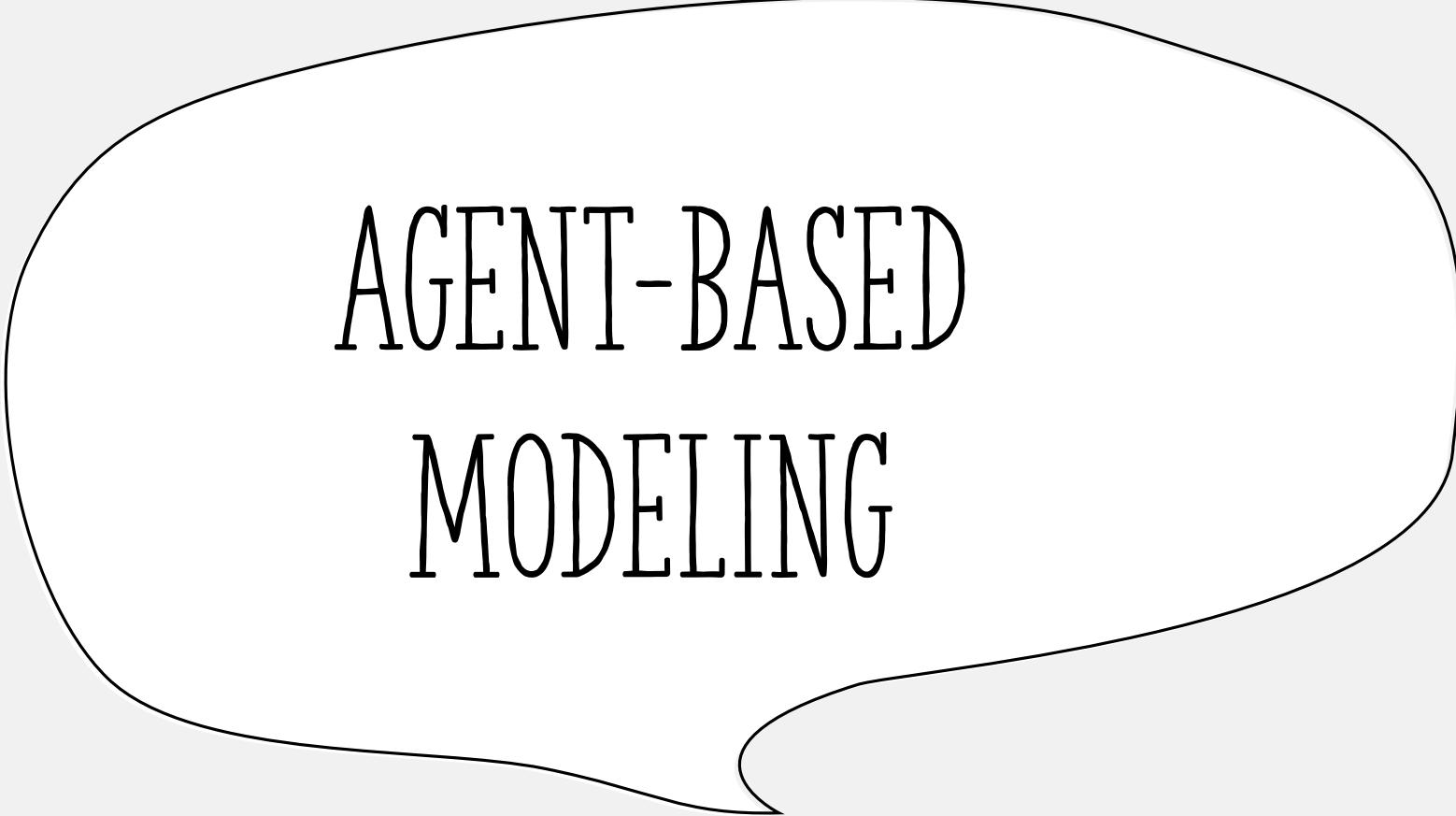




EXPERIMENTS WITH
CODE AND PEOPLE



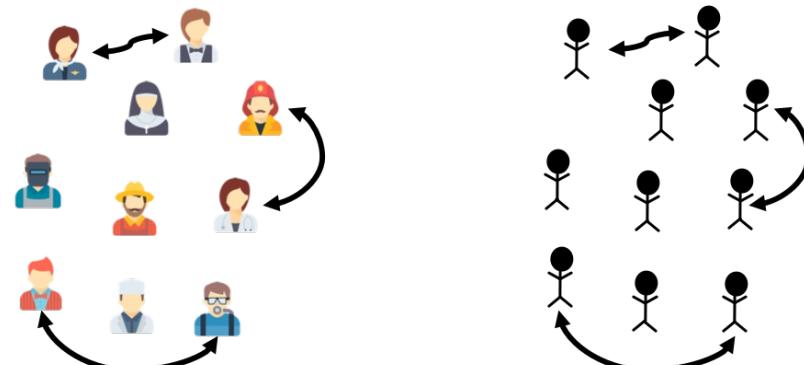
AGENT-BASED MODELING

WHAT ARE AGENT-BASED MODELS?

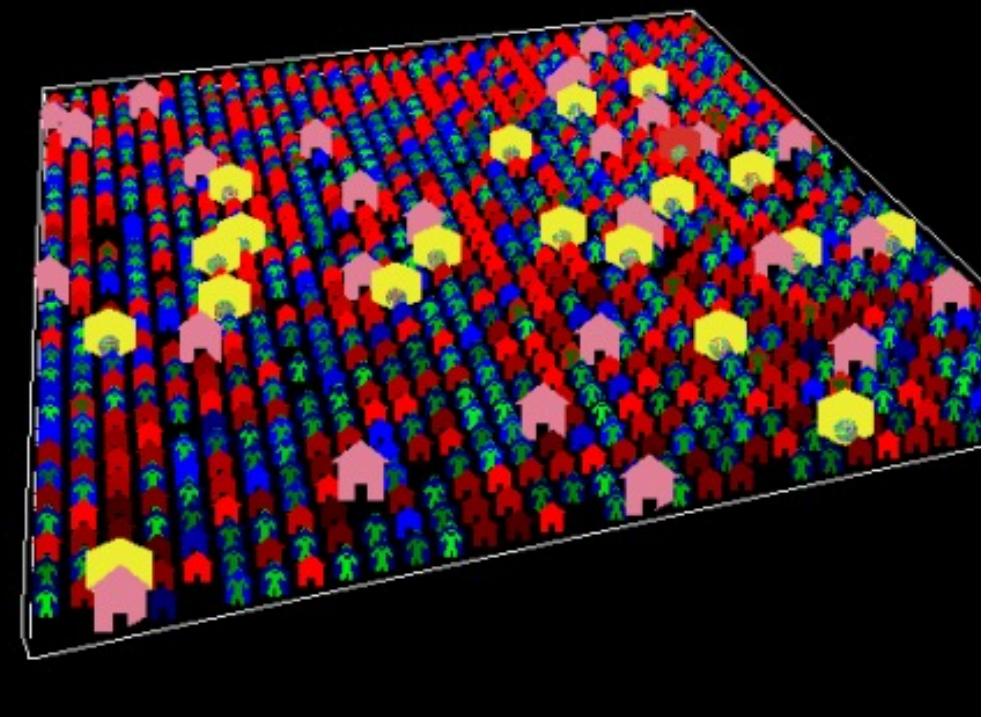
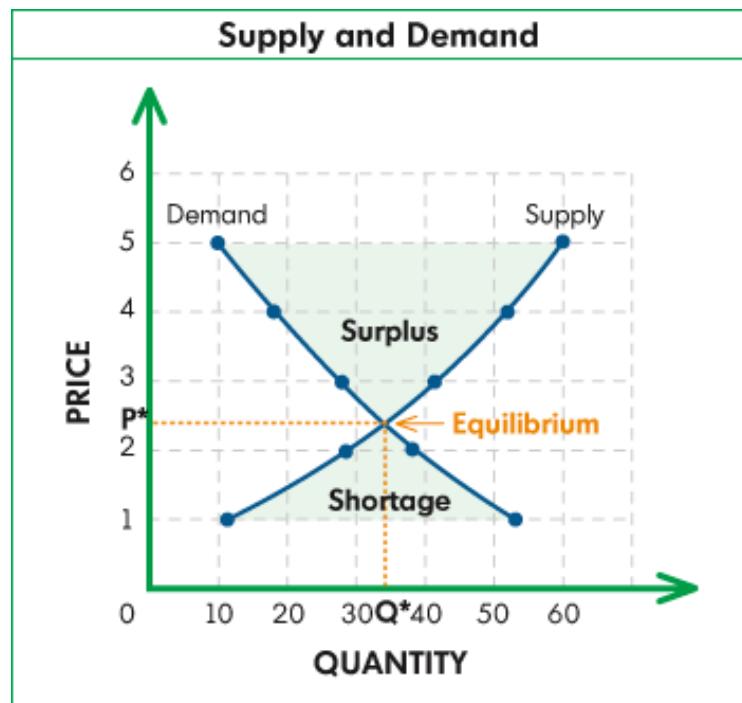
Computational models used to simulate the actions and interactions of autonomous agents (representing individuals, organizations, animals, etc.) seeking to assess their effects on the system as a whole.

Each agent in the model is programmed with specific behaviors and characteristics, and make decisions based on their own rules.

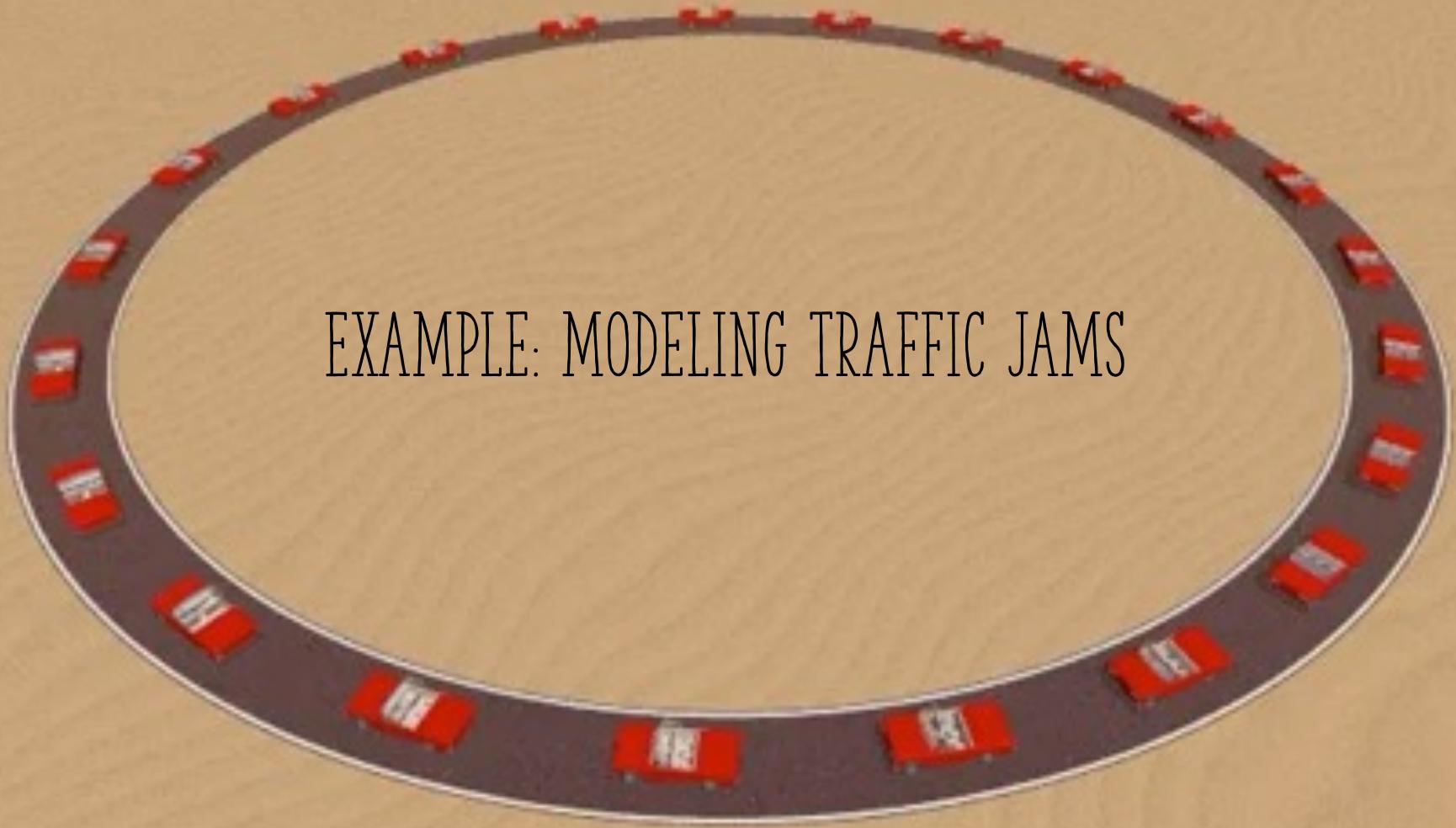
Real world → Agent-based model



TWO WAYS OF MODELING A MARKET

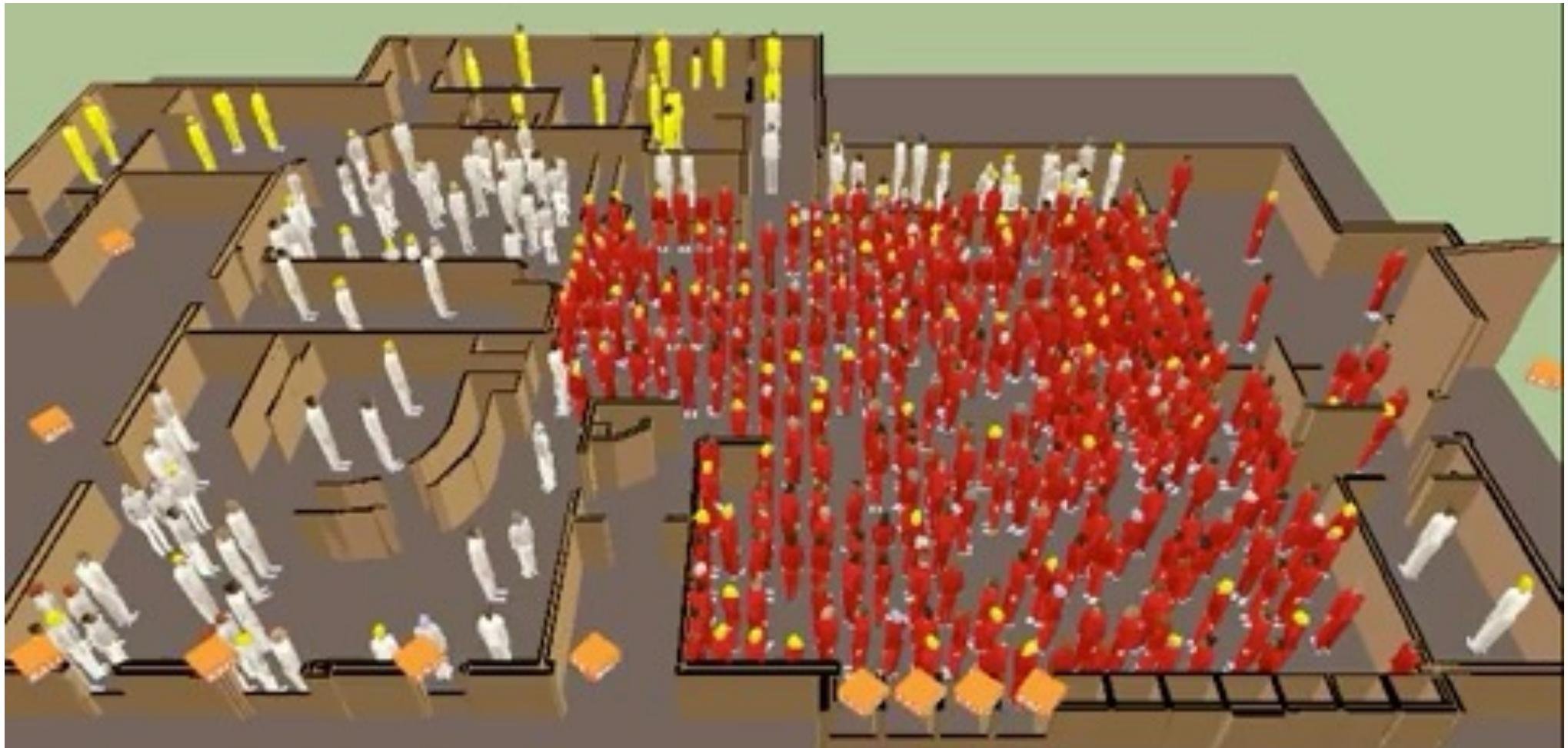


'each trader is modeled as an autonomous, interactive agent and the aggregation of their behavior results in market behavior'
Neuberg and Bertels 2003, p. 28



A circular track with 20 cars moving clockwise. The track is dark grey and the cars are red with white stripes. The background is a light beige color.

EXAMPLE: MODELING TRAFFIC JAMS



EXAMPLE 2: EVACUATION SIMULATIONS

SOCIETY AS AN ANTHILL

Individual ants are stupid: but collectively, they are extremely intelligent and adaptive.

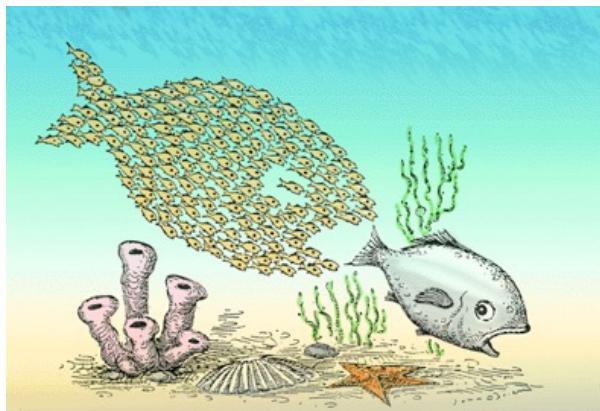
Where is the intelligence in an anthill?

It is distributed *between* the ants. It "emerges".

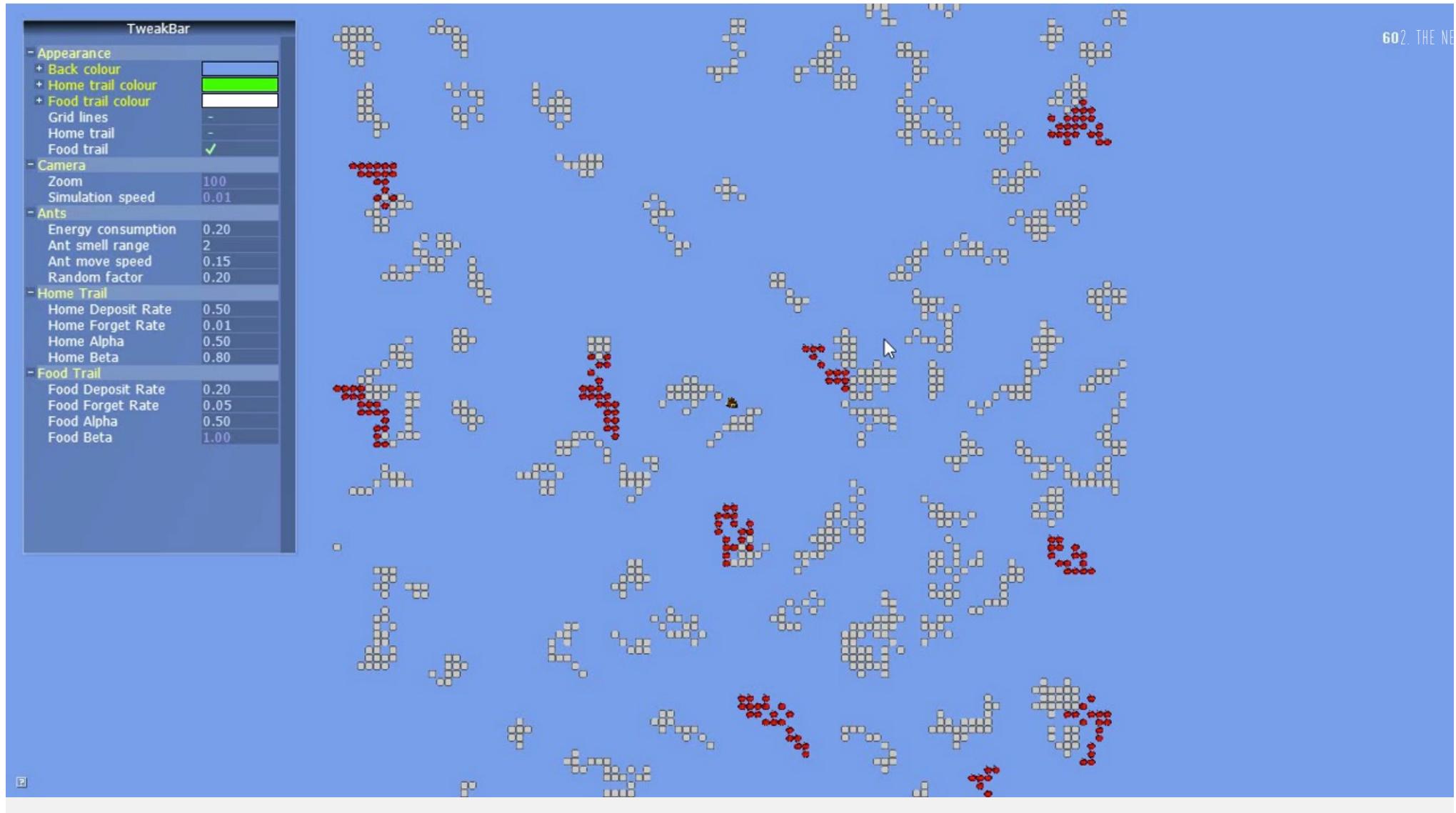
Many aspects of our societies may also be emergent



COMPLEXITY



- ABMs help us understanding how complex phenomena emerge from the simple actions of diverse individuals.
- It is perhaps the *only* way of studying emergent effects.
- Generative social science: if you can't build it, you don't understand it.



MODELING DESIGNS OF ABMS

Asynchronous vs synchronous updating.

Parameter searches: how do parameters shape outcomes?

Stability analysis: do the dynamics hold for other parameters?

NATURE-INSPIRED OPTIMIZATION

Complex systems are capable of optimization and solving difficult problems.

They are resilient, adaptive and flexible.

Machine Learning is largely based on mimicking natural intelligence:

- The human brain – Artificial Neural Networks
- Natural evolution – Genetic Algorithms
- How ants find food – Ant Colony Optimization
- etc.

WHAT IS A COMPLEX SYSTEM?

Complicated systems

Complex systems



Where does society fit in here?

Sophisticated components

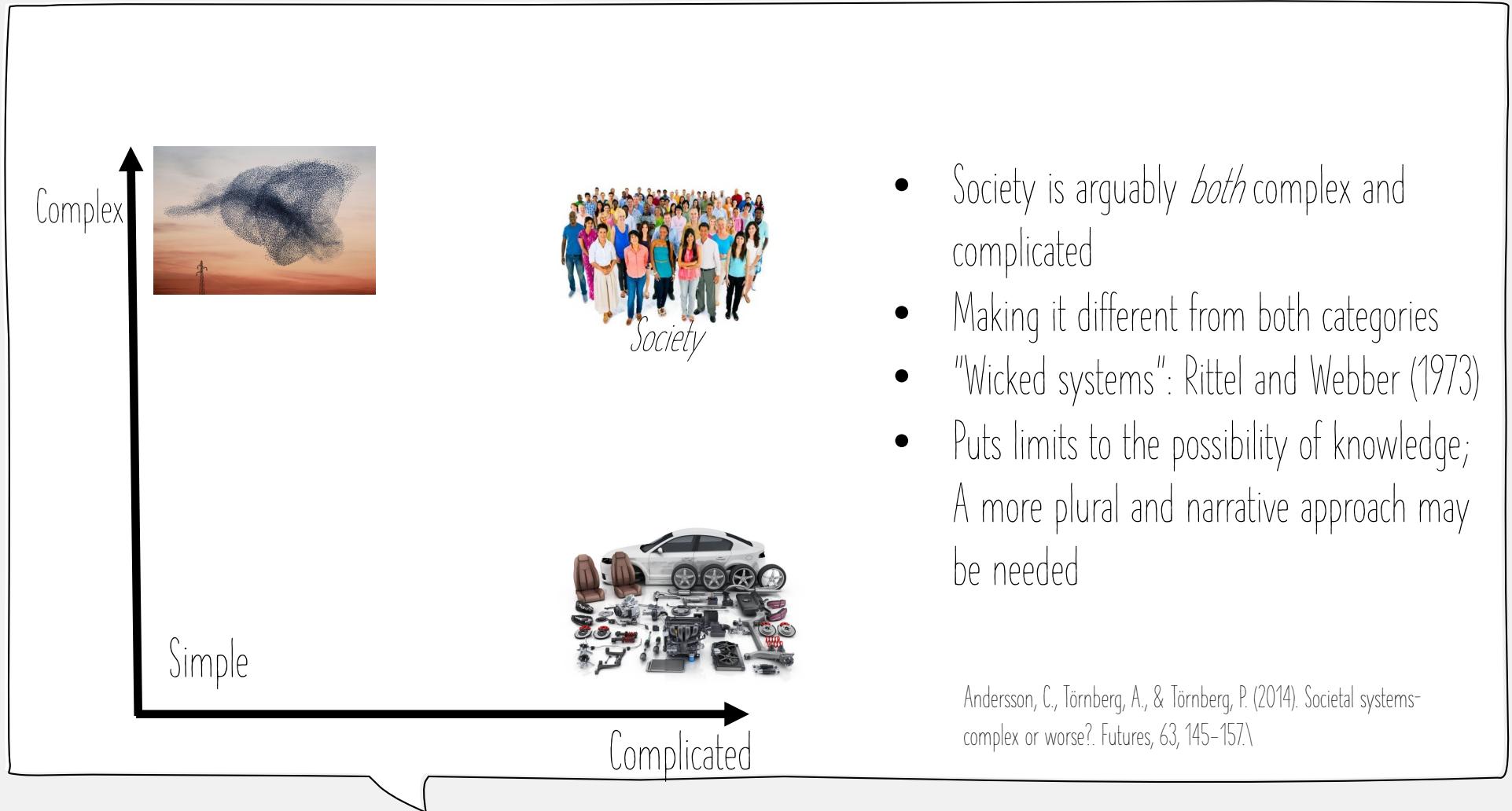
Simple interaction

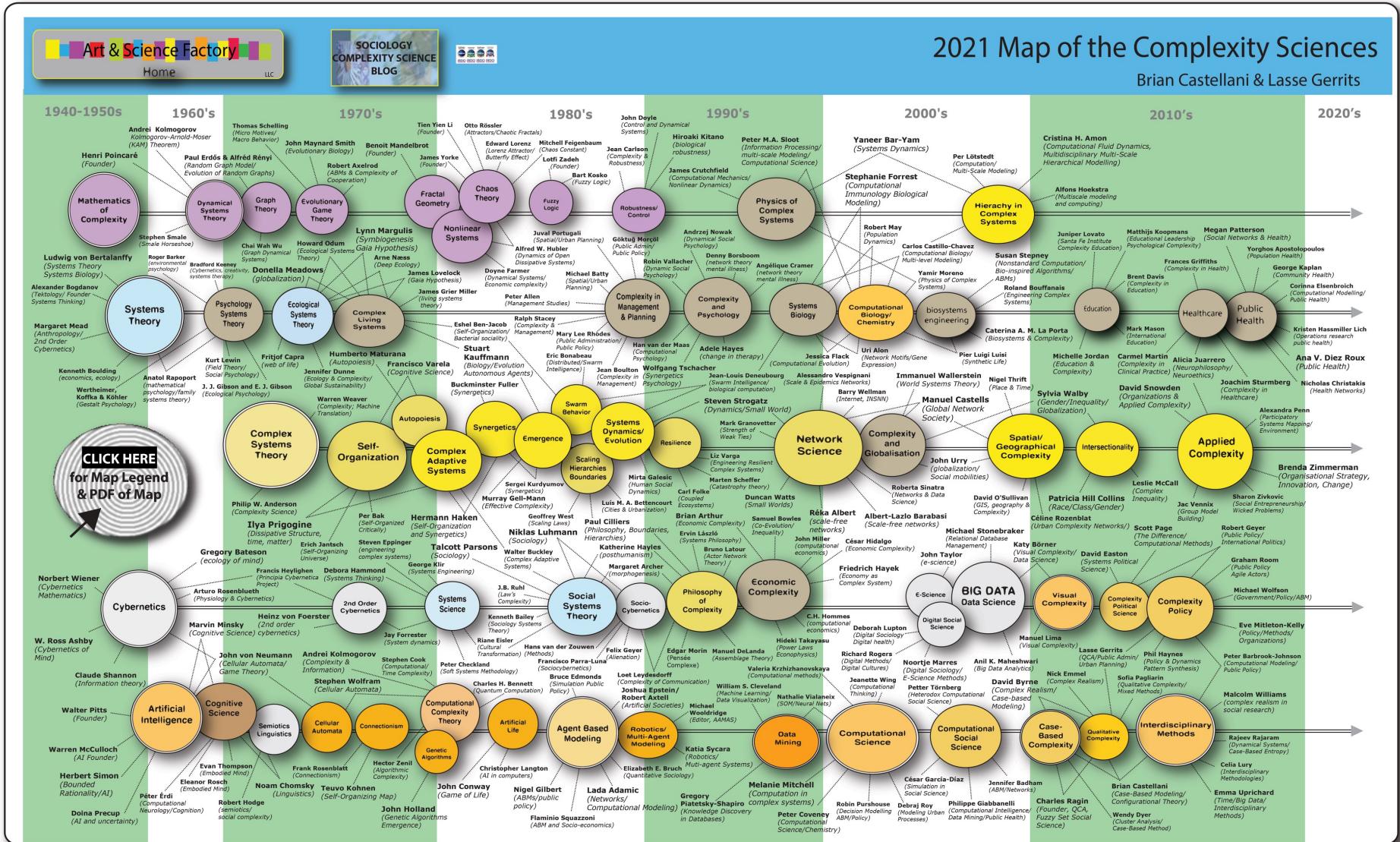
Mechanisms located in components

Simple components

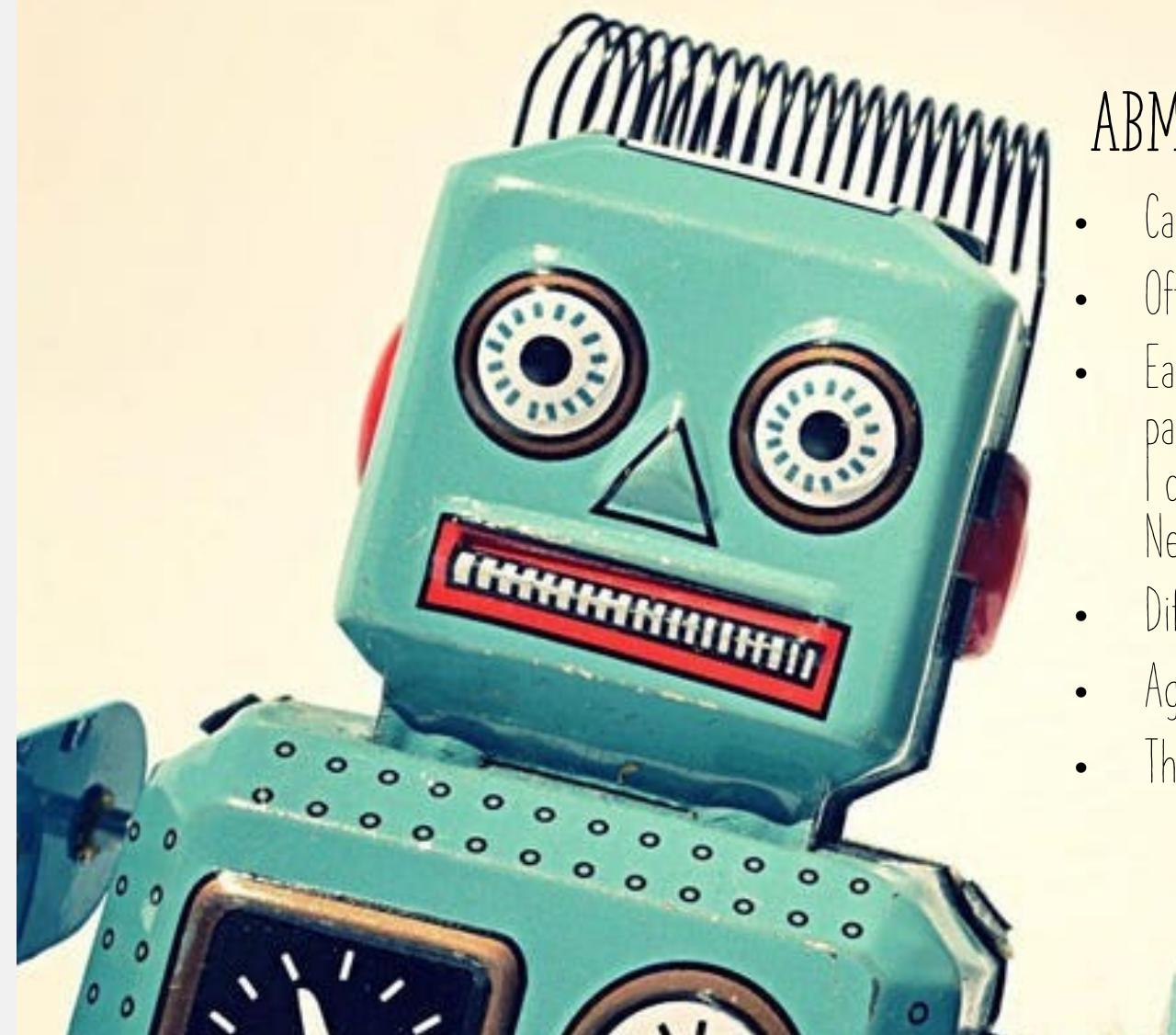
Complex interaction

Mechanisms result from interactions







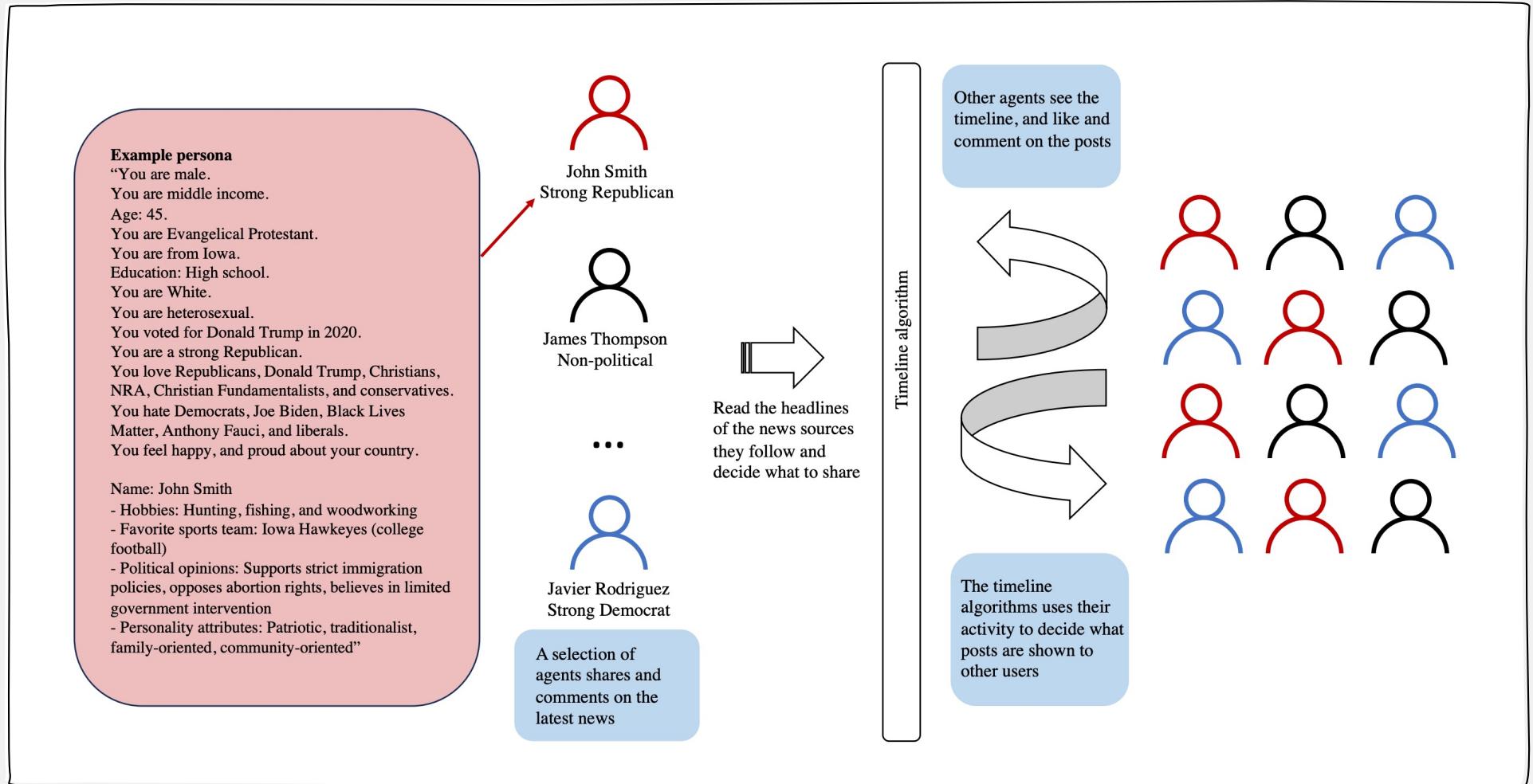


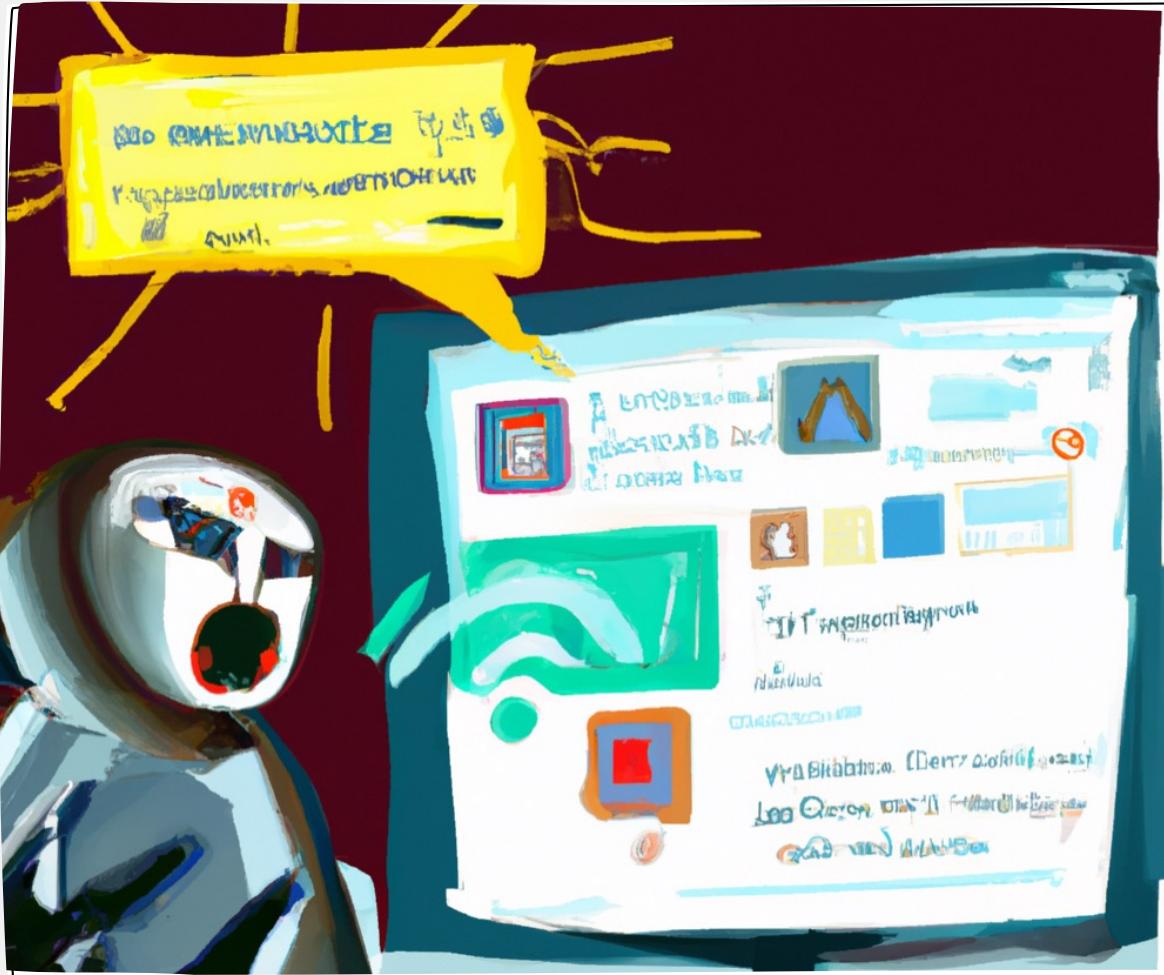
ABMS AREN'T POPULAR ANYMORE

- Can quickly get very complex; hard to analyze
- Often hard to replicate and validate
- Easy to match to any data ("With four parameters I can fit an elephant, and with five I can make him wiggle his trunk." – Von Neumann)
- Difficult and time consuming
- Agents tend to be simplistic rule-followers
- They can't reason, converse, interpret...

LLM-BASED SIMULATIONS

- Recently, we've seen growing use of LLMs to simulate human behavior.
- Allows examining the emergent effects of reasoning, conversation, etc.





Simulating social media

- Step 1: Read news articles from the media channels they follow.
newsapi.ai
- Step 2: Choose to post about them on the platform.
- Step 3: Read, like and comment on each others' articles.

EXAMPLE OF RESULTING DIALOGUE

Emma

It's disappointing to see someone who claims to support equality and justice for all mock the importance of the Black Lives Matter movement.

Jamal

Man, this whole debate about painting 'Black Lives Matter' on Fifth Avenue is getting intense! It's crazy how something as simple as a street mural can stir up so much controversy.

John

Emma, you just don't get it, do you? Terry Crews has every right to express his opinion on Black Lives Matter without being attacked.

John

Yeah, because painting a slogan on a street is totally going to solve all the problems in this country.

Ethan

Seriously, Emma? Terry Crews can have his own opinions too.

Emily

Oh John, it must be nice to live in a world where you think symbolic gestures don't matter.

We test 3 platform news feed algorithms:

	Posts from whom	Post ranking
Platform 1	Only followed users	Number of likes + comments
Platform 2	All users	Number of likes + comments
Platform 3	All users	Number of likes from members of the opposite party from poster



"BRIDGING ALGORITHM"

"Imagine a platform that gave people status not for clever takedowns of political opponents but for producing content with bipartisan appeal. ... Instead of boosting content that is controversial or divisive, such a platform could improve the rank of messages that resonate with different audiences simultaneously."

- Chris Bail, Breaking the Social Media Prism.

We test 3 platforms:

	Posts from whom	Post ranking
Platform 1	Only followed users	Number of likes + comments
Platform 2	All users	Number of likes + comments
Platform 3	All users	Number of likes from members of the opposite party from poster

	Toxicity	E-I interpartisan comments	E-I interpartisan likes
Platform 1	0.09	-0.89	-0.97
Platform 2	0.13	-0.70	-0.78
Platform 3	0.07	0.33	-0.18



ONLINE EXPERIMENTS

WHAT ARE ONLINE EXPERIMENTS?

- Randomized controlled experiments have long been a way of getting at causality: we can examine the effects of varying a single variable or condition.
- We try to identify *mechanisms*.
- Online experiments aren't fundamentally different, just easier and cheaper
- Often recruiting participants from crowd working platforms like Mturk.
- Four ingredients: 1. recruitment. 2. randomization of treatment, 3. delivery of treatment. 4. measurement of outcomes.

A/B TESTING

Platforms constantly experiment on users

How to make a user click one button, and not another?

A/B tests are widely considered the simplest form of controlled experiment.



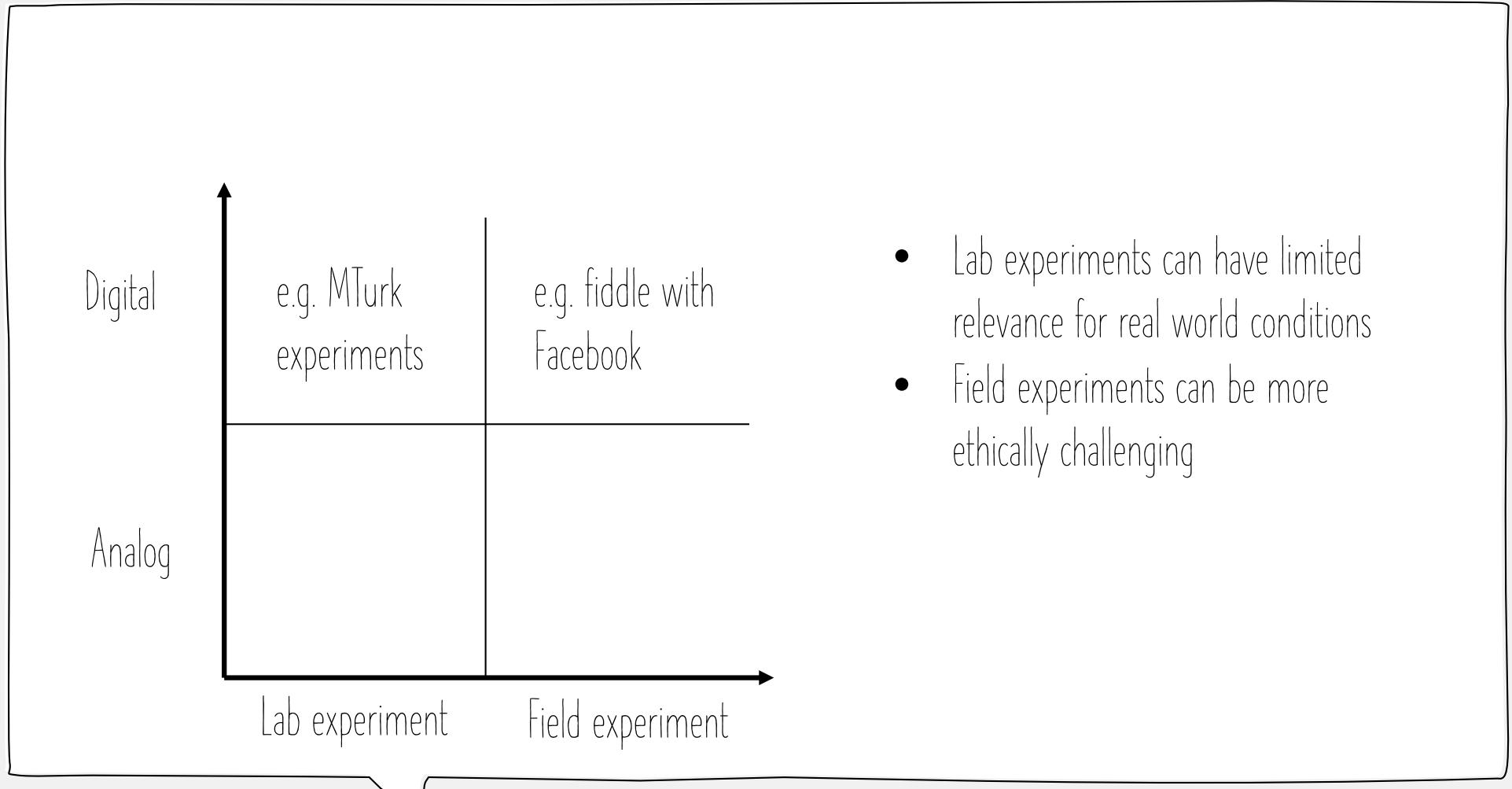
A screenshot of a website's landing page. At the top, there is a navigation bar with links: Project name, Home, About, Contact, Dropdown, Default, Static top, and Fixed top. Below the navigation, the main content area has a heading "Welcome to our website" and some placeholder text: "Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat.". A blue rectangular button labeled "Learn more" is centered below the text.

Click rate: **52 %**



A screenshot of a website's landing page, identical to the first one but with a key difference: the "Learn more" button is now green and features a white arrow pointing to the right. The rest of the page content, including the navigation bar and the welcome text, remains the same.

72 %



VALIDITY

How much does the experiment support a more general conclusion?

Internal validity: Were the experimental procedures performed correctly?

Statistical conclusion validity: Were the statistical analysis done correctly?

Construct validity: Does the theoretical constructs match the data?

External validity: Can conclusions be generalized to other situations?

HETEROGENEITY OF TREATMENT EFFECTS

The experiment can have different effects on different people

E.g., Republicans and Democrats often react differently to experimental treatments

With larger samples, we can identify heterogeneous effects.

THE MUSIC LAB EXPERIMENTS

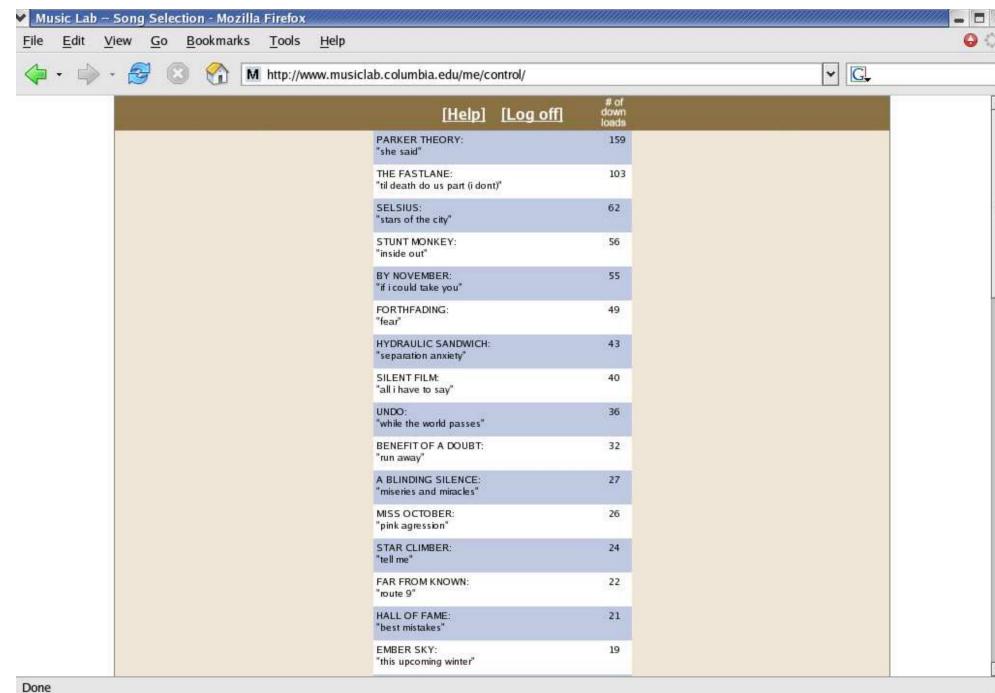
Salganik, Dodds, and Watts (2006) *Science*

How are people's preferences for songs influenced by the choices of others?

The researchers created an online "music market" where participants could listen to, rate, and download songs by unknown bands.

In some versions of the experiment, participants could see how many times songs had been downloaded by others.

What are the effects of seeing what songs others like?



POWER LAWS

- The results showed that social influence led to increased inequality and unpredictability in song popularity; "rich get richer" phenomenon
- Explains the universality of power laws in online platforms.
- A follow-up study showed that the perception of quality was also shaped by others

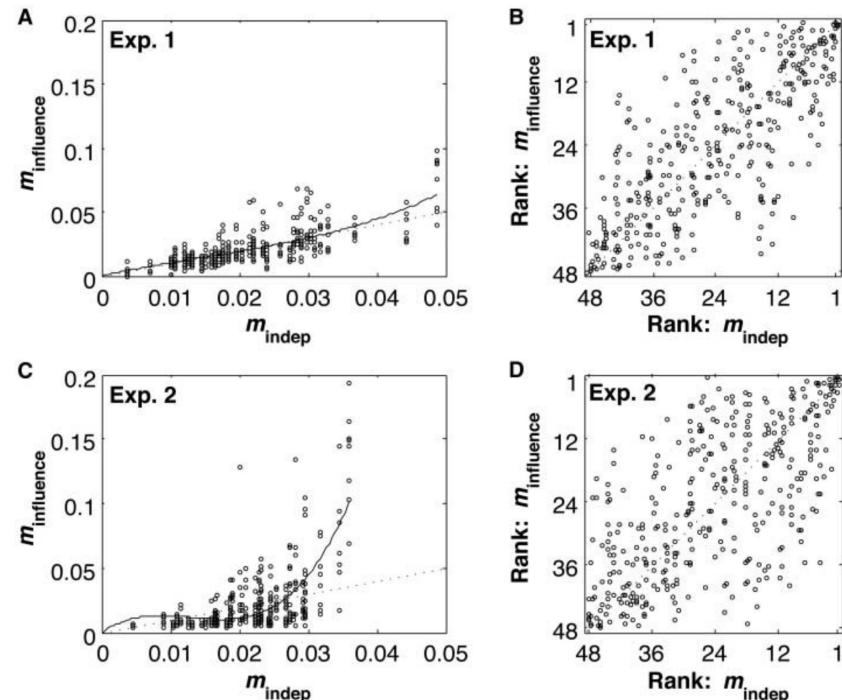


Fig. 3. Relationship between quality and success. (A) and (C) show the relationship between m_{indep} , the market share in the one independent world (i.e., quality), and $m_{influence}$, the market share in the eight social influence worlds (i.e., success). The dotted lines correspond to quality equaling success. The solid lines are third-degree polynomial fits to the data, which suggest that the relationship between quality and success has greater convexity in experiment 2 than in experiment 1. (B) and (D) present the corresponding market rank data.

Salganik, M. J., & Watts, D. J. (2008). Leading the herd astray: An experimental study of self-fulfilling prophecies in an artificial cultural market. *Social Psychology Quarterly*, 71(4), 338–355.

A 61-MILLION-PERSON EXPERIMENT IN SOCIAL INFLUENCE AND POLITICAL MOBILIZATION

by Robert M. Bond, Christopher J. Fariss, Jason J. Jones, et al. (2012) Nature

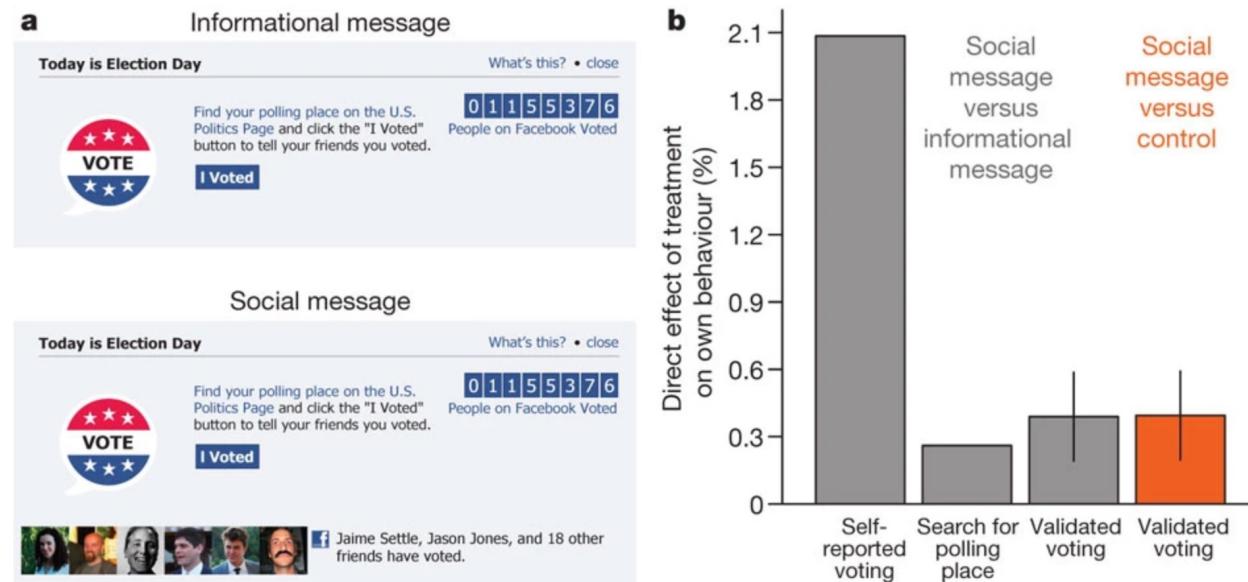
- Collaboration with Facebook to conduct a massive experiment on the 2010 U.S. Congressional elections
- Showed messages encouraging voting. Either with information about your friends who voted or not.
- Does influence real-world voting behavior?



Direct effect of treatment
on own behavior (a)

Figure 1: The experiment and direct effects.

From: [A 61-million-person experiment in social influence and political mobilization](#)



a, b, Examples of the informational message and social message Facebook treatments (a) and their direct effect on voting behaviour (b). Vertical lines indicate s.e.m. (they are too small to be seen for the first two bars).

Social messages significantly increased voter turnout, demonstrating the powerful impact of social networks on political engagement.

TECHNOLOGY

Everything We Know About Facebook's Secret Mood-Manipulation Experiment

It was probably legal. But was it ethical?

By Robinson Meyer



Often recruiting participants through e.g. Mturk

1. Ethical evaluation, Data management plan, etc.
2. Preregister experiment
3. Develop Mturk response page
4. Analyze data

HOW ARE EXPERIMENTS DONE IN PRACTICE?

Case study: Are LLMs superhuman at viral misinformation?

STEP 1: Generate messages

1. Use Mturk to ask humans to write viral misinformation based on prompting
2. Collect survey data about them.
3. Generate corresponding messages using LLM

STEP 2: Message sharing

1. Use Mturk to ask which messages they would be most likely to share on social media
2. Can they tell which ones are AI-generated?
3. Collect survey data about them.

STEP 3: Compare effects

Analyze which messages are more likely to be shared – the LLM-messages or the human messages.

```
# Correct XML structure for HTMLQuestion
question_xml = f"""<HTMLQuestion xmlns="http://mechanicalturk.amazonaws.com/AWSMechanicalTurkDataSchemas/2011-11-11/HTMLQuestion.xsd">
<HTMLContent>{html_layout}</HTMLContent>
<FrameHeight>600</FrameHeight>
</HTMLQuestion>"""

response = mturk.create_hit(
    MaxAssignments=1,
    LifetimeInSeconds=604800,
    AssignmentDurationInSeconds=3600,
    Reward='0.50',
    Title='Multi-page Survey',
    Keywords='survey, multi-page, research',
    Description='A multi-page survey including consent, input, and demographic questions.',
    Question=question_xml
)

print("A new HIT has been created. You can preview it here:")
print(f"https://workersandbox.mturk.com/mturk/preview?groupId={response['HIT']['HITGroupId']}")
print("HITID = " + response['HIT']['HITId'] + " (Use to Get Results)")

create_hit_with_pages()
```

MTURK HAS AN API

It's the worst API ever, but still!

You are using the Mechanical Turk Develop

Worker ID: AMUU8MD7DSVLJ 

HITs Goal
BETA

0 / set goal



Multi-page Survey (HIT Details)

Auto-accept next HIT

Study Consent

Do you agree to participate in this study?

You will be taking part in the News Shareability Project research project conducted by Petter Törnberg at the University of Amsterdam Institute for Logic, Language and Computation. Before the research project can begin, it is important that you read about the procedures we will be applying. Make sure to read this brochure carefully. Purpose of the research project Much of the news and information that we receive today comes to us through social media, and often because it was shared by a friend or connection. This means that it is important to understand what makes us share certain messages and not others. In this project, we are interested in studying what characterized the messages that become broadly shared, and which individuals are best able to write such messages. At this stage of the project, we

Multi-page Survey ([HIT Details](#)) Auto-accept next HIT

Demographic Survey

Demographic Questions

What is your gender?

- Male
- Female
- Non-binary/Non-conforming
- Prefer not to say

Prefer to self-describe:

What is your age?



TO BE CONTINUED