Agent-based modeling

Model exposé

Exposé will cover

- Supply & demand

- Thomas Schelling's segregation model

- Mark Granovetter's Threshold model

- George Akerlof's Market of lemons

Is this a model?

$$(*) \qquad \sin 2x = \sin x$$

$$(1) \qquad 2\sin x \cos x = \sin x$$

$$(2) \qquad 2\sin x \cos x - \sin x = 0$$

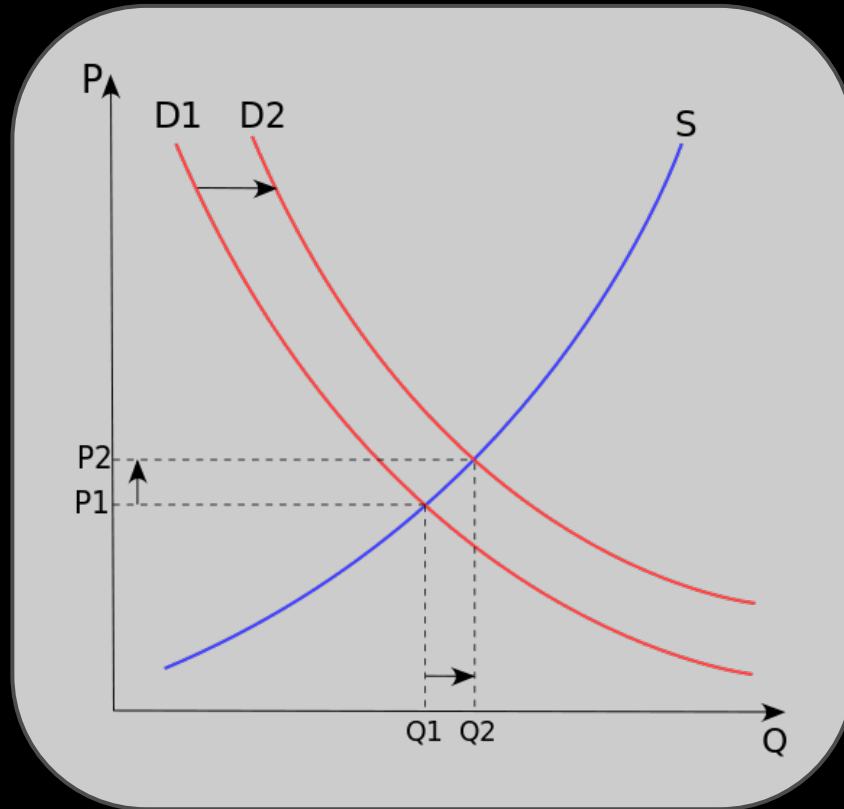$$(3) \qquad 2\sin x(\cos x - 1/2) = 0$$

$$(4.1) \qquad \sin x = 0$$

$$x = \underline{n\pi}$$

$$(4.2) \qquad \cos x = 1/2 = \cos(\pi/3)$$

$$x = \underline{\pm\pi/3 + n2\pi}$$

Supply & Demand: Introduction

Supply & Demand: Determinants

1. If demand ... pply remains unchang... rice.

2. If deman... mains unchang... ce.

3. If deman... rve shifts to the right ... e.

4. If demand remains unchanged and supply decreases (supply curve shifts to the left), a shortage occurs, leading to a higher equilibrium price.

Hence, it has the usage bit!

Supply & Demand: Ontology

Supply

1. Production costs: how much a goods costs to be produced. Production costs are the cost of the inputs, primarily labor, capital, energy and materials.
2. Firms' expectations about future prices
3. Number of suppliers

Demand

1. Income.
2. Tastes & preferences.
3. Prices of related goods and services.
4. Consumers' expectations about future prices and incomes that can be checked.
5. Number of potential consumers.

Supply & Demand: A general model

Deirdre McCloskey:

The vaguer the model the better the story can fit into the historical world, while the more exact the model, the more absurd the history becomes.
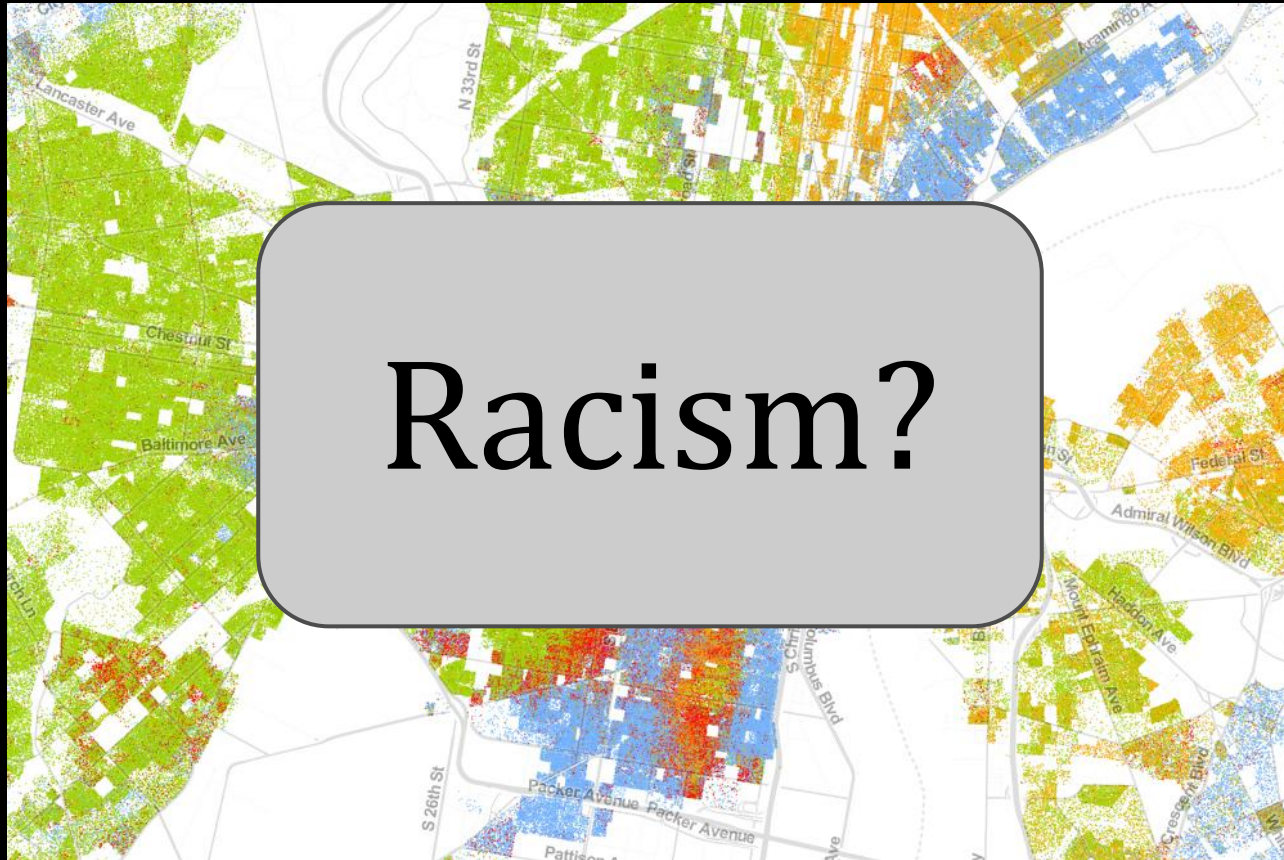
Supply & Demand: Outro

Comments?

Is this a good model?

Schelling: The idea

Racism?

Schelling: How do it actually look?

Schelling: The Agent-based model

- Everyone has a rule for when to move

- Moving works in a given way

- A two-dimensional grid imposes limitations

- Neighborhood definitions: Egocentric, pre-defined. Represent what? Which is best?

Schelling: The model - agents

Assumptions about agents:

- Act in according to her preferences

- Not think strategically about others' action

- Have the same type of preferences as the rest

- Full information about the current ratios

Schelling: The model - preferences

Tolerance

Distributions

Non-minority

and so forth … Why choose either?

Schelling: The tipping dynamics

- Genesis tipping

- Exodus tipping

Schelling: Simulations
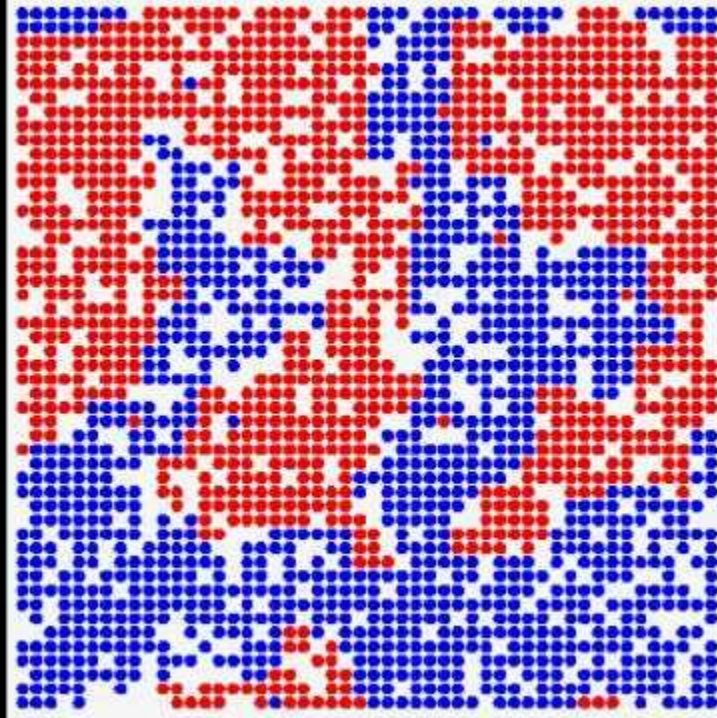
Schelling: Micro & Macro

Given a macrobehavior, what is the micromotives?

Does it matter?

Why not just ask people?

Schelling: Predictions/insights

What does Schelling's model teach us about:

- West
- China
- Ritter

Segregation in general?

Schelling: The idea

Structural racism?
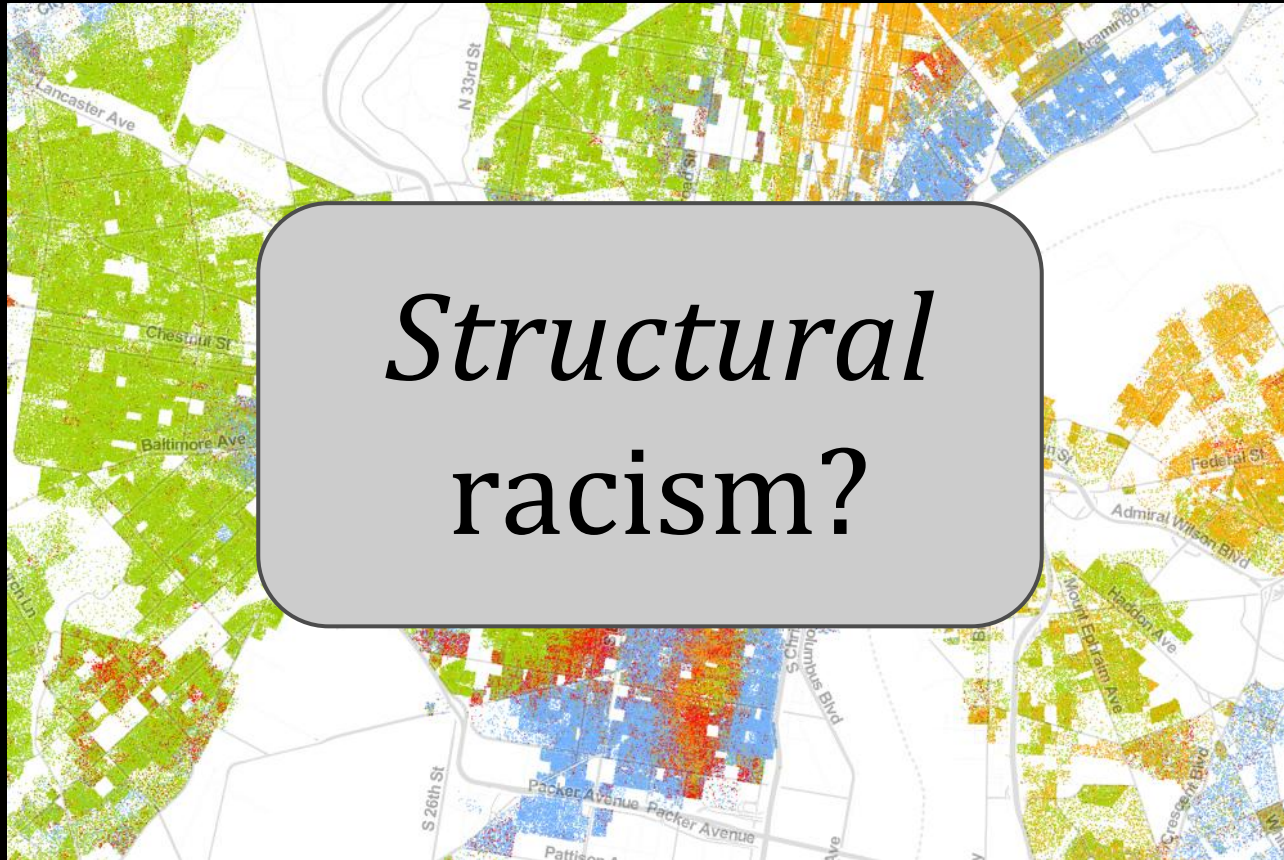
Schelling: How do we test it?

Strategies? Ideas?

Schelling: Other applications

What could it apply to more?

What is a generic description of what it models?
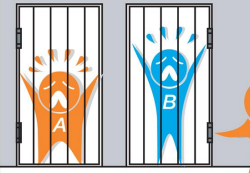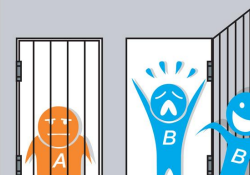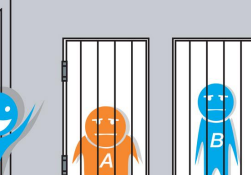
Quite general for stories - somewhat specific model

Schelling: Outro

Comments?

Is this a good model?

Prisoner's dilemma: Recap

Prisoner's dilemma: Applications

- Arms races

- Negative campaigning

- Competition on prices

- Sharing food

Prisoner's dilemma: Rational choice

- Do they know what game they play?

- Are they perfectly rational?

- Utility functions - are they really actual?

Prisoner's dilemma: Extensions

General models: A basis

- Repetition / reputation

- Belief formation and learning

- Similarity

Prisoner's dilemma: Outro
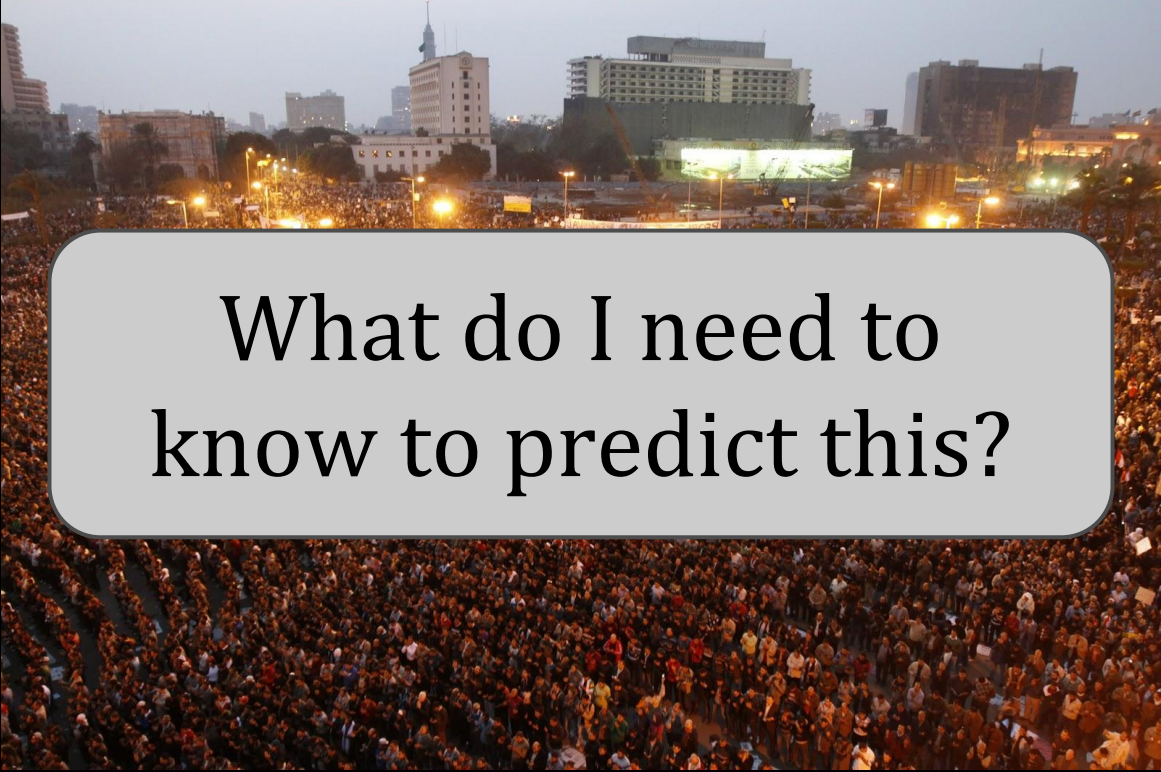
Any comments?

Is this a good model?

Granovetter: The idea

Granovetter: Question?

What do I need to know to predict this?

Granovetter: The model

Peer effect threshold model

A threshold per agent

Then, potential bandwagoning

Granovetter: Assumption about agents

Threshold holders - agnostic

    Expected costs

    Expected rewards, and what not.

Full knowledge about current amount committed

No strategic thinking

All equal - no ones participation counts for more

Granovetter: Dynamics

Lower thresholds, higher chance of success

Granovetter: The model
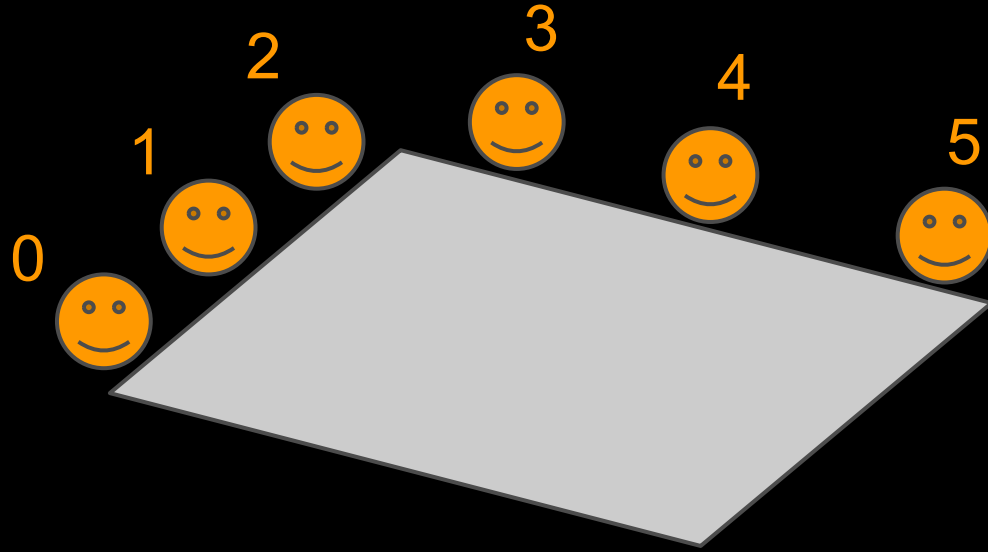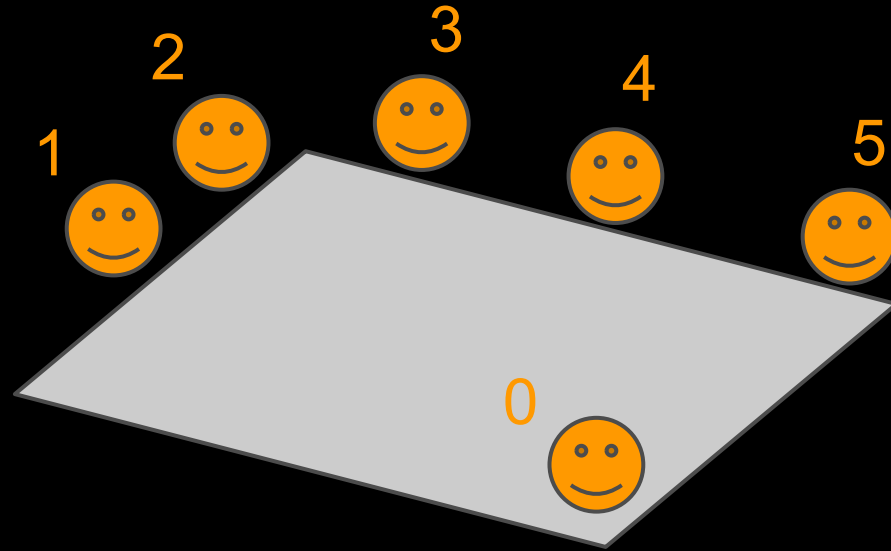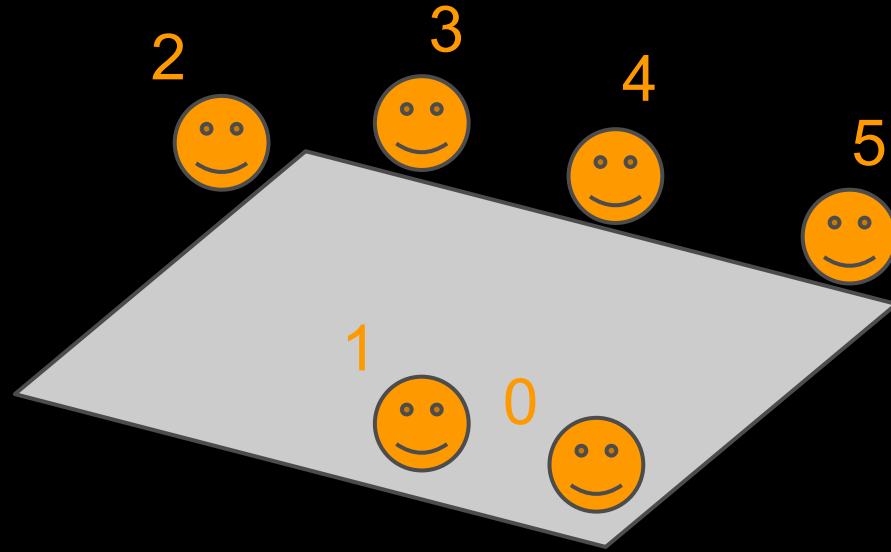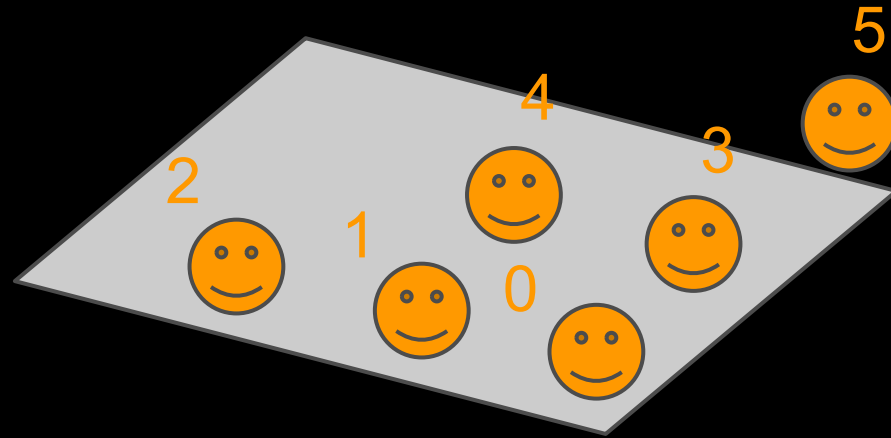
Granovetter: The model

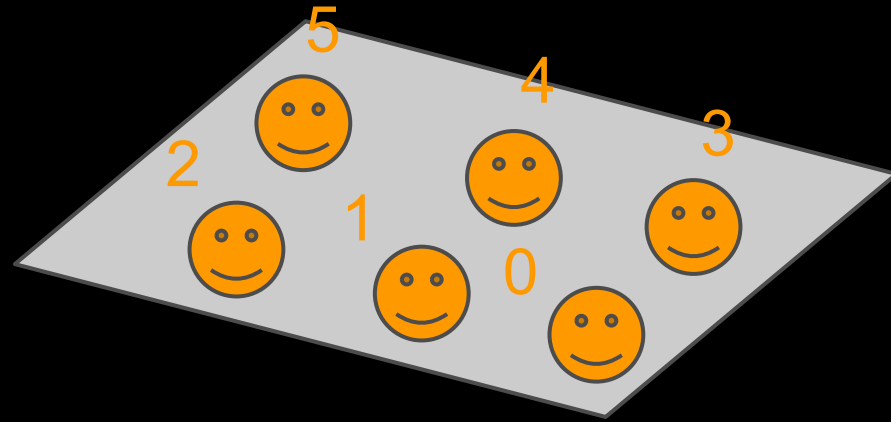# Granovetter: The model

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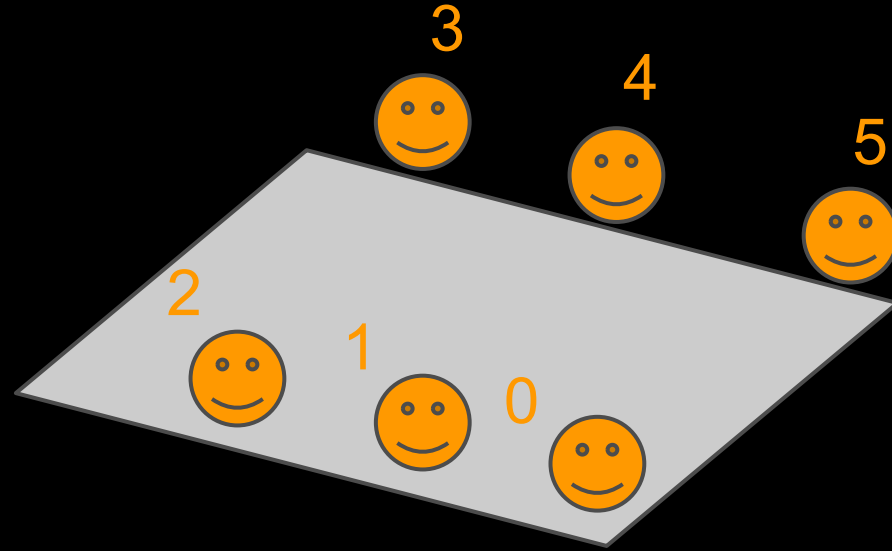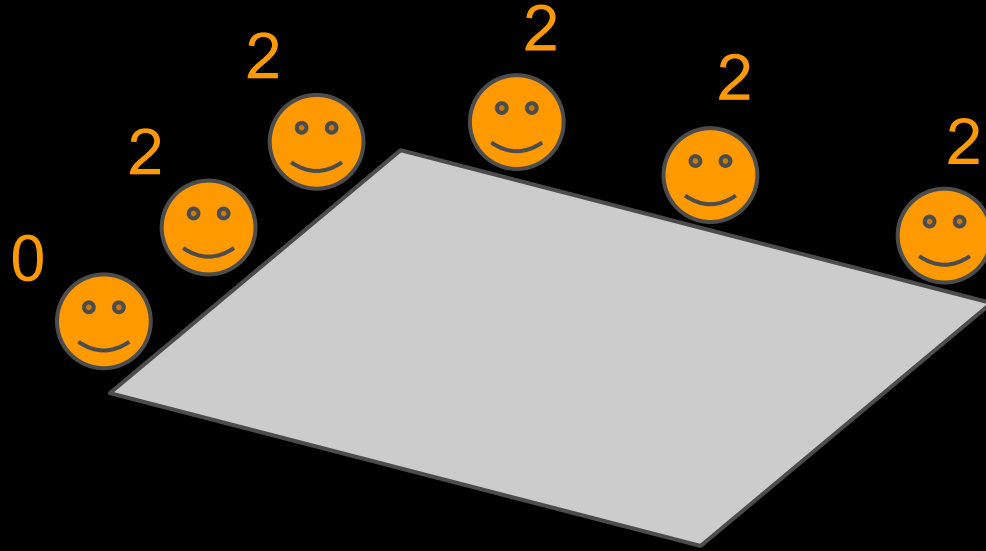
Granovetter: The model
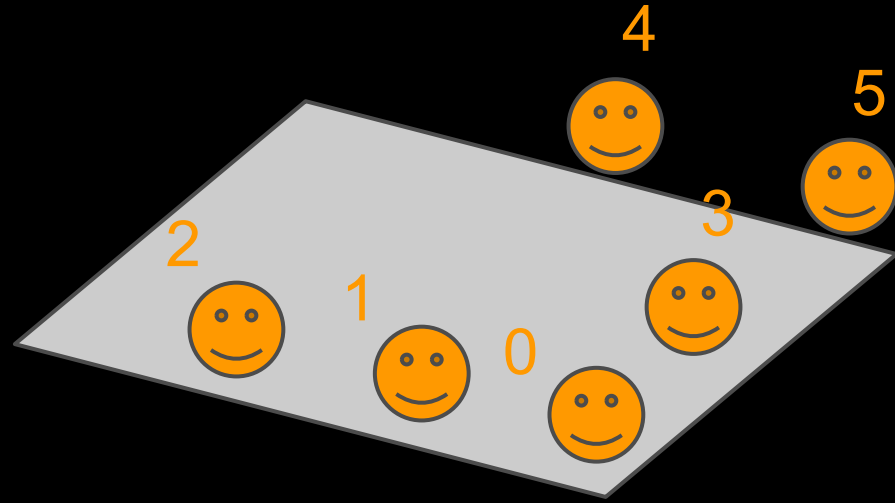
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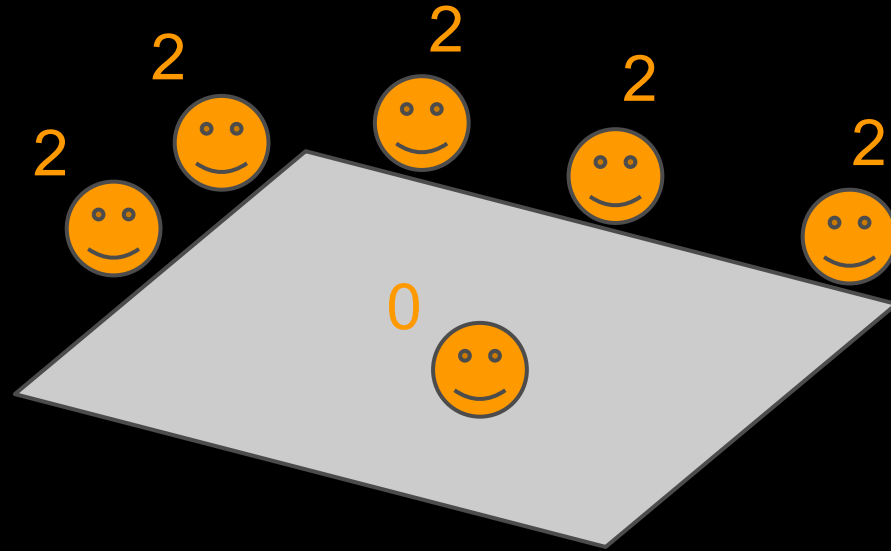
Granovetter: The model

Granovetter: The model

Granovetter: Message

Threshold distributions matter!

First case, average: (0+1+2+3+4+5)/6 =

= 2 + 1/2

Second case, average: (0+2+2+2+2+2)/6 =

= 1 + 2/3

Granovetter: Ontology

Who are the agents?

What is the setting - "the plaza" ?
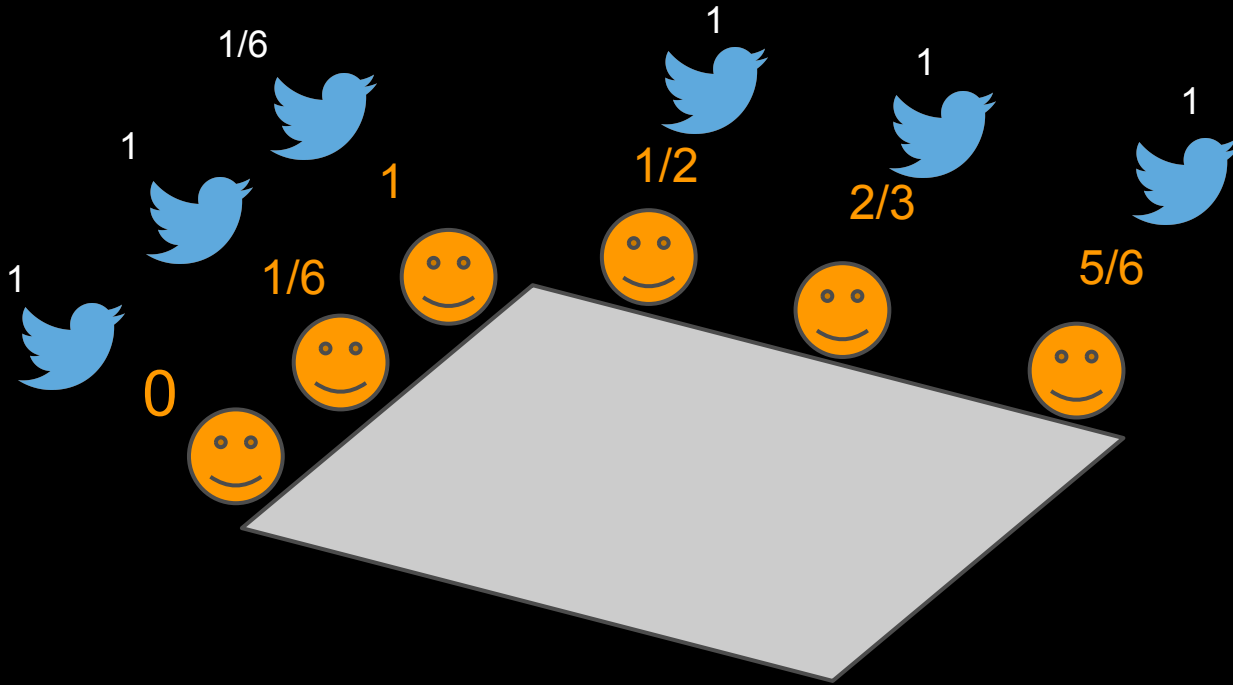
Refined Granovetter: The question

Refined Granovetter: The hunch

If we could just invent a new technology the bandwagoning would continue. But how do we manifest that?
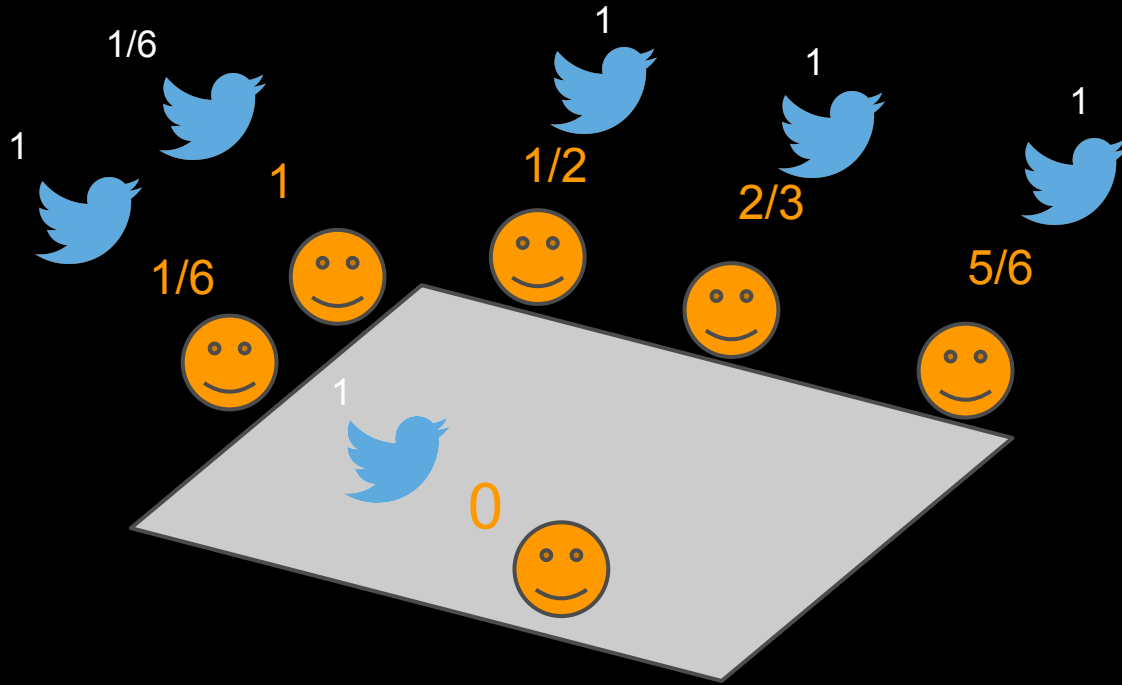
How to represent it?

Refined Granovetter: The model
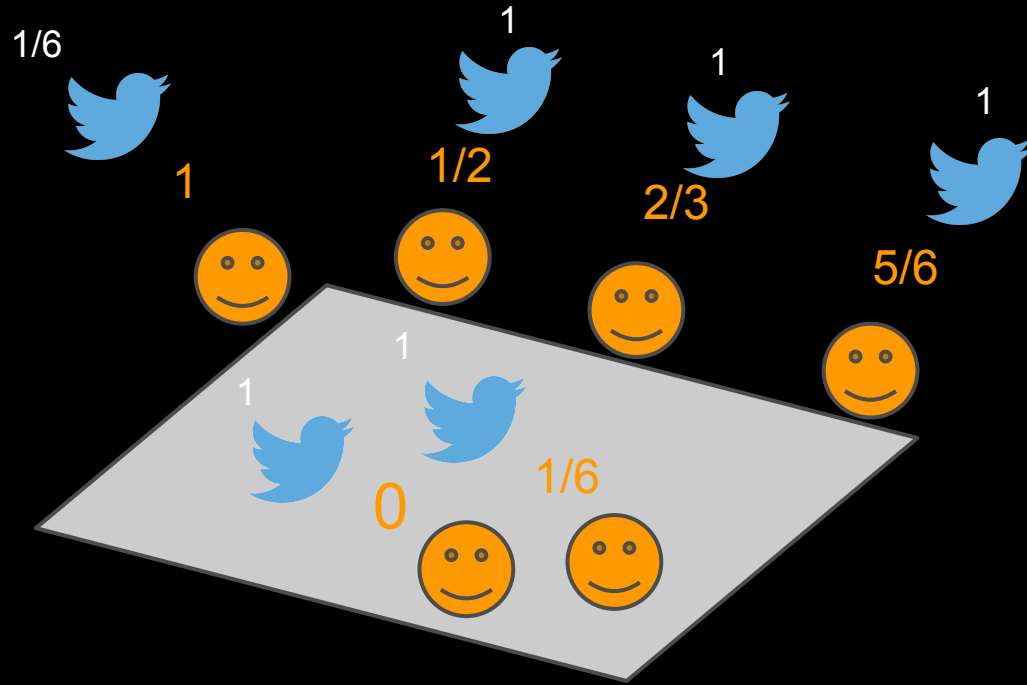

Median difficulty = Signal 🐦 : 1

Refined Granovetter: The model

Median difficulty = Signal 🐦 : 1   Societal commitment level: 1/6
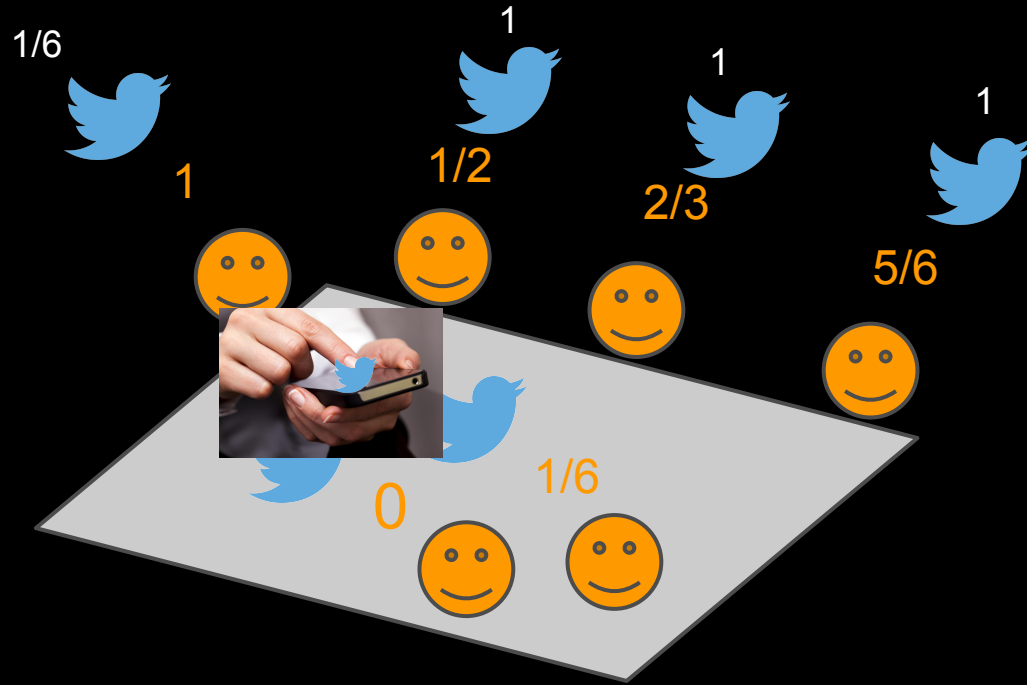
Refined Granovetter: The model

Median difficulty = Signal 🐦 : 1   Societal commitment level: 1/3

Refined Granovetter: The model

Median difficulty = Signal 🐦 : 1

Societal commitment level: 1/2

Refined Granovetter: Results

- Instigators will win if they can invent a participation method with arbitrary signal

- A dictator might to make punishment both higher and lower for an action, depending on what actions exists.

Refined Granovetter: Comment

A more specific model become way less general, fits fewer stories.

Other comments?

A good model?

Rounding up

What was the best model? Motivate.