

# Thresholds, cascades, and predictability

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Social Network (Soc 204)  
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Logistics:

- ▶ balancing out the precepts
- ▶ time in precept for student-driven questions

Questions?

Vote:

1. Gladwell, M. (1996). The tipping point. *The New Yorker*.
2. Watts, Chapter 8.
3. Watts, D.J. (2002). A simple model of global cascades on random networks. *PNAS*.

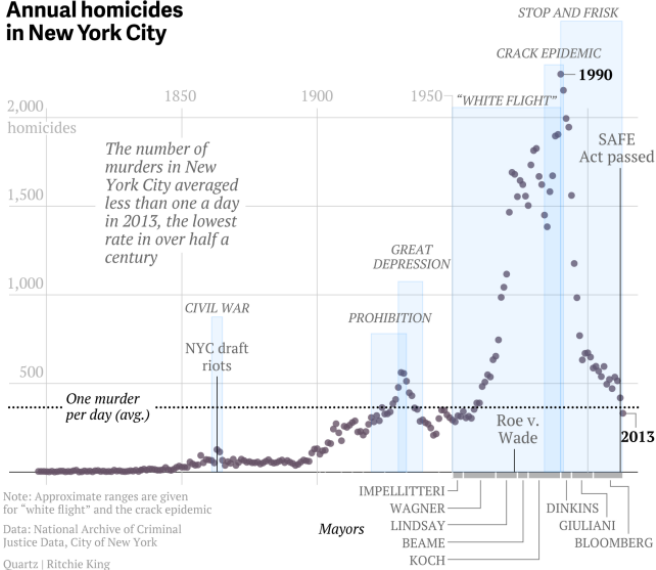
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- ▶ when there are interdependent decisions, individual rationality can lead to collective irrationality

## Annual homicides in New York City

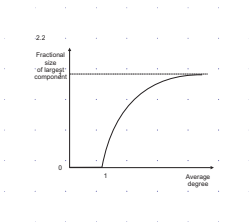


## Nonlinear change



[http://www.davidmelamed.com/2013/07/15/  
user-testing-ketchup-bottles-leads-to-counter-intuitive-surge-in-profits/](http://www.davidmelamed.com/2013/07/15/user-testing-ketchup-bottles-leads-to-counter-intuitive-surge-in-profits/)

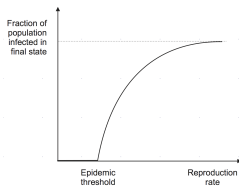
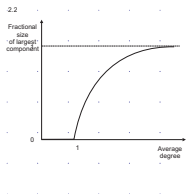
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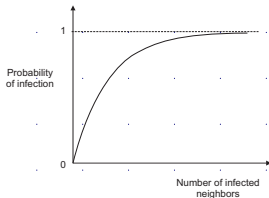
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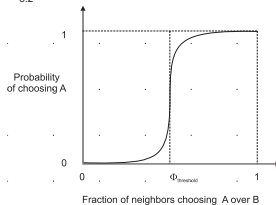
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“What if homicides, which we often causally refer to as an epidemic, actually *is* an epidemic, and moves through the populations the way that the flu bug does.” Malcom Gladwell

8.1



8.2



(a) Probability of activation in disease spreading

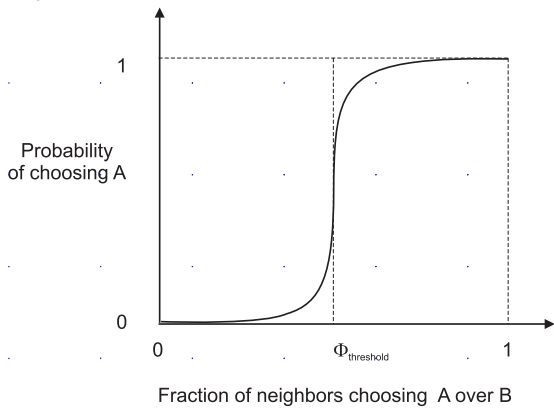
(b) Probability of activation in social spreading

For more on why social decisions might involve thresholds, see Lopez-Pintado and Watts (2008) [Social Influence, Binary Decisions and Collective Dynamics](#)

## Differences between social contagion and biological contagion:

- ▶ social contacts are interdependent and disease contacts are independent
- ▶ social spreading on fraction of neighbors doing some behavior rather than absolute number: diseases depends on absolute number

8.2



Standing ovation demo

Demo illustrates that

- ▶ hard to predict collective outcome from individual preferences
- ▶ hard to infer individual preferences from collective outcomes

For more examples, see Granovetter (1978) [Threshold Models of Collective Behavior](#)

Now what happens if we move that exact process onto a network?

# A simple model of global cascades on random networks

**Duncan J. Watts\***

Department of Sociology, Columbia University New York, NY 10027

Communicated by Murray Gell-Mann, Santa Fe Institute, Santa Fe, NM, February 14, 2002 (received for review May 29, 2001)



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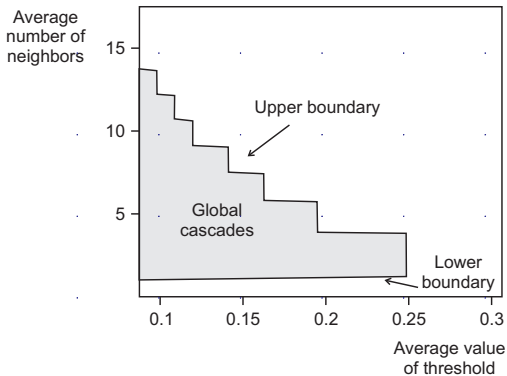
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- ▶ All nodes turned off
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8.5



Note that the percolating vulnerable cluster is not about influential people; it is about easily influenced people



I need your help.  
How can I prevent the riots?

<http://www.princeton.edu/president/eisgruber/who/eisgruber/Indoor.jpg>

Assume:

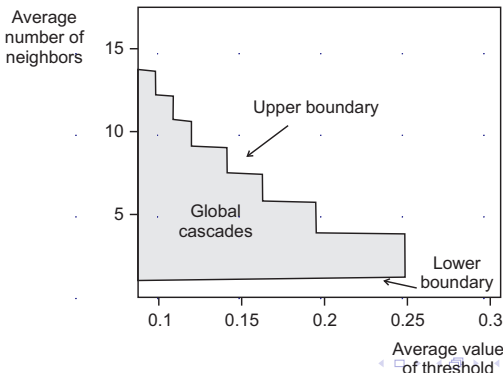
- ▶ the social network of Princeton students is an Erdos Renyi random graph
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Assume:

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- ▶ all Princeton students have exactly the same threshold

What do you recommend? Explain your answer in terms of actions he can understand and in terms of the cascade window.

8.5



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- ▶ In social contagion what is the effect of increased connectivity? **It depends**

Model in Watts (2002) helps us understand why

- ▶ global cascades can be triggered by very small shocks
- ▶ global cascades occur rarely despite many shocks that are a priori indistinguishable



Mohamed Bouazizi

[http://en.wikipedia.org/wiki/File:Mohamed\\_Bouazizi.jpg](http://en.wikipedia.org/wiki/File:Mohamed_Bouazizi.jpg)



[http://commons.wikimedia.org/wiki/File:Caravane\\_de\\_la\\_lib%C3%A9ration\\_4.jpg](http://commons.wikimedia.org/wiki/File:Caravane_de_la_lib%C3%A9ration_4.jpg)



[http://commons.wikimedia.org/wiki/File:Info\\_box\\_collage\\_for\\_mena\\_Arabic\\_protests.png](http://commons.wikimedia.org/wiki/File:Info_box_collage_for_mena_Arabic_protests.png)

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- ▶ disease contagion and social contagion have different micro rules and macro dynamics
- ▶ hard to predict collective outcome from individual preferences and hard to infer individual preferences from collective outcomes
- ▶ sometimes small shocks get big and sometimes they don't

<http://bit.ly/socnet204>

<http://bit.ly/socnet204>

Next class:

- ▶ Hedstrom, P. (2006). Experimental macro sociology: Predicting the next best seller. *Science*.
- ▶ Salganik, M.J., Dodds, P.S., and Watts, D.J. (2006). Experimental study of inequality and unpredictability in an artificial cultural market. *Science*.
- ▶ Salganik, M.J., and Watts, D.J. (2008). Leading the herd astray: Experimental study of self-fulfilling prophecies in an artificial cultural market. *Social Psychology Quarterly*.