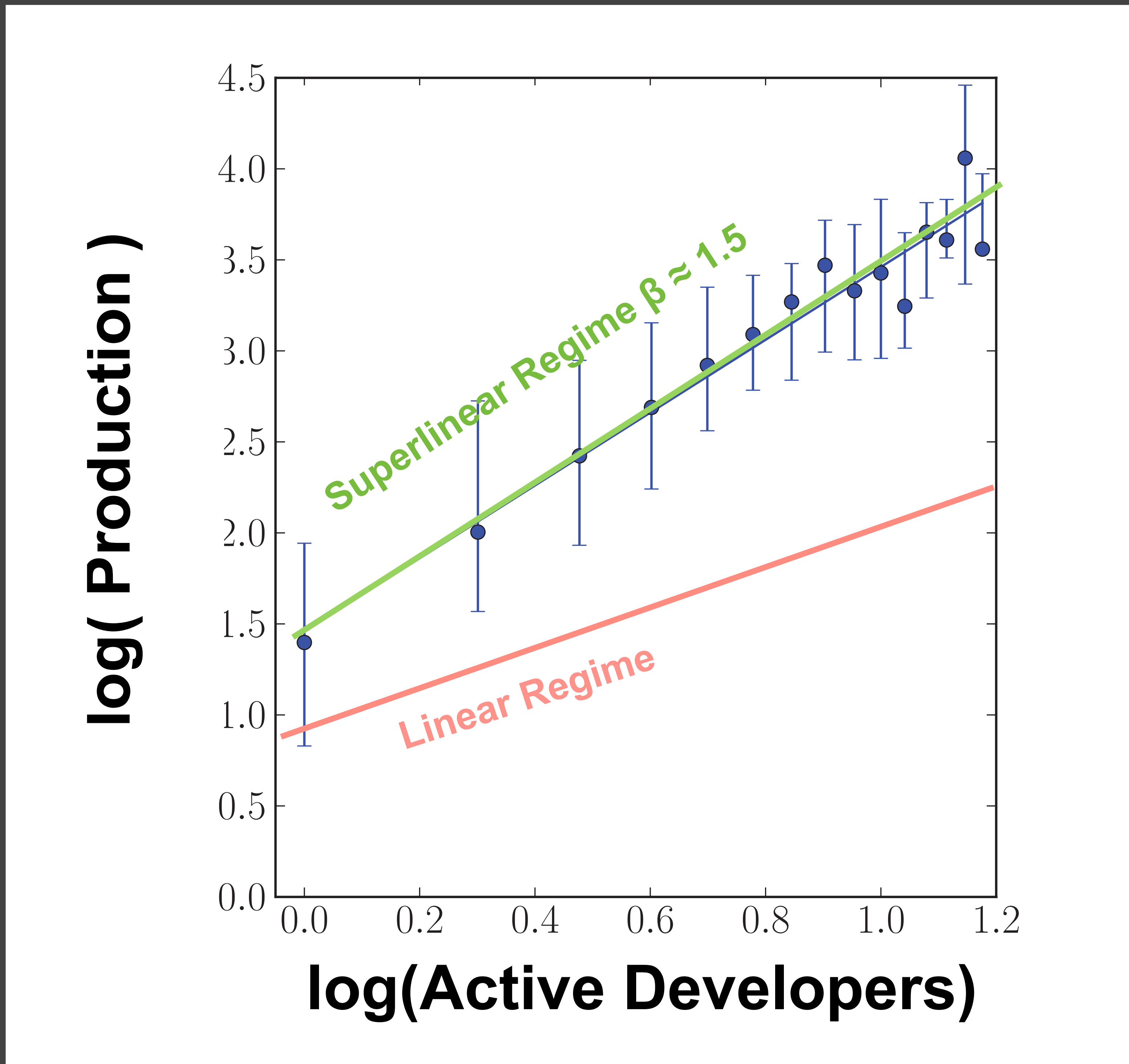
generation-by-generation dynamics

Social triggering in open collaboration



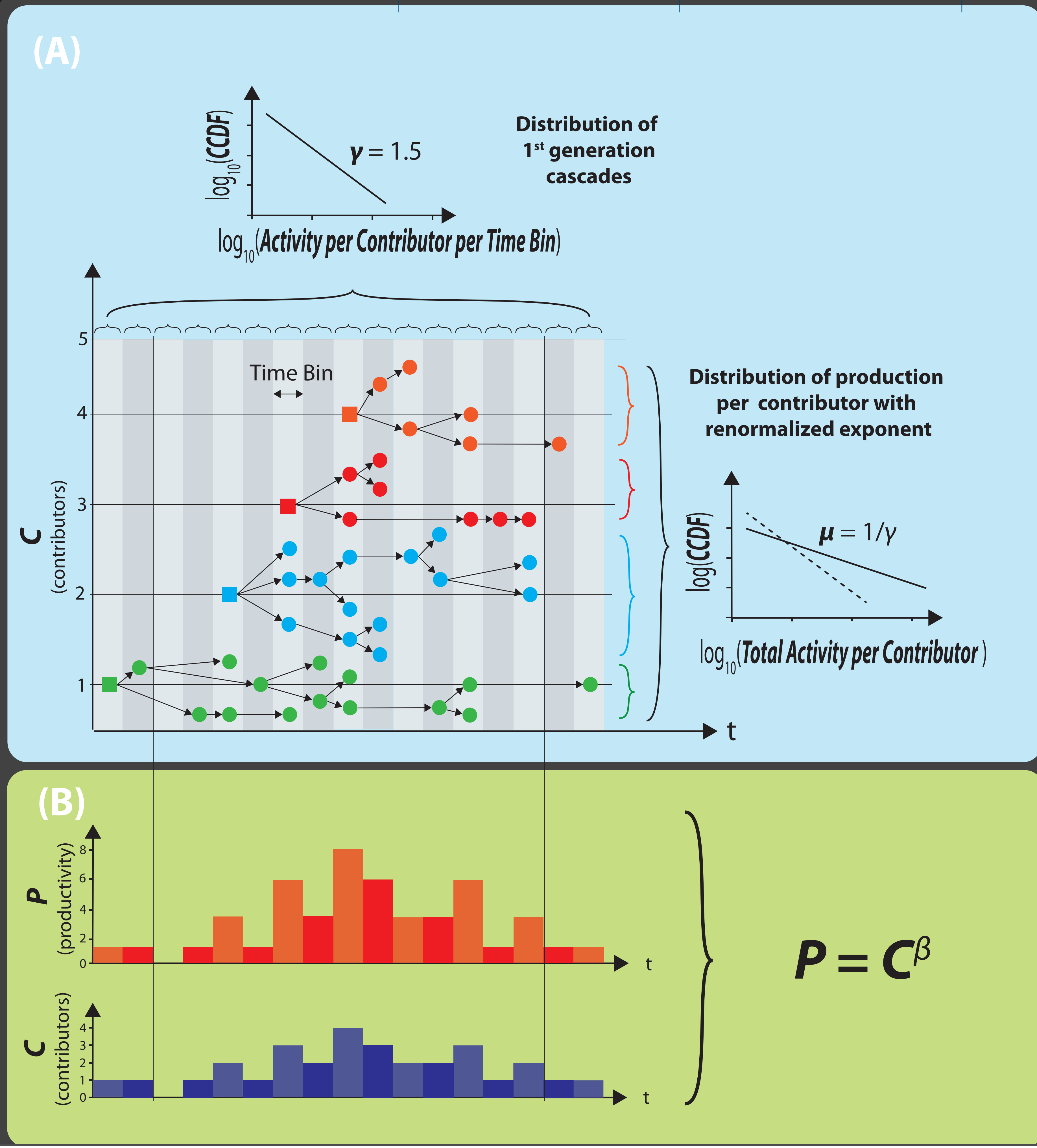
Long-term aging of open collaboration projects

Superlinear Productivity : $1 \oplus 1 \approx 2.8$



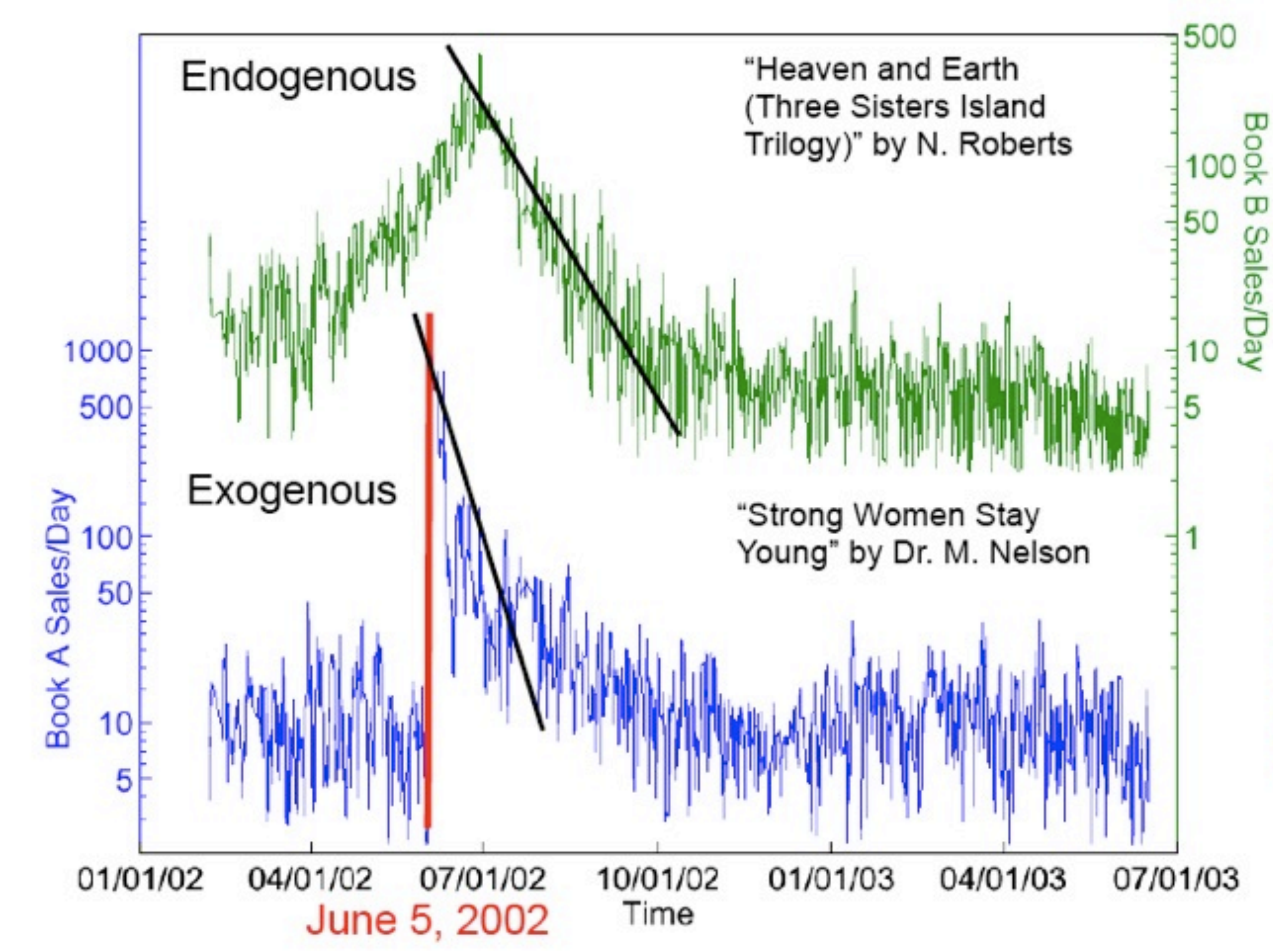
Maillart, T. , D. Sornette, A. Saichev, G. Ghezzi, *working paper* (2013)

Superlinear Productivity : $1 \oplus 1 \approx 2.8$



Other examples of social epidemics

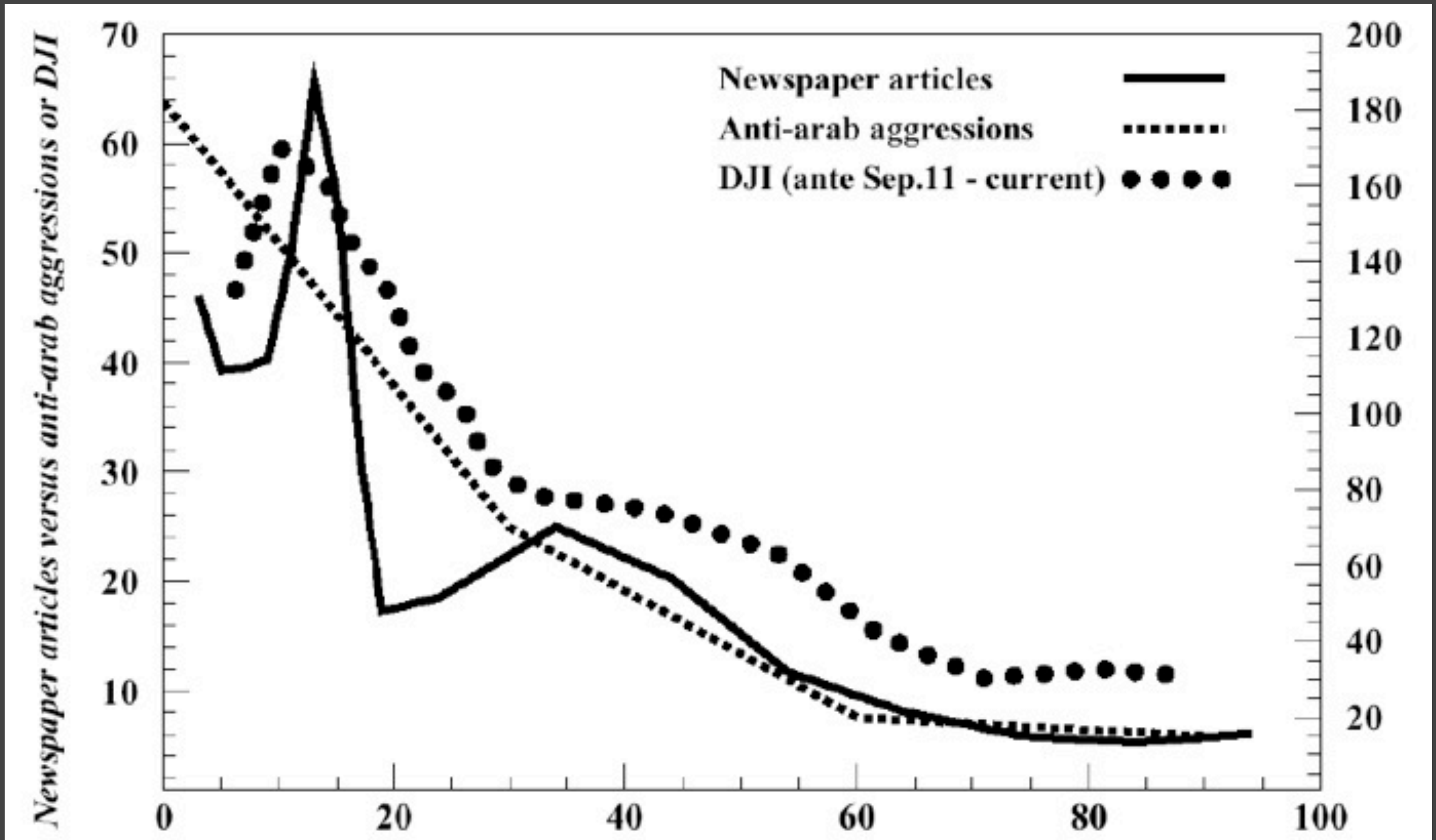
Book sales



June 4, 2002: New York Times article crediting the "groundbreaking research" of Dr. Nelson

Other examples of social epidemics

Political shocks



Roehner, Sornette & Andersen (2004)

Laws of social dynamics
apply very well to
open collaboration :-)

Applications

Reverse engineer social structures

Quantify triggering dynamics

Find what determines cascades

Machine learning

...

In a nutshell,

measure and manage !

Lab 3 (Tu 9/24)

“Hunting Social Epidemics”

Economics of Time

Time is scarce

Time cannot be stored

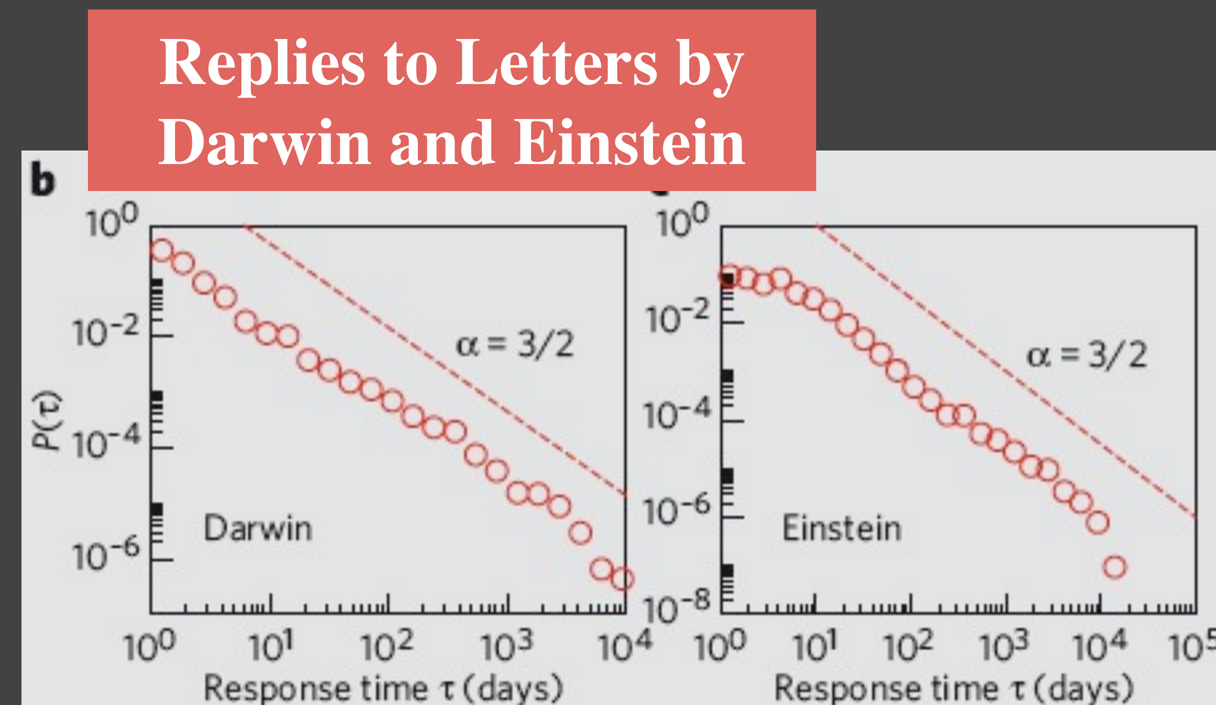
Money can’t buy time

Waiting Times in Human Dynamics

Priority Queueing :

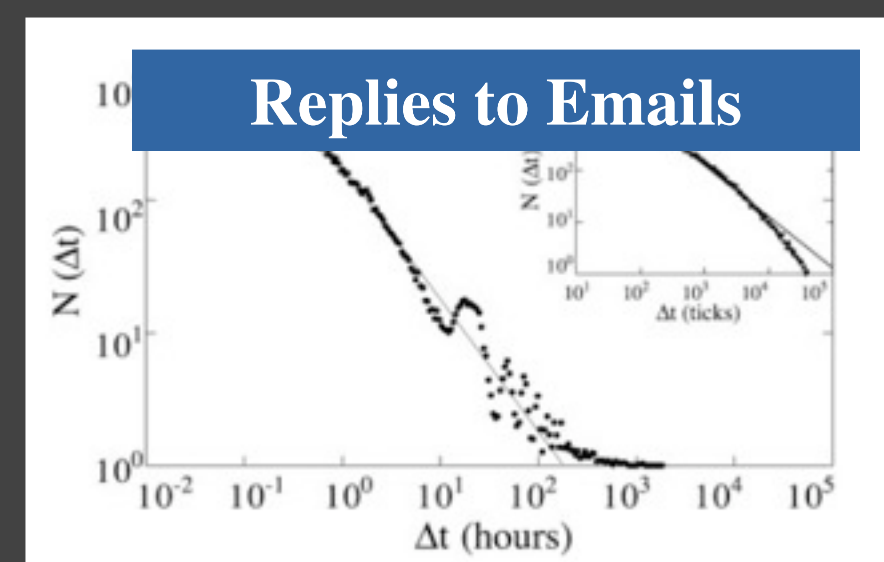
Models :

- Cobham *(1954)*
- Barabasi *(2005)*
- Grinstein & Linkser (2006,2008)
- Saichev & Sornette (2010)



Empirical Evidence :

- Oliveira & Barabasi (2005)
- Eckmann (2004)
- Crane et al. (2010)
- Maillart et al. (2011)



⇒ Human timing also governs all human interactions !

Priority Queueing Model

a. least priority task

- no matter what task prioritization strategy
- a task is always least urgent compared to some others

b. input / output task flows

$\beta := \langle\tau\rangle - \langle\eta\rangle$ with

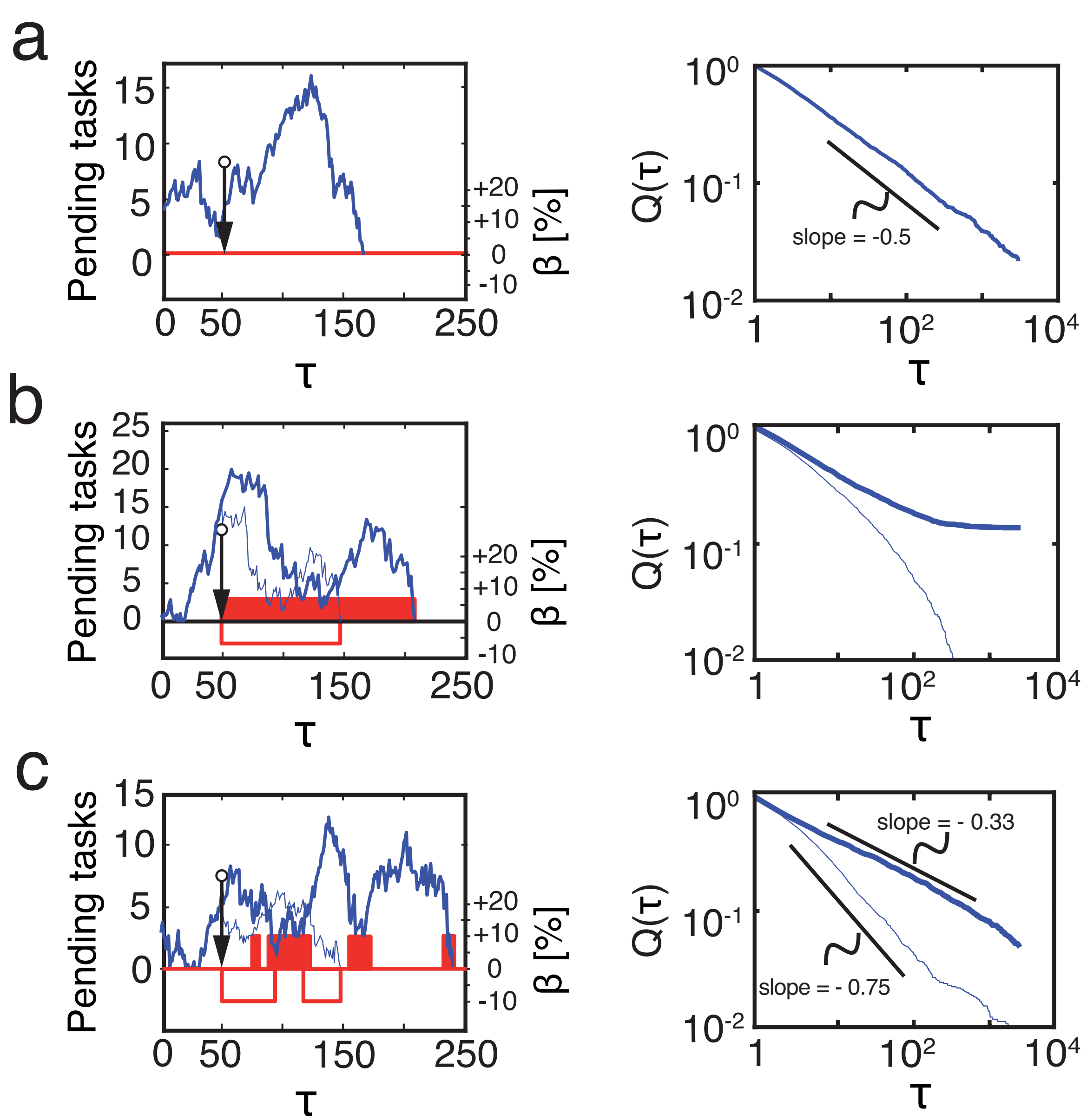
$\langle\tau\rangle$: average rate of performing tasks

$\langle\eta\rangle$: average rate of tasks entry

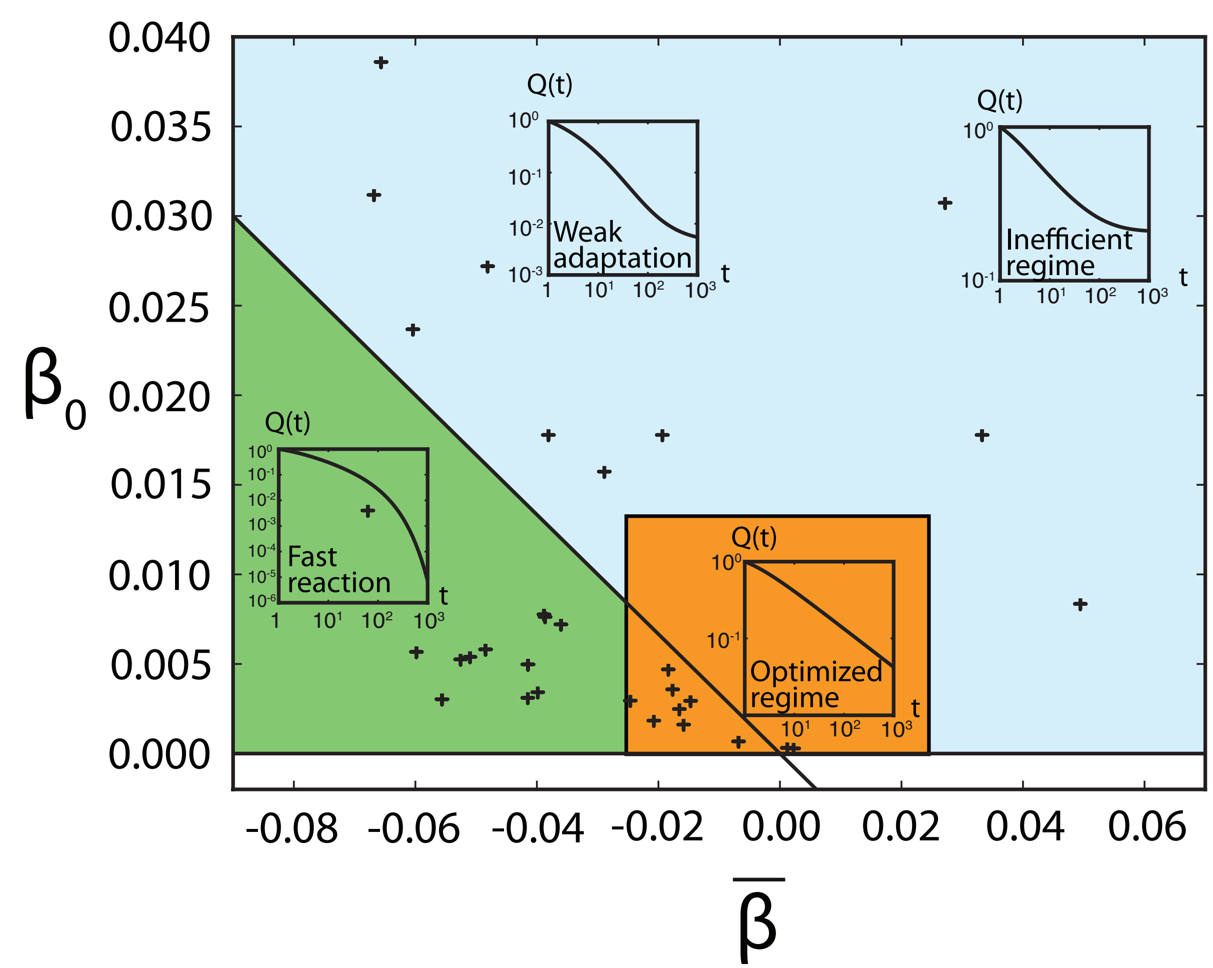
$\Rightarrow$ First return problem of a Wiener process

Priority Queueing Model

Simulations



Empirical Results



Browser Updates

T. Maillart, D. Sornette, S. Frei, T. Duebendorfer and A. Saichev, Quantification of Deviations from Rationality with Heavy-tails in Human Dynamics, *Physical Review E*, **2011.**

Economics of Time

Wealth | **Time**

$$\text{available wealth } W \rightarrow \text{available time } T$$

$$\text{consumption spends } c \text{ units of wealth} \rightarrow \text{solving a task consumes time } \tau$$

$$\text{utility from consuming } c: \; u(c) \rightarrow \text{gain from solving a task taking time } \tau: \; u(\tau)$$

$$\text{total utility U of consuming over } T \text{ periods}: \rightarrow \text{total utility U from solving } N \text{ tasks during time } T$$

$$U = \int_0^T u(c_t)e^{-\rho t}dt \rightarrow U = \sum_{i=1}^{N(T)} u(\tau_i)$$

$$\text{budget constraint } \int_0^T c(t)dt \leq W \rightarrow \text{time budget } \sum_{i=1}^{N(T)} \tau_i \leq T \; .$$

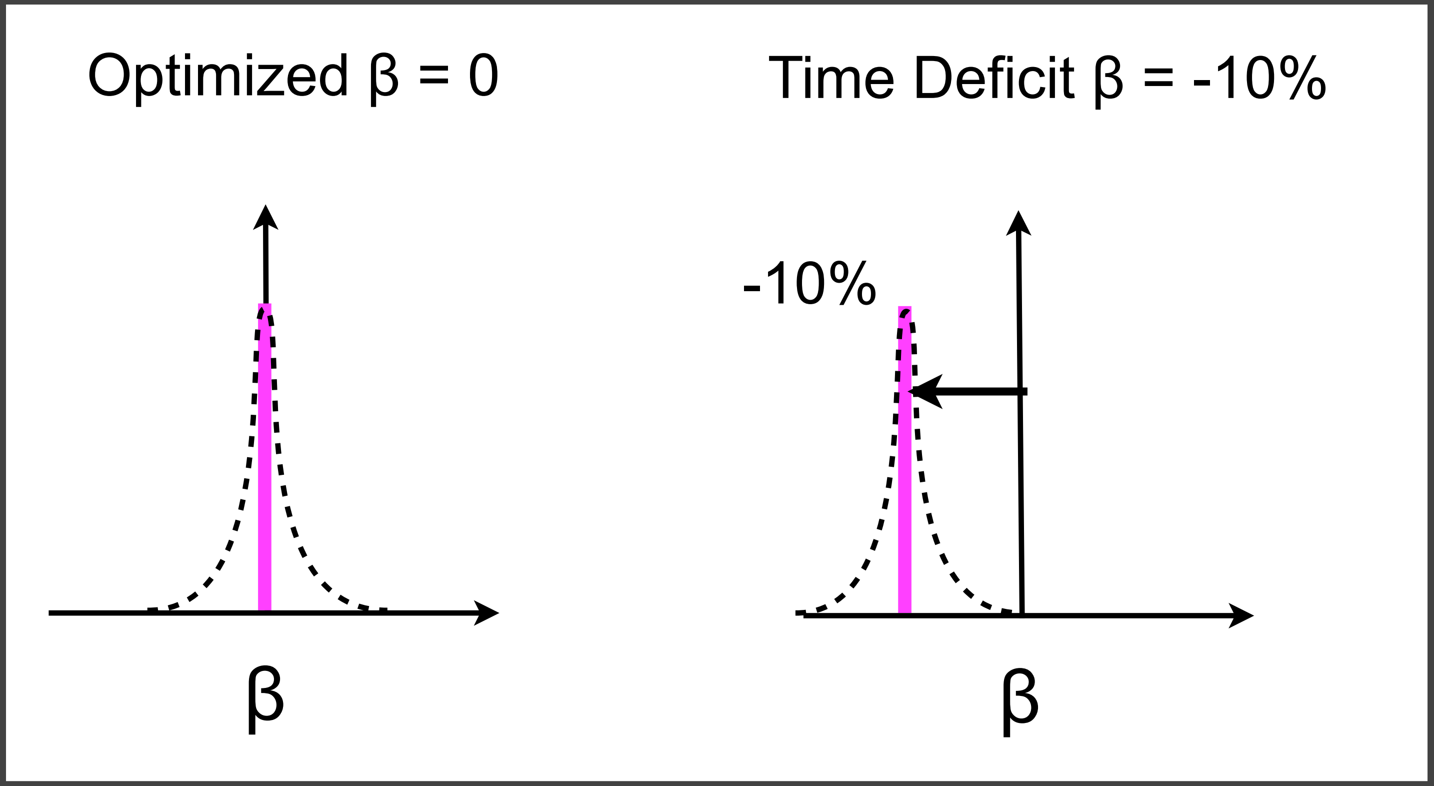
Time Utilization

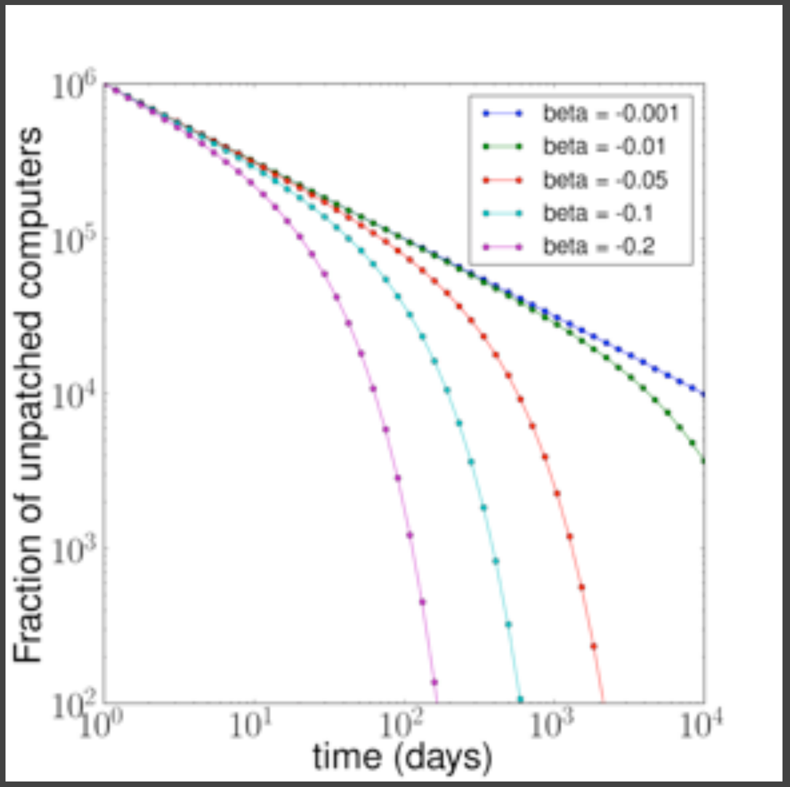
$$\kappa = \frac{1}{T}\sum_{i=1}^{N(T)} \tau_i \quad \langle\kappa\rangle = \frac{1}{T}\sum_{i=1}^{N(T)} \langle\tau_i\rangle = \frac{N}{T}\langle\tau\rangle = \frac{\langle\tau\rangle}{\langle\eta\rangle} = 1 + \frac{\beta}{\langle\eta\rangle}, \quad \text{for} \quad \kappa < 1 (\beta < 0),$$

Economics of Time

Policy question :

- can we make people execute a given task “faster” ?
- i.e. in a way that it would “sub-optimal” for them, but better for society ?





Research Question :

- Is it possible to test *Economics of Time* in a lab experiment ?