Tipping Points in Society

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# Tipping points in the media

World Population
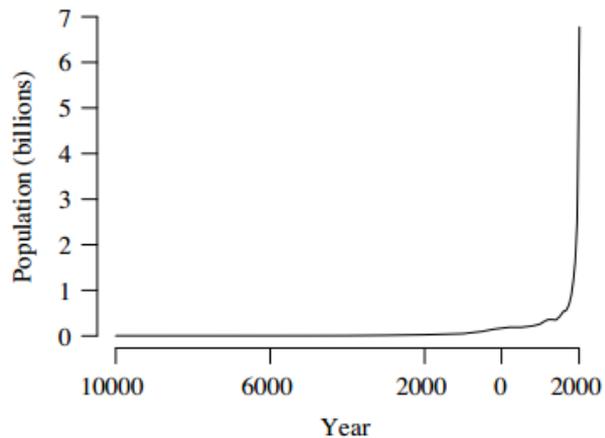
Wikipedia Articles
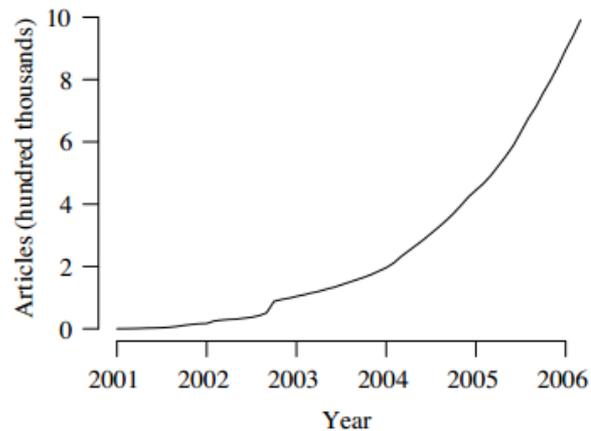
Ambiguity of tipping points in the media
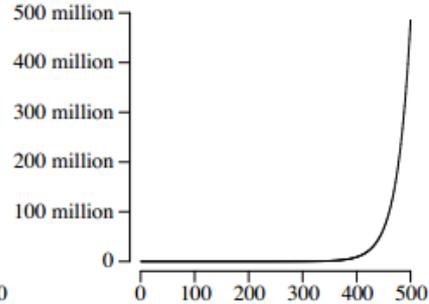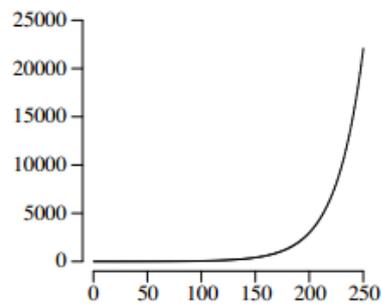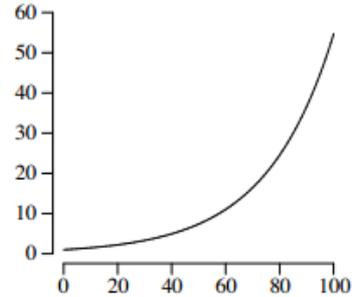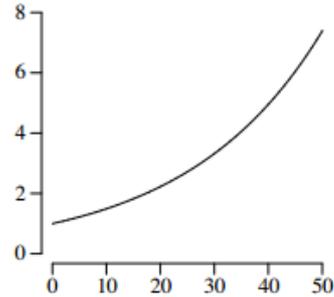
Tipping points definition

► Rather than just exponential growth, tipping points are associated with unstable equilibriums, bifurcations and phase transitions (all of which may cause exponential growth)

► Types: direct (i.e. Bandwagon process) and contextual

► Definition: a point in time where a small change in a system variable modifies the system qualitatively, creating a dramatic effect in its state at some time in the future – not necessarily immediately

Tipping points in society: origin of the concept

► Morton Grodzins study in U.S. neighbourhoods

– He discovered that most of the white families remained in the neighbourhood as long as the comparative number of black families remained very small. But, at a certain point, when too many black families arrived, the remaining white families would move out *en masse* in a process known as **white flight**. He called that moment the "tipping point" [1]

Agenda

▶ Part I: Tipping points in *charging systems*

- 1. Social epidemics (Gladwell [2])

- 2. Dissemination of culture model (Axelrod [3])

- 3. Society as a self-organized critical system (Kron and Grund [4])

▶ Part II: Landscapes in *charging systems*

- 4. *Charge landscapes* and *avalanche landscapes*

- 5. Applications of landscapes

1. Social Epidemics

Malcolm Gladwell

NY Times bestseller
in year 2000
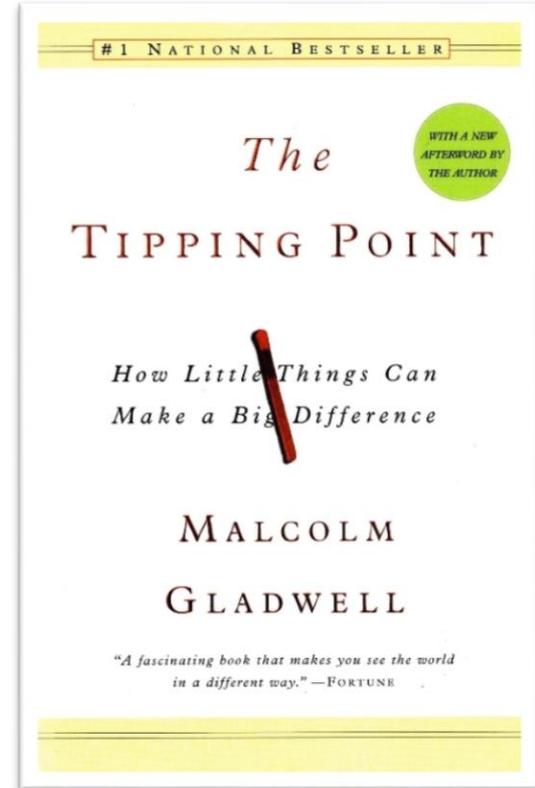
1.1 Gladwell's social epidemics rules

▶ People: The law of the few

  – Mavens, connectors and salesmen

▶ Infection: The stickiness factor

▶ Environment: The power of context

Connectors have relationships with many, many other individuals

Salesmen can influence people to take action

Mavens have deep knowledge about a particular subject and are keen to share it
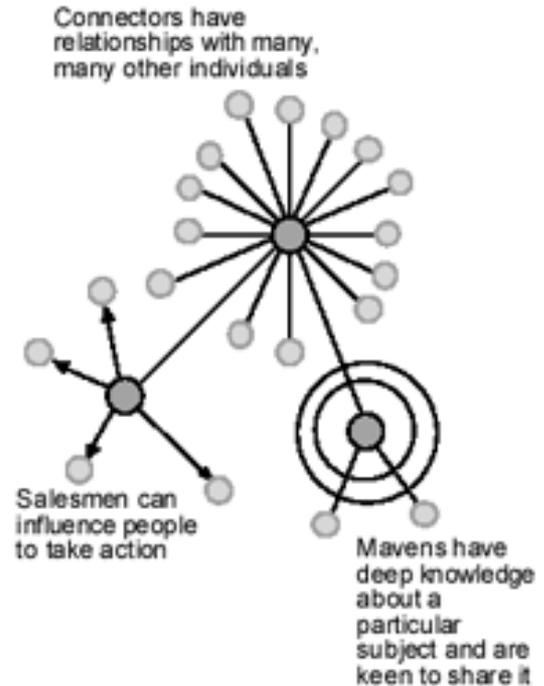
1.2 Making an ABM model from Gladwell's ideas

Parameters of the model:

► People
- – Number of people, network type, average node degree, percentages and locations of mavens, connectors and salesmen, susceptibility of population

► Infection
- – Stickiness, charge th, interactions th, cut-interactions, recover capacity, time of infection, immunity

► Environment
- – Parameters are implicit in the above ones

1.3 Programming the model

1.4 Case: Hush puppies (Law of the few)

▶ "Hollywood" network type

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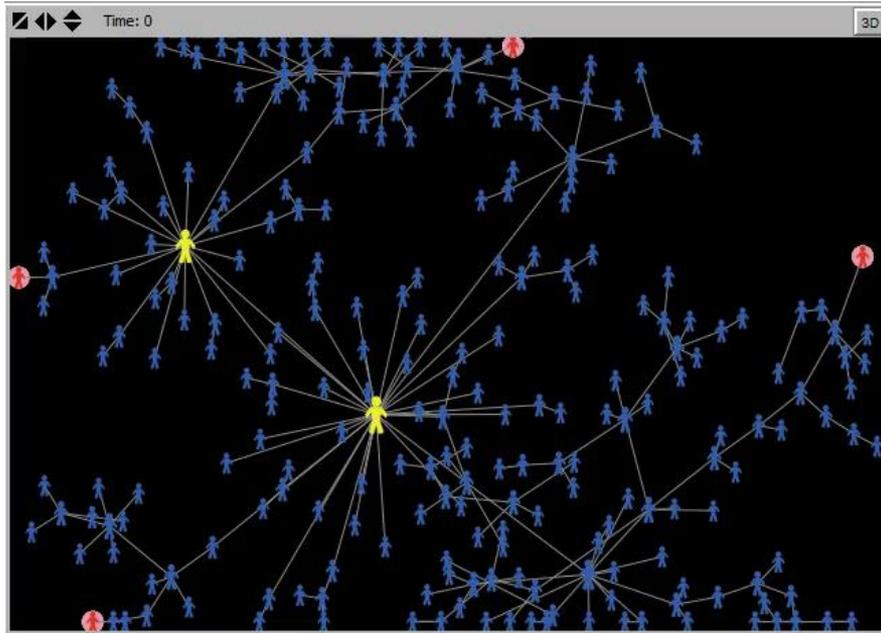
1.5 Case: Sesame street and C-C (stickiness factor)

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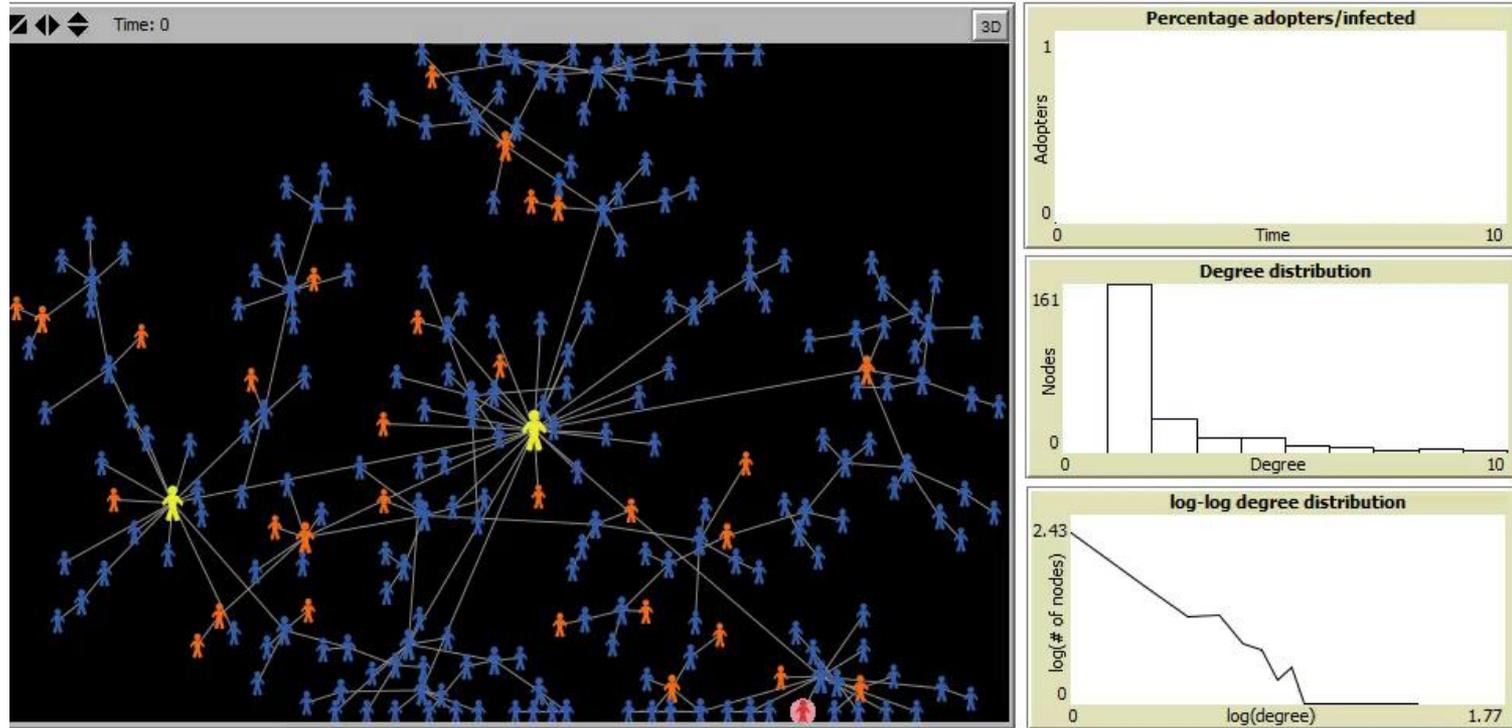
1.6 Case: Syphilis in Baltimore (power of context)

▶ 3 little causes

- Less doctors
- More drugs → more sex
- Displaced people
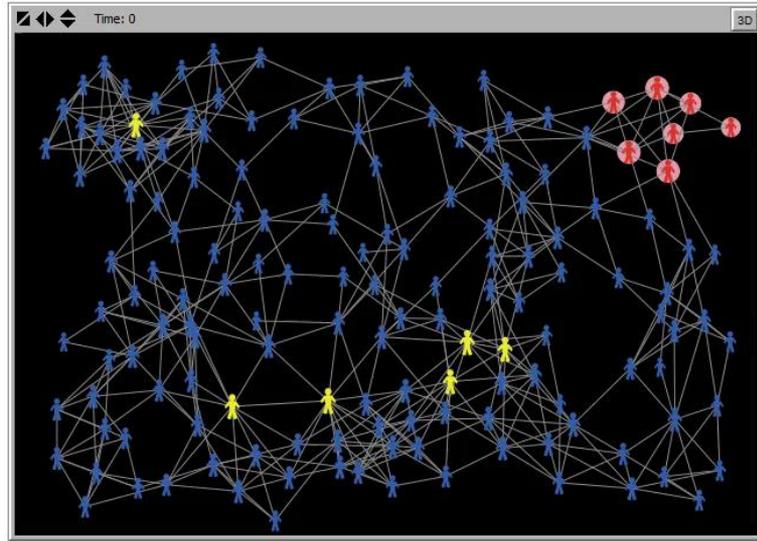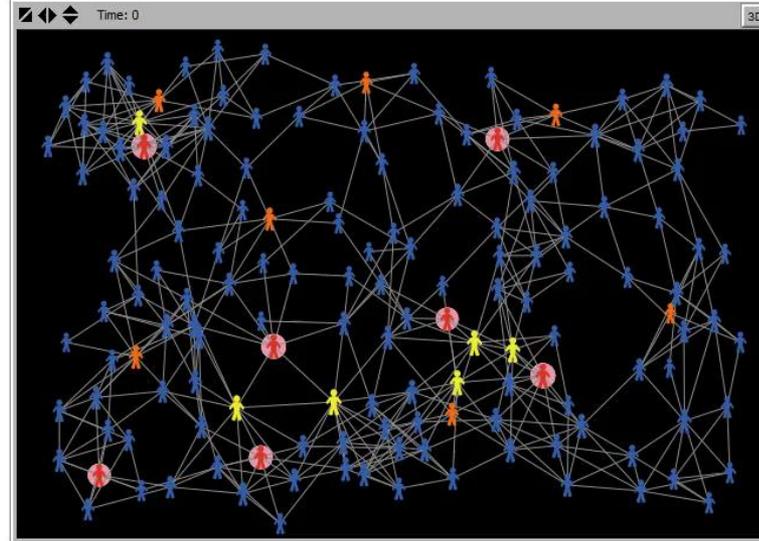
# 1.6 Case: Syphilis in Baltimore (power of context)
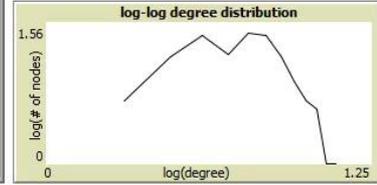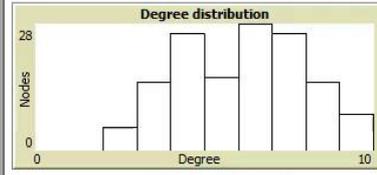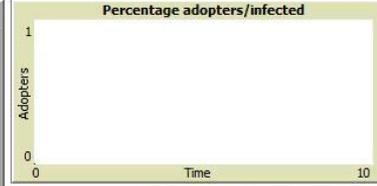
2. Axelrod model of dissemination of culture

► Paper: "The Dissemination of Culture: a model with local convergence and global polarization", by Axelrod [3]

► Axelrod: "If people tend to become more alike in their beliefs, attitudes and behaviour when they interact, why do not all such differences eventually disappear?"

► So he created a model to explain the above question based on the following two premises

– 1. People are more likely to interact with others who share many of their cultural attributes

– 2. Interactions between two people tend to increase the number of attributes they share

2.1 Defining the model
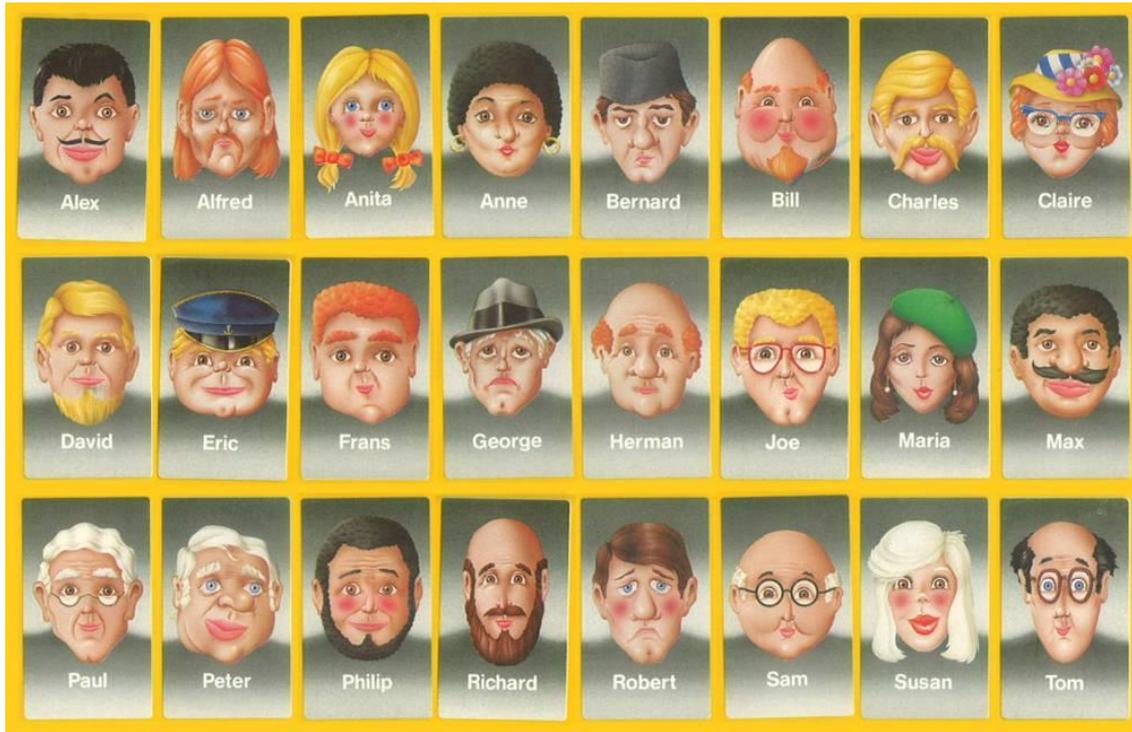
F features
T attributes

$$\begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ \vdots \\ x_F \end{pmatrix}$$

Mandarin, German, Hindi...
Football, swimming, curling...
Windows, Linux, Mac...

Jazz, reguetón, thrash metal...
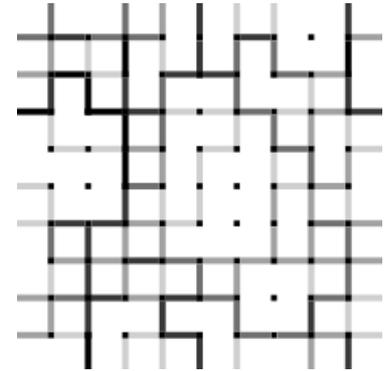
2.2 Observing average number of stable regions

Average Number of Stable Regions

Number of Cultural Features	Traits per Feature		
	5	10	15
5	1.0	3.2	20.0
10	1.0	1.0	1.4
15	1.0	1.0	1.2

NOTE: These runs were done with a territory of 10×10 sites, and each interior site had four neighbors. Each condition was run 10 times.

2.3 Running the model
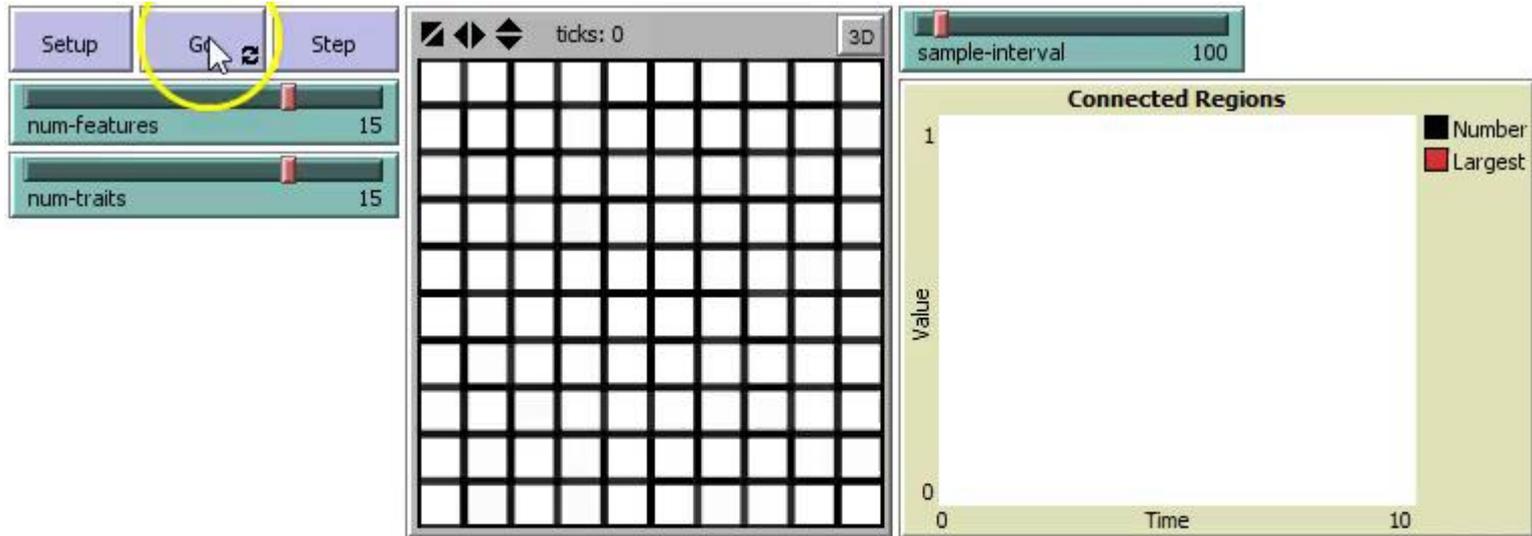
3. Self-organized criticality

► Paper: "Society as a Self-Organized Critical System" by Kron and Grund [4]

► Quotes from the paper:

– Modern society can be seen as a self-organized critical system that endogenously reaches critical states. Small or large breakdowns can be caused by single events

– The model of self-organized criticality can be used to show how the permanent addition of energy (political power) to a close coupled system (of nations) can result in positive feedback loops. Doing so, we can explain how a single "historical grain of sand" (the assassination in Sarajevo of Archduke Franz Ferdinand) was able to trigger an apocalyptic "avalanche of warlike actions" with more casualties than ever before

3.1 Sand-pile model
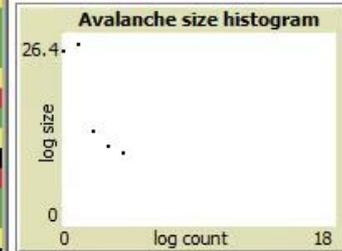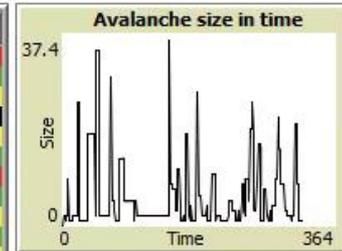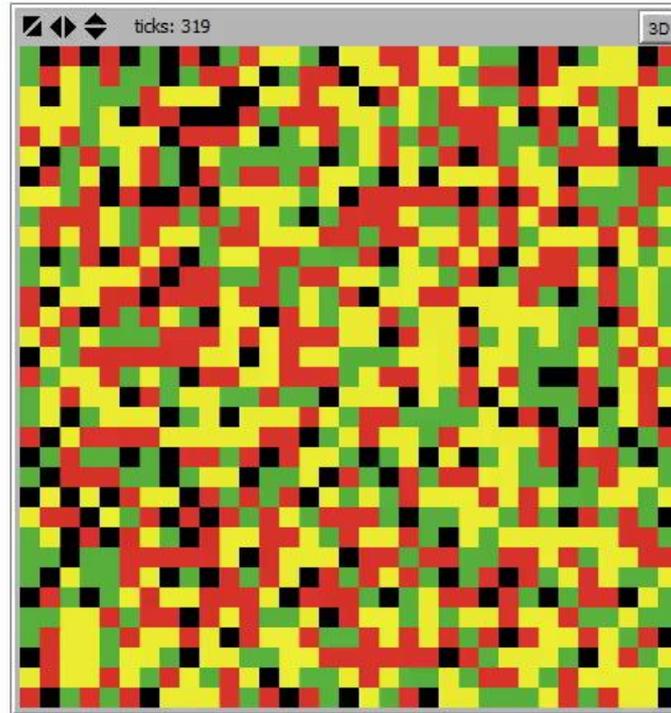
3.2 Self-organized criticality in society

► More quotes from the paper:

– The pile self-organizes and builds up an increasingly complex structure. At some point all non-disruptive locations that do not cause the collapse of the system are occupied (the system is over-critical)

– We do not need an explanation for how the single historical event of the assassination resulted in WWI, but we need a macro-sociological explanation for the **critical state** that made such a series of events possible (*avalanche landscape*)

4. Charge and avalanche landscapes
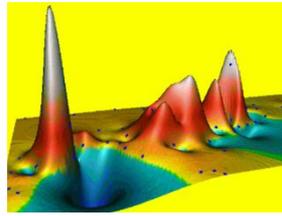
► What the 3 examples given have in common?

– A global contextual tipping point makes the system to begin charging. Then small changes (direct tipping points) cause avalanches through charged elements

– When things seem to be stable they may be not, perhaps a hidden tipping point happened that made the system to begin charging and then a small change can cause an avalanche

► Landscapes

– Landscapes are 'kind of' a simple way of studying the **GlobalContextualTippingPoint→SystemCharging→DirectLocalTippingPointAvalanche(s)** phenomena in networked and spatial systems

– *Charge landscapes* can be made and used to create *avalanche landscapes*. Then *avalanche landscapes* can be used to get a general overview of the potential avalanches in order to attenuate or amplify avalanches

4.1 Charge landscapes
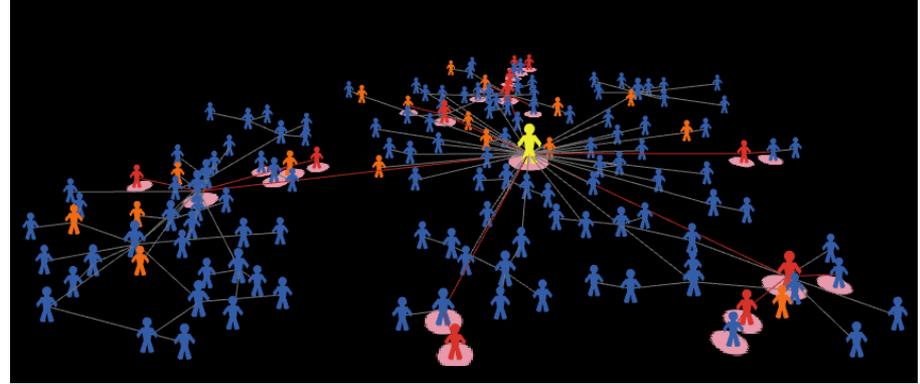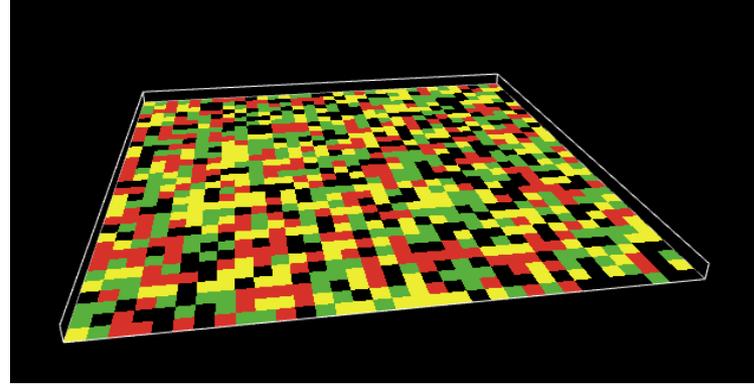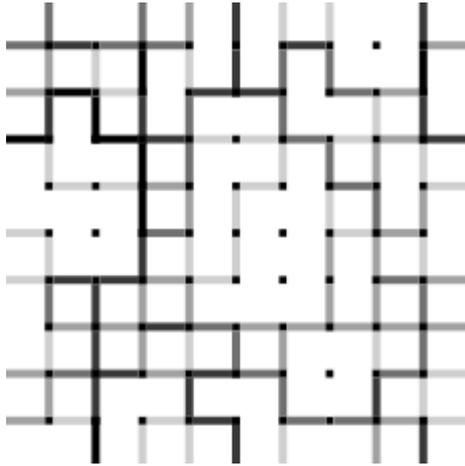
4.2 Avalanche landscapes
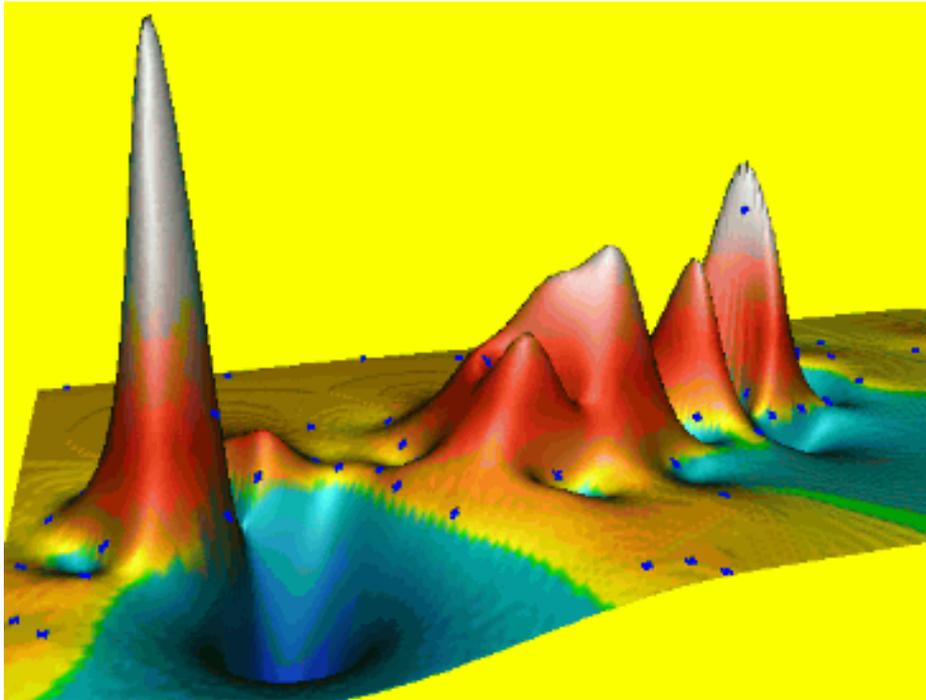
- ▶ For deterministic systems, calculate or estimate sizes of avalanches in *charge landscape.* For stochastic systems, calculate or estimate expected values of avalanche sizes
- ▶ Great visual tools for explaining tipping points to non-technical audiences

5. Applications of landscapes

▶ Applications of landscapes in networked systems:

– Networks of people: fashion, digital marketing, infectious diseases, riots (i.e. Arab Spring)

– Networks of organizations: state creation, transnational integration, wars, financial crisis

▶ Applications of landscapes in spatial systems:

– Development: one variable can make a tipping point in other

– Urban planning: urban racial segregation (Schelling model)

– Behavioural economics nudges: create simple policies (tipping points) that make big change in society (i.e theory of broken windows)

► References

– [1] *Tipping points (Sociology)*, Wikipedia

– [2*] The Tipping Point*, Malcolm Gladwell, 2000

– [3] *The Dissemination of Culture: a model with local convergence and global polarization*, Robert Axelrod, The Journal of Conflict Resolution, Vol. 41. Issue 2 (April 1997)

– [4] *Society as a Self-Organized Critical System*, Thomas Kron and Thomas Grund, Cybernetics and Human Knowing, Vol.16

– [5] Tipping points, P. J. Lamberson and S. E. Page, Sante Fe Institute working paper 2012-02-002