Class 10: Thresholds, cascades, and predictability

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Sociology 204: Social Networks
Princeton University

2/2 Threshold model on networks

Now what happens when people following a threshold rule are placed into a network? What kinds of cascades can occur?

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A simple model of global cascades on random networks

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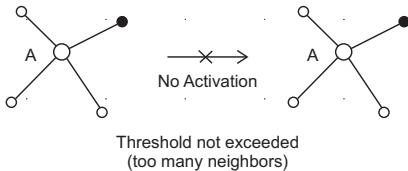Simple model of individual behavior + simple network → complex collective behavior
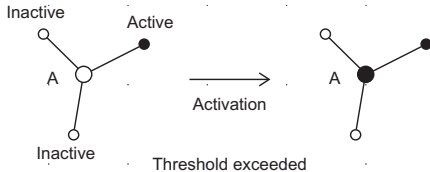
Setup:

- ▶ Homogenous thresholds on Erdos-Reyni random graph
- ▶ All nodes turned off
- ▶ One node randomly turned on

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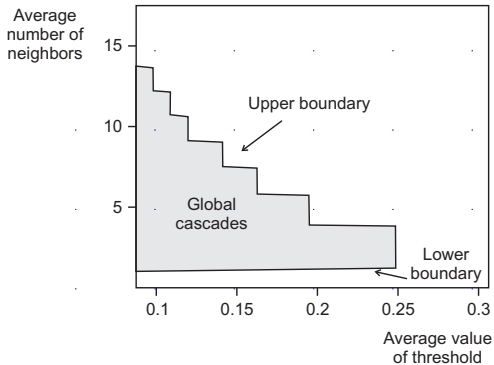- ▶ One node randomly turned on

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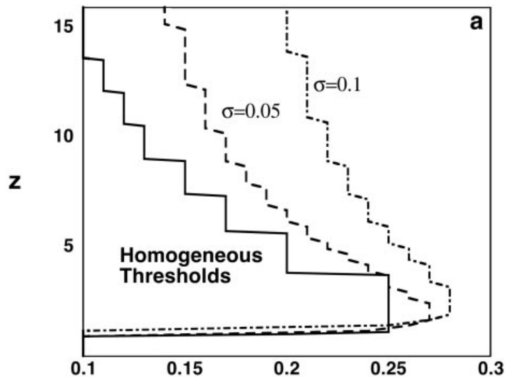- ▶ All nodes turned off
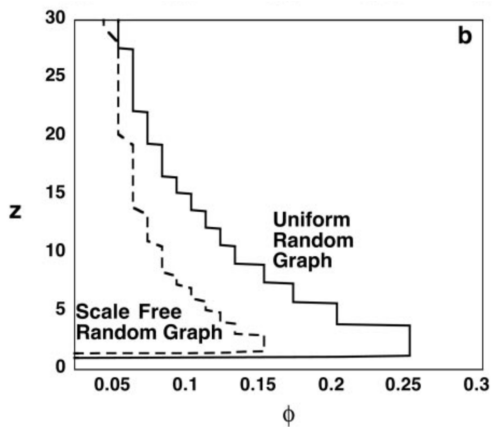- ▶ One node randomly turned on

Note that the percolating vulnerable cluster is not about influential people; it is about easily influenced people
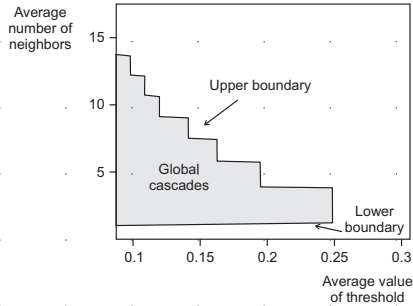
Assumes: Homogenous thresholds on Erdos-Reyni random graph (Watts 2002 calls it "uniform random graph"). What about heterogeneity?

Heterogeneity in thresholds makes cascade window bigger.

Heterogeneity in degree distribution makes cascade window smaller.

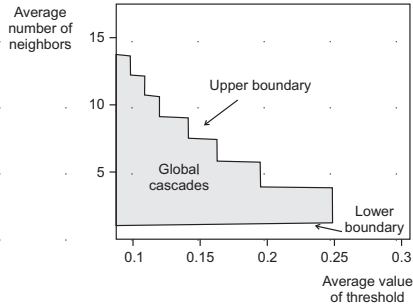8.5

Average number of neighbors

Upper boundary

Global cascades

Lower boundary

Average value of threshold

Think back to the comparison of biological and social contagion.

▶ In biological contagion what is the effect of increased connectivity?

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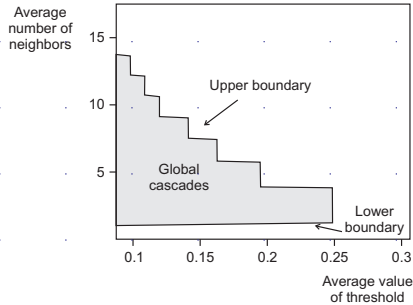▶ In biological contagion what is the effect of increased connectivity? More spread
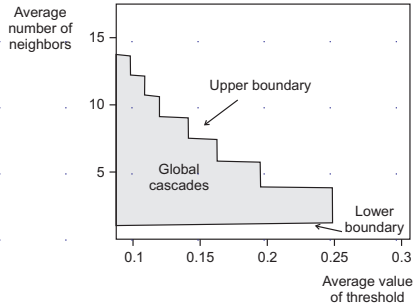▶ In social contagion what is the effect of increased connectivity?

Think back to the comparison of biological and social contagion.

► In biological contagion what is the effect of increased connectivity? More spread

► 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

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- 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://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

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Summary:

- ▶ 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

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*.