

# Network structure and money flow as drivers of conspiracy thinking

**Gent Serifi, Anja Sjöström, Jose Luis Ocana Pujol, Christopher Witzany**

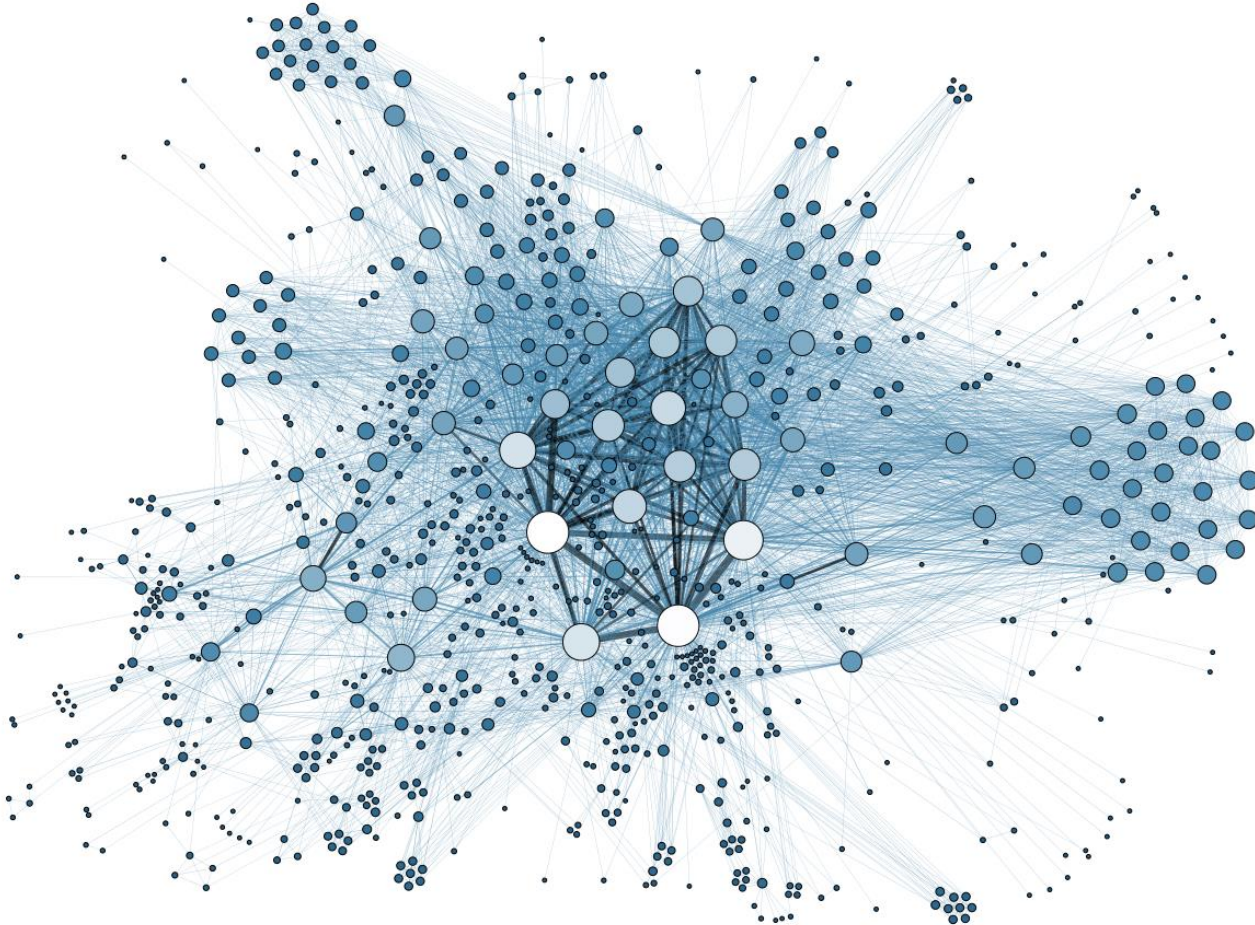
**05.12.2022**

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1. Some background on conspiracy theories → research question
2. Our model
3. Preliminary results
4. Outlook, further work, and considerations

# **Some background on conspiracy theories**

# The data availability paradox



- We can access more data than ever
- Conspiracy theories are more popular than ever



# Examples of popular conspiracy theories

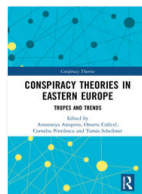






## How the pandemic and politics gave us a golden age of conspiracy theories

By AJ Willingham, CNN  
Published 11:23 AM EDT, Sat October 3, 2020



Chapter

## Soros conspiracy theories and the rise of populism in post-socialist Hungary and Romania

By Corneliu Pintilescu, Attila Kustán Magyari

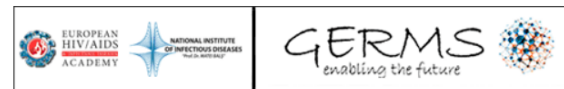
Book [Conspiracy Theories in Eastern Europe](#)

Edition 1st Edition  
First Published 2020  
Imprint Routledge  
Pages 25  
eBook ISBN 9780429326073



Share

[Journal List](#) > [Germs](#) > [v.7\(4\); 2017 Dec](#) > PMC5734925



[Germs](#). 2017 Dec; 7(4): 168–170.

Published online 2017 Dec 5. doi: [10.18683/germs.2017.1122](#)

## The golden age of anti-vaccine conspiracies

[Richard A. Stein](#)\*

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PMCID: PMC5734925

PMID: [29264353](#)

# We are in the golden age of conspiracy theories

The Washington Post  
Democracy Dies in Darkness

POLITICO

MAGAZINE

Q & A

## You're Living in the Golden Age of Conspiracy Theories

How the coronavirus pandemic primed America for a new pandemic of misinformation.

THE FIX

## 'Post-truth' named 2016 word of the year by Oxford Dictionaries



By Amy B. Wang

November 16, 2016 at 9:16 a.m. EST

The Guardian

The Trump era is a golden age of conspiracy theories - on the right and left  
*Nicolas Guilhot and Samuel Moyn*





The only way to fight the spread of conspiracy theories is to reduce the conditions of social inequality that produce them



✎ 'Conspiracy has long haunted American politics, but the age of Trump has made it an almost universal syndrome.' Photograph: Jonathan Ernst/Reuters

*Are we?*

# Have beliefs in conspiracy theories increased over time?

**Joseph Uscinski**<sup>1</sup><sup>\*</sup>, **Adam Enders**<sup>2</sup>, **Casey Klofstad**<sup>1</sup>, **Michelle Seelig**<sup>3</sup><sup>‡</sup>,  
**Hugo Drochon**<sup>4</sup><sup>‡</sup>, **Kamal Premaratne**<sup>5</sup><sup>‡</sup>, **Manohar Murthi**<sup>5</sup><sup>‡</sup>

“The public is convinced that beliefs in conspiracy theories are increasing, and many scholars, journalists, and policymakers agree.”

 **4 studies**

“In no instance do we observe systematic evidence for an increase in conspiracism, however operationalized.”



# Have beliefs in conspiracy theories increased over time?

science  ORF.at

Suchen



Aktuell Forscher/innen schreiben Radio & TV Kontakt



STUDIE

## Kein Run auf Verschwörungstheorien

Ob der von Regierungen verheimlichte Kontakt mit Außerirdischen oder das Coronavirus als Biowaffe: Verschwörungstheorien gibt es auf der ganzen Welt. In vier Teilstudien zeigen Forscherinnen und Forscher nun aber, dass der Glaube an diese Theorien auch in Zeiten von Social Media nicht zunimmt.

AFP/DENIS CHARLET

Forbes

BREAKING • BUSINESS

# Belief In Conspiracy Theories Has Not Increased, Study Argues

**Jacob Strier** Former Contributor ⓘ

*Summer Editorial Intern on the Forbes Wealth Team.*

# Limitations of the study

- Many “political” conspiracy theories analyzed: do people still care about who killed Kennedy?
- Studies 2,3 and 4: Oldest data point 2012.
- Study 1: popularity conspiracy theories compared over different amounts of time (from 6 months to 55 years):
  - Mean 12 years
  - Median 8 years
  - Std Dev Mean > Mean!





# Variety in conspirac

FLAT EARTH CONFERENCE COME TO CARY

NEWS







# Variety in the age of conspiracy theories







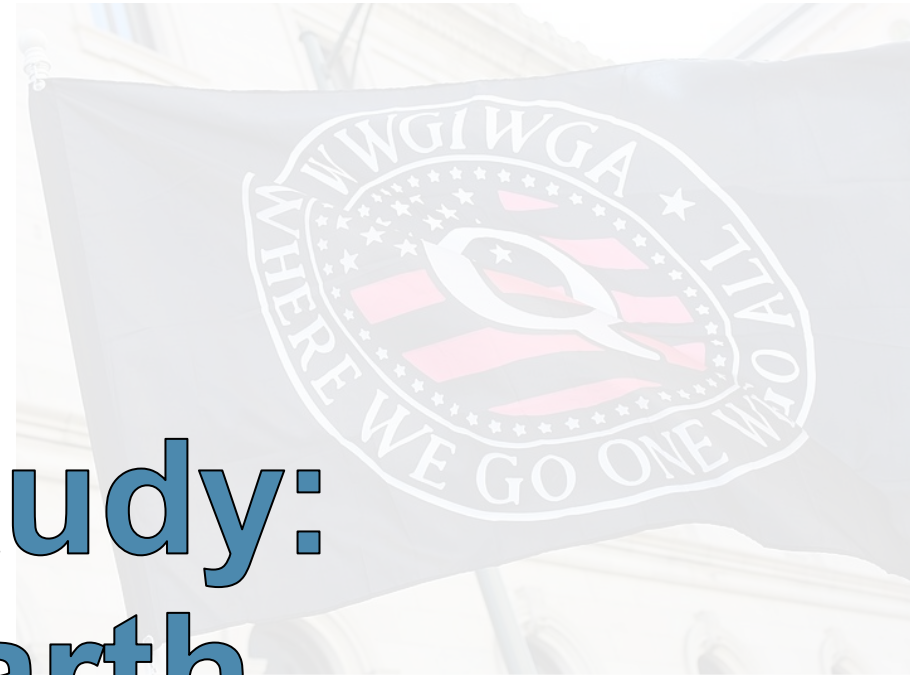
# Variety in the age of conspiracy theories





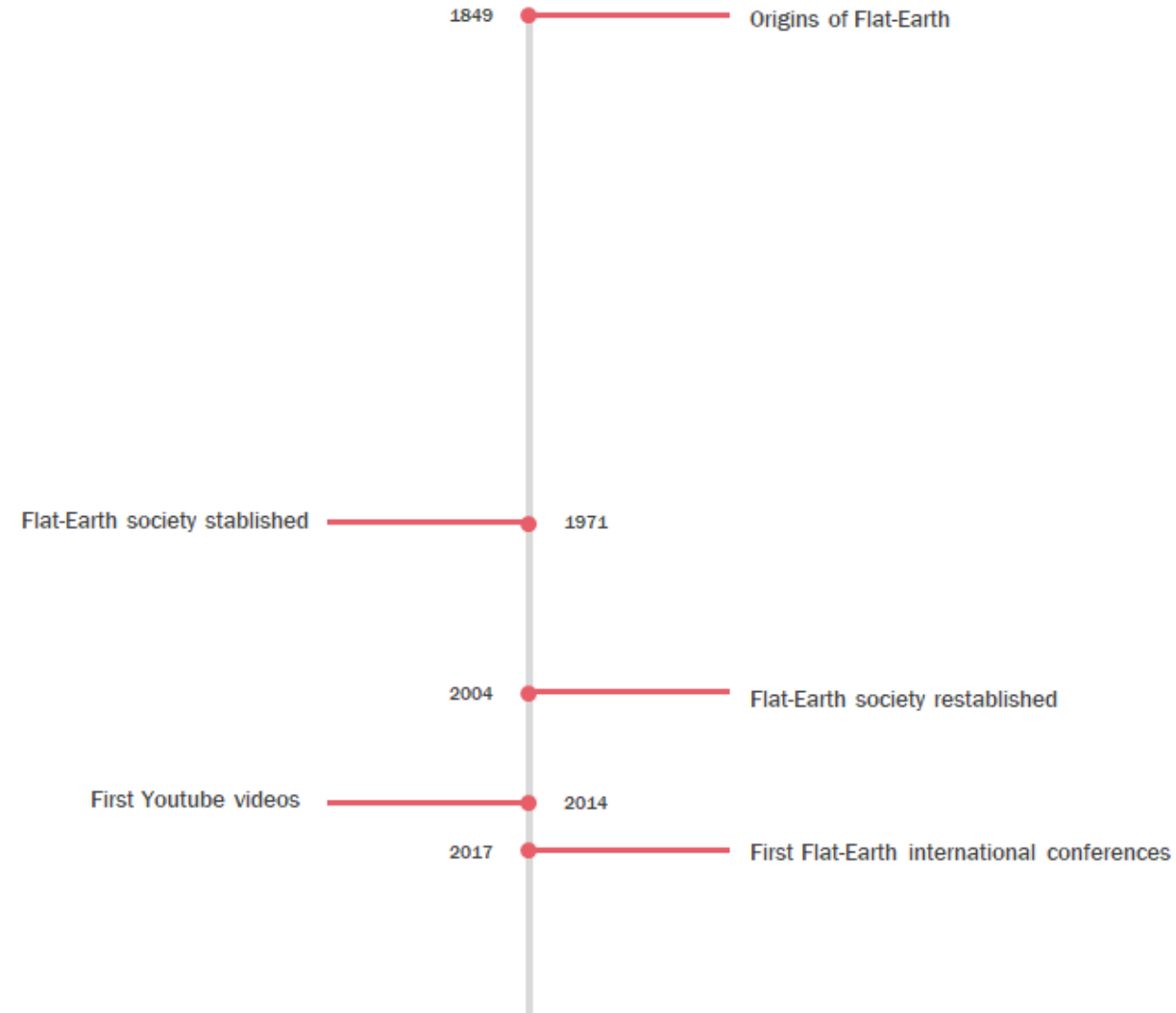


# Case study: Flat Earth



# Case study: Flat Earth

- Timeline<sup>1,2</sup>: long history.

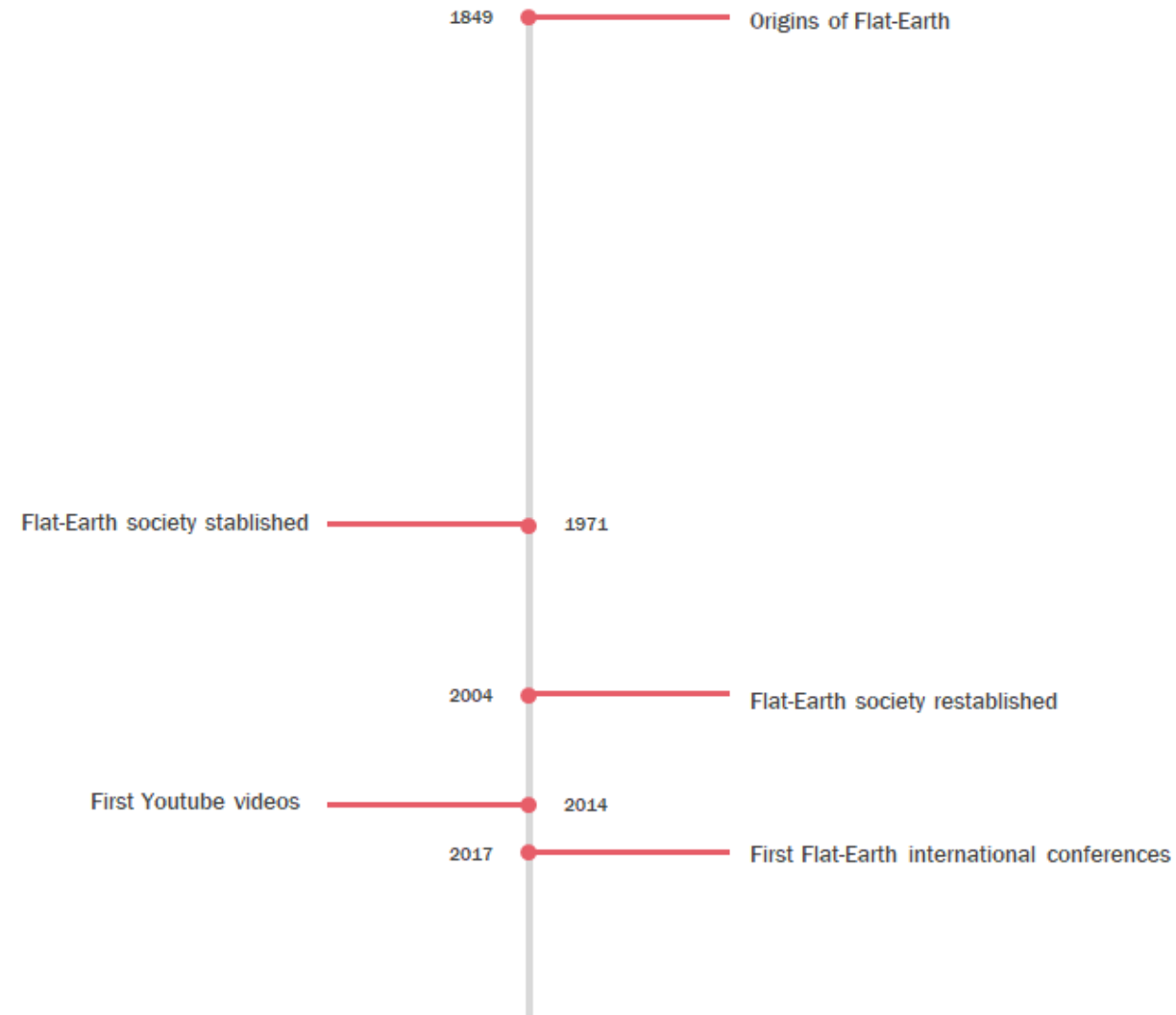


1 Olshansky, A.; Peaslee, R. M.; Landrum, A. R. Flat-Smacked! Converting to Flat Earthism. *Journal of Media and Religion* **2020**, 19 (2), 46–59. <https://doi.org/10.1080/15348423.2020.1774257>.

2 Paolillo, J. C. The Flat Earth Phenomenon on YouTube. *First Monday* **2018**. <https://doi.org/10.5210/fm.v23i12.8251>.

# Case study: Flat Earth

- Timeline<sup>1,2</sup>: long history.
- Most people in Flat Earth Conferences converted recently by Youtube<sup>1</sup>
- Different demographics, more sensitive to science-based arguments<sup>2</sup>



<sup>1</sup> Olshansky, A.; Peaslee, R. M.; Landrum, A. R. Flat-Smacked! Converting to Flat Earthism. *Journal of Media and Religion* **2020**, *19* (2), 46–59. <https://doi.org/10.1080/15348423.2020.1774257>.

<sup>2</sup> Paolillo, J. C. The Flat Earth Phenomenon on YouTube. *First Monday* **2018**. <https://doi.org/10.5210/fm.v23i12.8251>.

# Why do we care?

- Less popular than other science-related conspiracy theories (vaccines, moon landing...). 3-12% of western society<sup>1</sup>.
- Still, broad media attention: Netflix.



<sup>1</sup> 3 serious surveys (US and UK) compared. Anecdotal evidence from another 3 countries in the same range.  
More info in back up slides

# Why do we care?

- Less popular than other science-related conspiracy theories (vaccines, moon landing...)
- Still, broad media attention: Netflix.
- Unlike other misinformation (eg. Vaccine hesitancy), it seems to be considered "innocent" and "laughable".





# Summary of the introduction: gap

POLITICO

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MAGAZINE









Q&A

## **You're Living in the Golden Age of Conspiracy Theories**

How the coronavirus pandemic primed America for a new pandemic of misinformation.

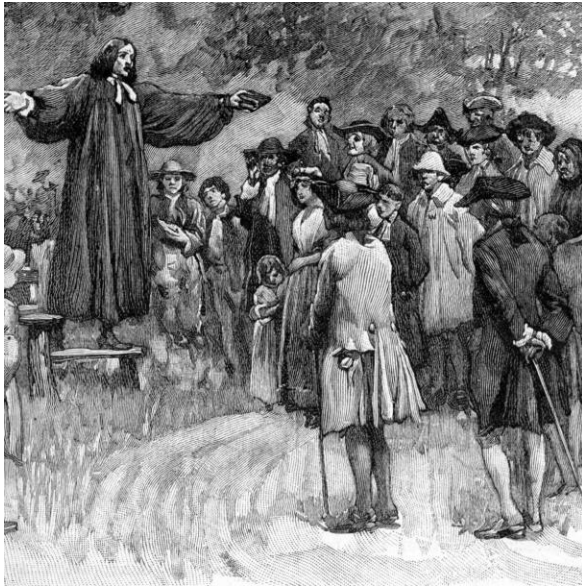
**VS**

## **Have beliefs in conspiracy theories increased over time?**

Joseph Uscinski  , Adam Enders , Casey Klofstad , Michelle Seelig , Hugo Drochon , Kamal Premaratne ,  
Manohar Murthi 

Published: July 20, 2022 • <https://doi.org/10.1371/journal.pone.0270429>

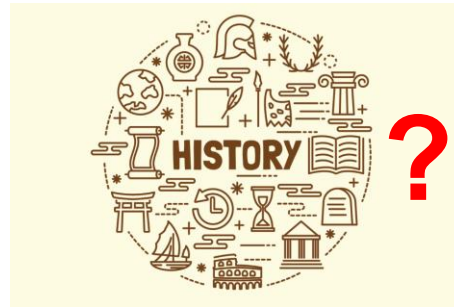
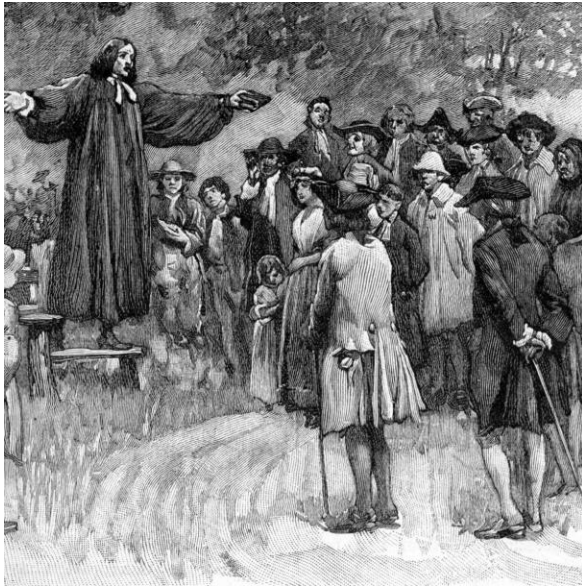
# Summary of the introduction: gap



**VS**



# Summary of the introduction: gap



## Research question:

Is the topology of the  
network responsible for the  
increase in conspiracy thinking?



# Our model

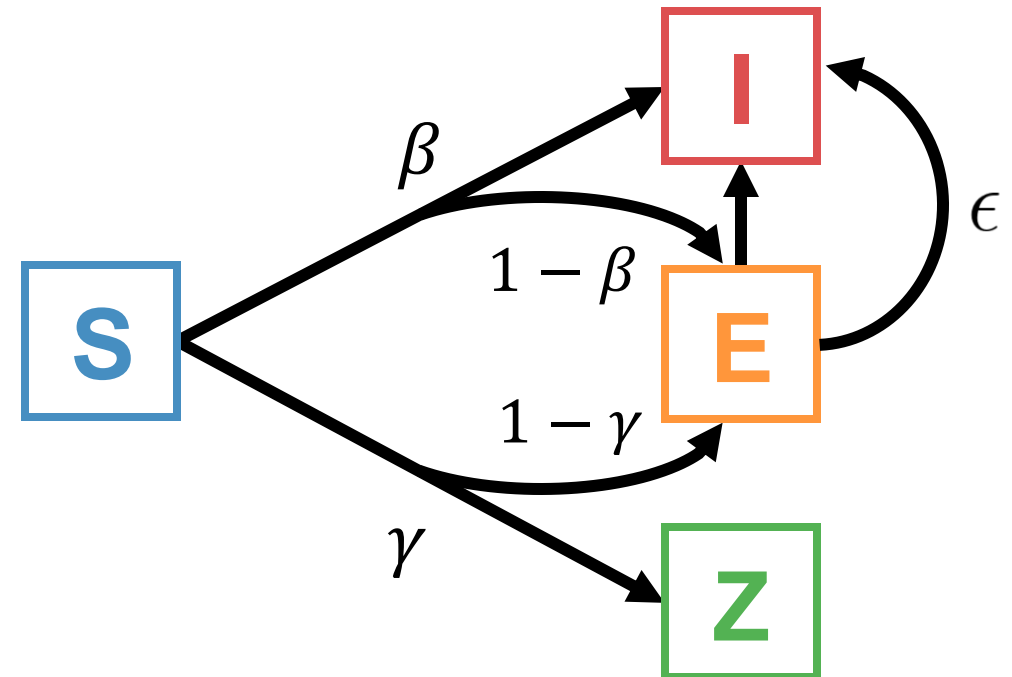


# SEIZ-Model of Opinion Spread

4 possible opinion-states:

- **Susceptible** (never heard of it)
- **Exposed** (heard of it, processing)
- **Infected** (believes)
- **Zkeptic** (does not believe)

transitions:

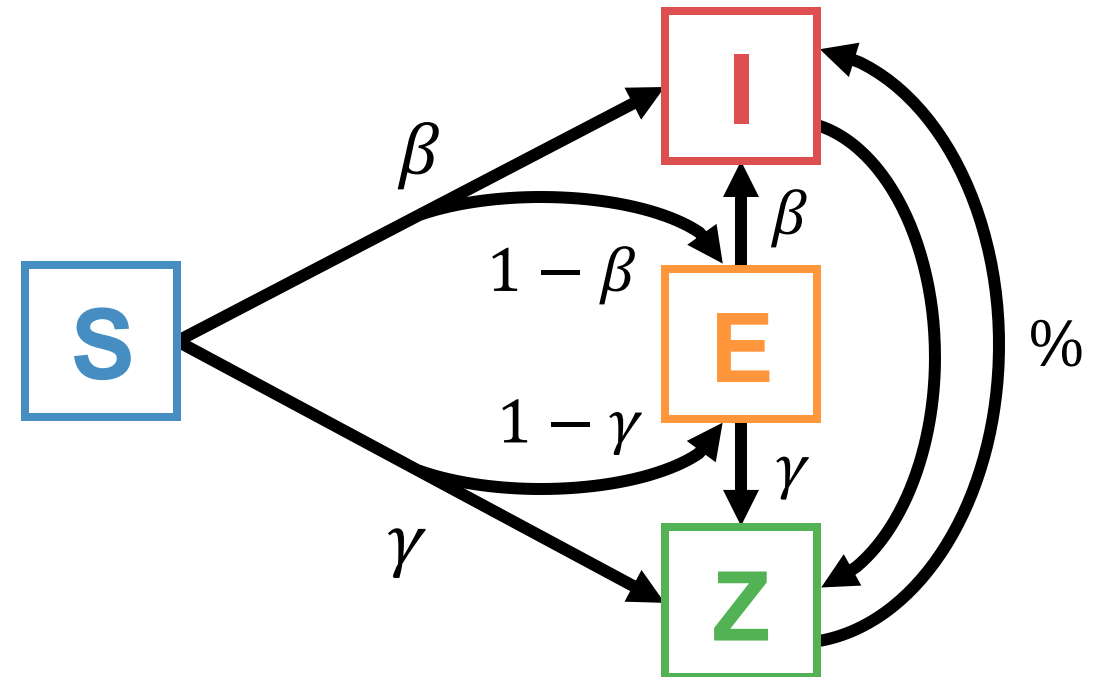


# Modifications to the SEIZ-Model

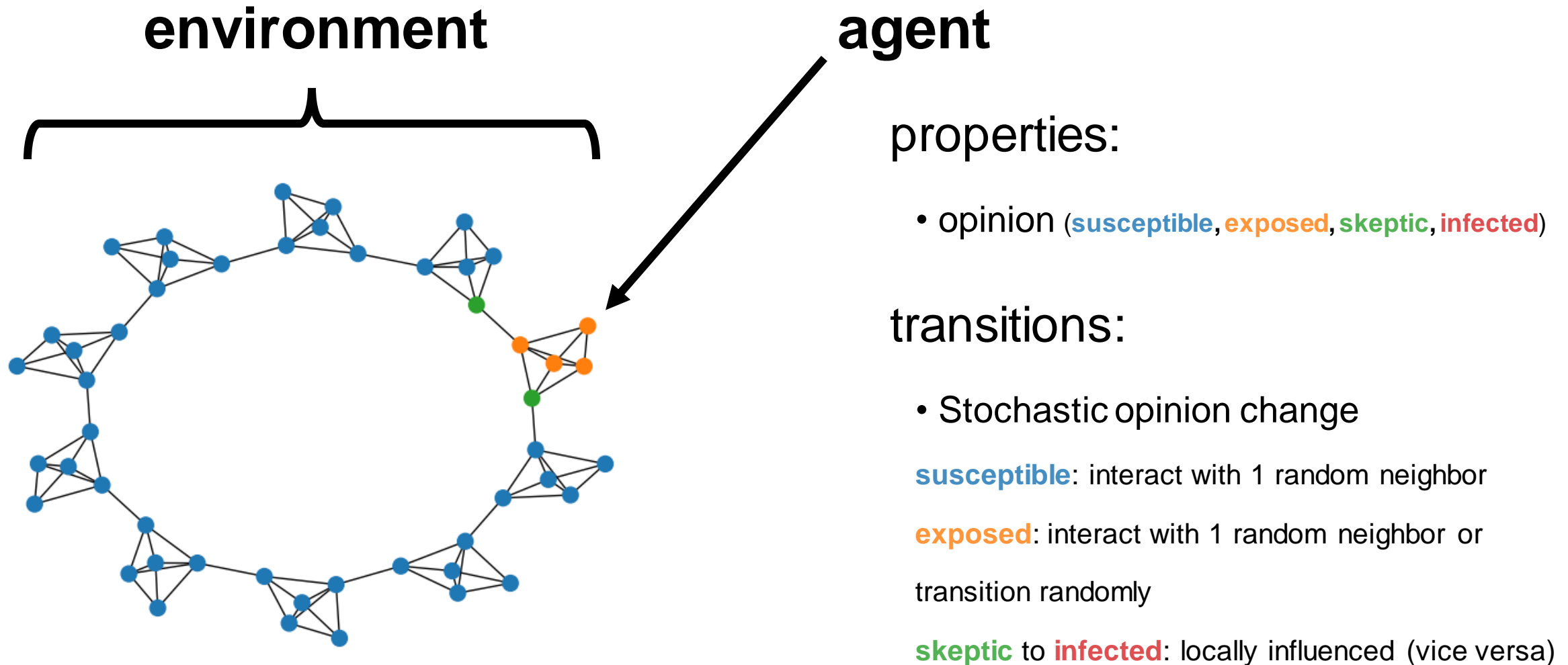
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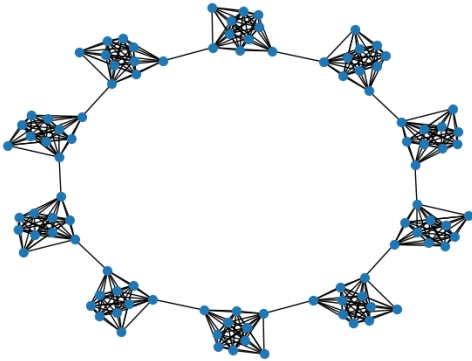
transitions:



# Agent based modelling

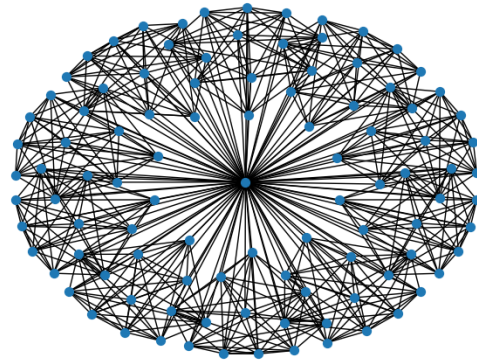


# We select representative topologies for 4 "epochs"



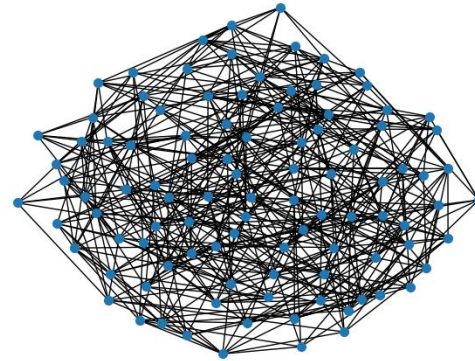
**pre media**

"small  
communities"



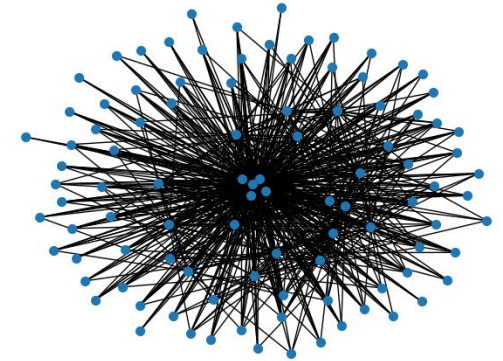
**legacy media**

"max  
centralization"



**early internet**

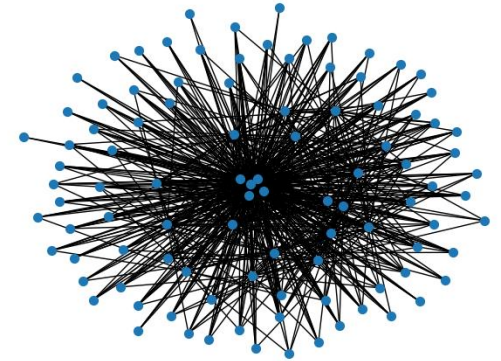
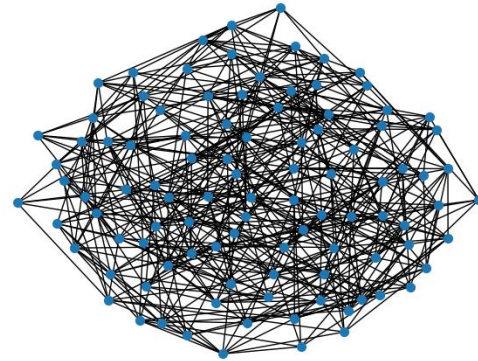
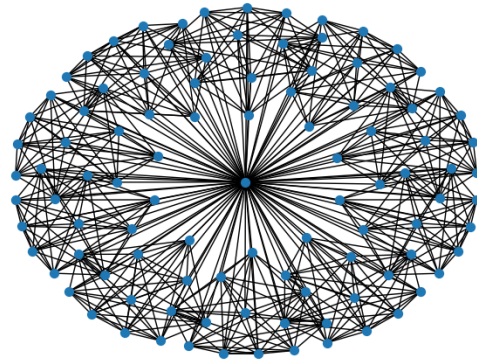
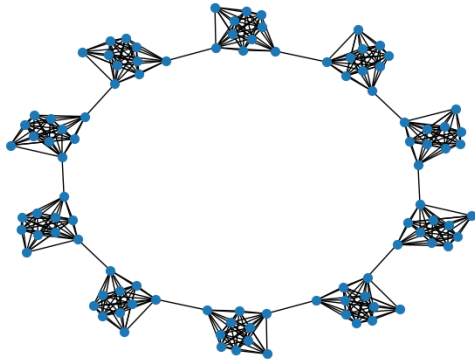
"fair distribution of  
connections"



**modern internet**

"unequal distribution of  
connections"

# Networks are engineered to have similar densities



Assuming limit on maximum number of connections, based on Prof. Dunbell's work<sup>1</sup>.

Density  $d = \frac{2m}{n(n-1)}$ , m=nodes, n=edges

0.09

0.11

0.10

0.11

<sup>1</sup> 3 serious surveys (US and UK) compared. Anecdotal evidence from another 3 countries in the same range. More info in backup slides



# Preliminary results

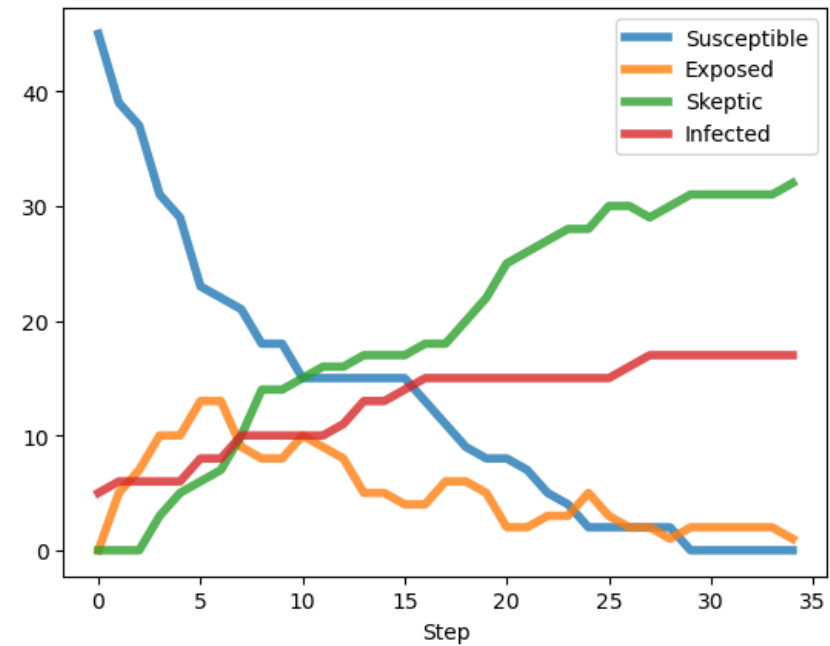
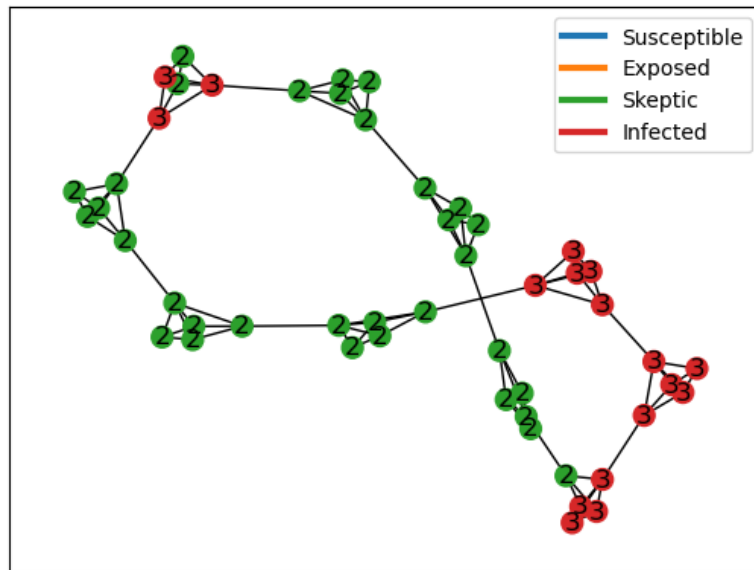
# Presentation of results

For every graph type, representing an "epochs", we:

- Ran the model for 20-35 steps until results started to saturate as observed in the line plots
- Visualized the network graph every step of the way
- Generated the phase diagrams correlating pairs of variables from:
  - Number of initial believers
  - Number of initial skeptics
  - Neighbor threshold - I.e. percentage of neighbors that need an opinion for a node to flip
  - Probability of a susceptible to become infected / skeptical by interacting with one
- Phase diagrams: plotted max occurrences instead of mean

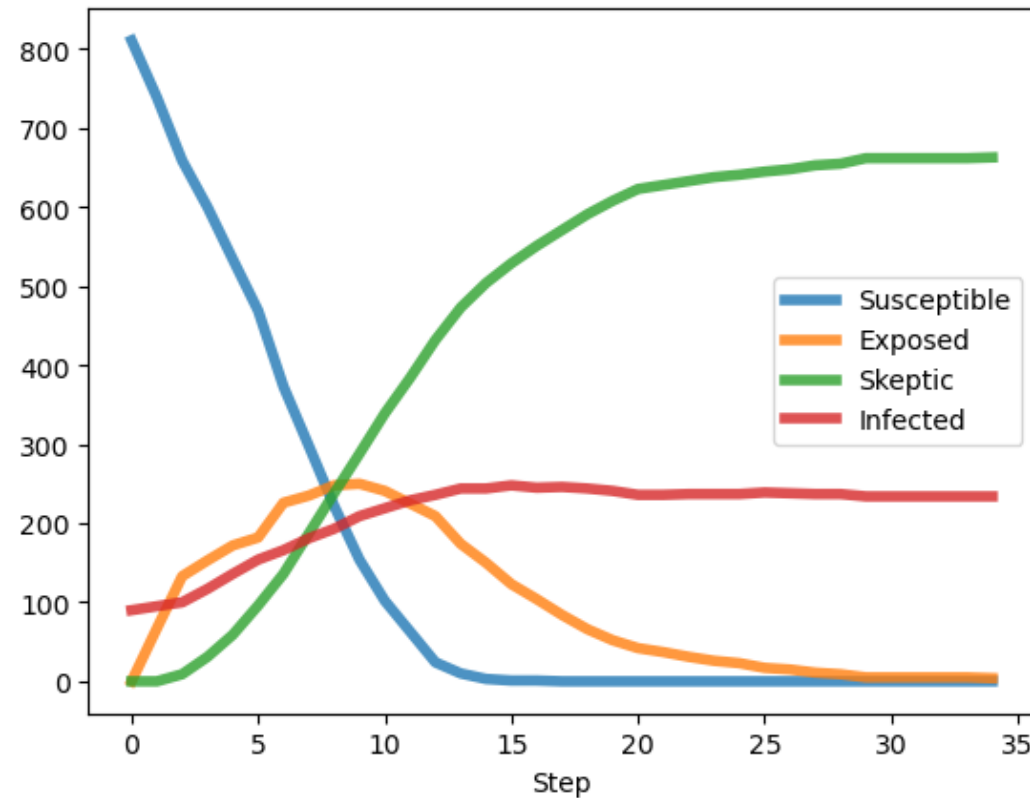
# The pre-media era

Modelled as small communities sparsely connected between each other → **networkX**: CAVEMAN graph model



# The legacy media era

Modelled by a highly centralized network meant to model a central information entity like television →  
**networkX**: WINDMILL graph model

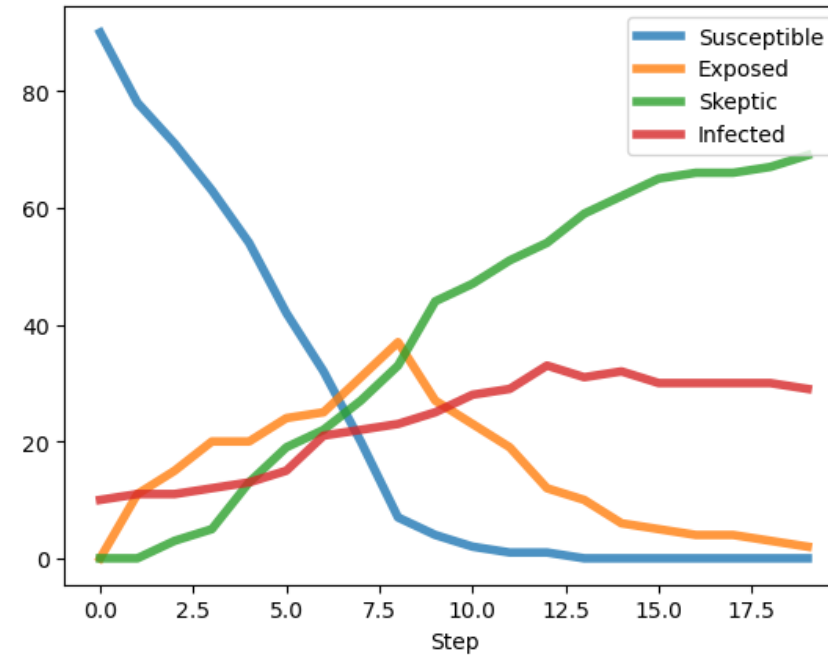
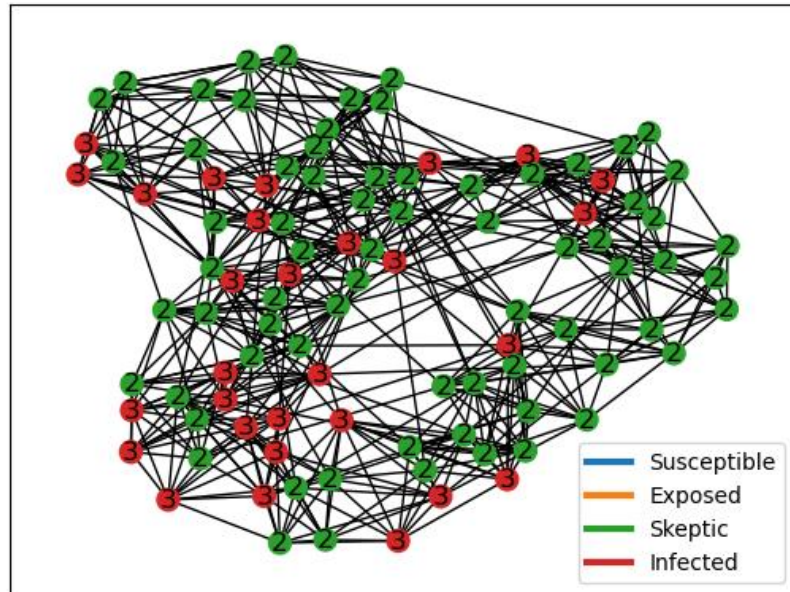




# The early-internet era

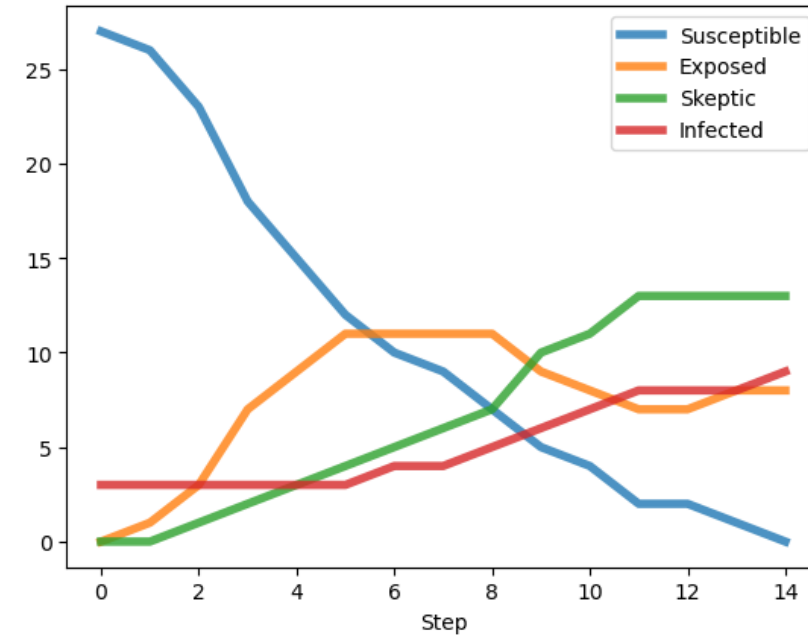
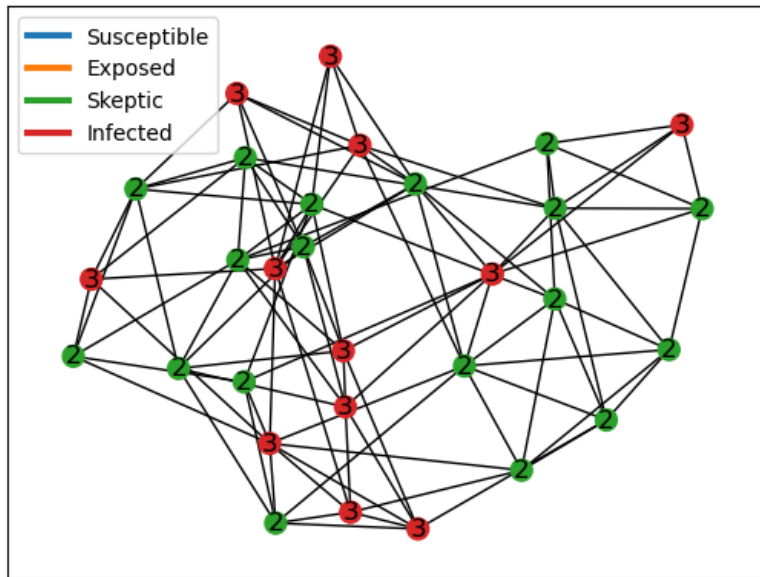
Modelled as a fair distribution with little clustering and relative closeness between nodes

→ **networkX**: SMALL WORLD graph model

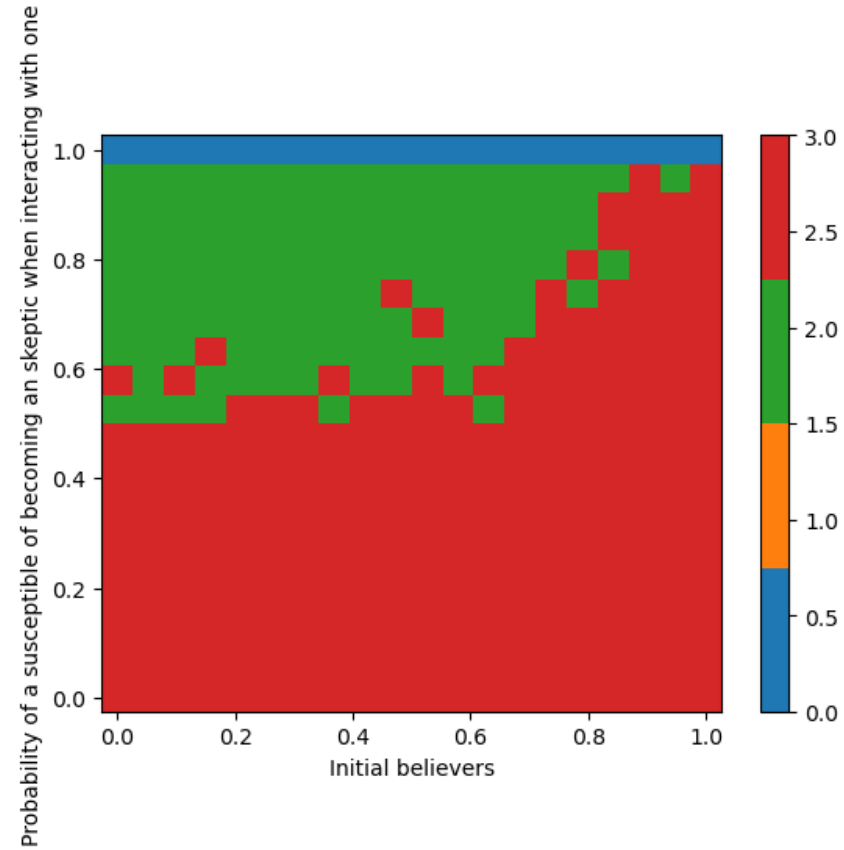


# The modern internet era

Modelled with a more unequal number of connections – idea: people are highly connected thanks to the internet but a minority still remain more influential



# Phase diagrams and takeaways



# Takeaways – network structure

The network structure has effect in the early stages on the growth of a believer community but little effect on reducing it



**Limitations and outlook**



# **Outlook, further work, and considerations**

# Limitations

- No data for probabilities of opinion change!
- Are our network archtypes representative of the realworld?
- Populations are heterogeneous!  
(i.e. not everybody is the same)

# Remember that rocket guy?



"We used flat Earth as a PR stunt... Flat Earth allowed us to get so much publicity that we kept going!

I know he didn't believe in flat Earth and it was a schtick."

# Outlook (to-do)



- dynamic network



- incentive to spread
- inhibition of opinion change  
after spending money



# merch



4,327 53

Views CrossRef citations to date Altmetric

104

Articles

## The roles of information deficits and identity threat in the prevalence of misperceptions

Brendan Nyhan & Jason Reifler

Pages 222-244 | Published online: 06 May 2018

## Prison Gang Members' Tattoos as Identity Work: The Visual Communication of Moral Careers

Michael P. Phelan Scott A. Hunt

First published: 22 December 2011 | <https://doi.org/10.1525/si.1998.21.3.277> | Citations: 40

Revision | Published: 11 February 2019

## Gang Organization and Gang Identity: An Investigation of Enduring Gang Membership

John Leverso & Ross L. Matsueda

*Journal of Quantitative Criminology* 35, 797–829 (2019) | [Cite this article](#)

2228 Accesses | 17 Citations | 8 Altmetric | [Metrics](#)

# buying merch boosts identity consolidation



4,327 53

Views CrossRef citations to date Altmetric

104

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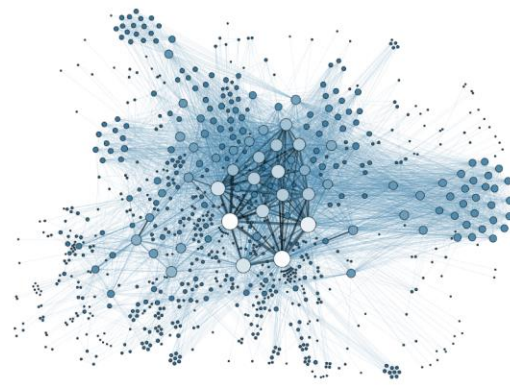
*Journal of Quantitative Criminology* 35, 797–829 (2019) | [Cite this article](#)

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## Research question:

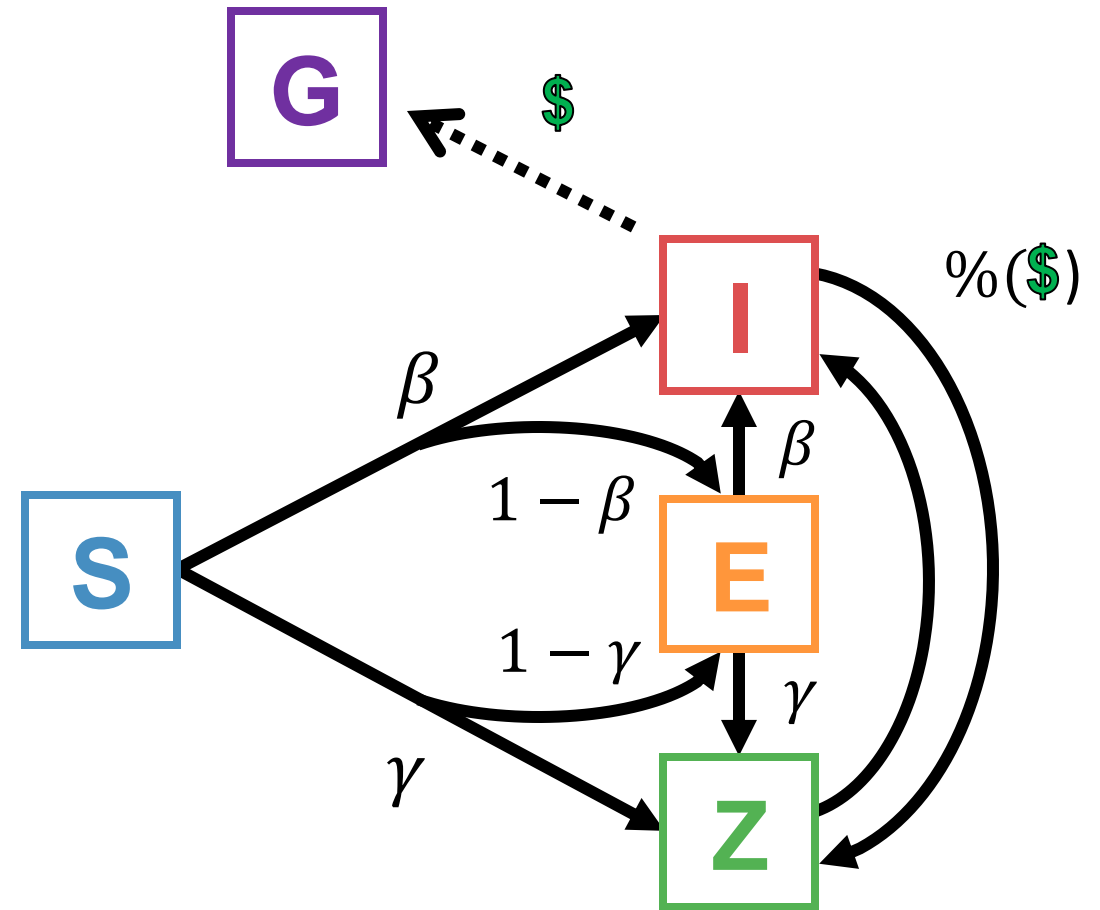
Could network structure and  
**money flow** jointly cause an  
increase in conspiracy thinking?

\$\$\$



# Outlook (to-do)

- **Susceptible** (never heard of it)
- **Exposed** (heard of it, processing)
- **Infected** (believes)
- **Zkeptic** (does not believe)
- + **Grifter** („infected“, makes money from infected)

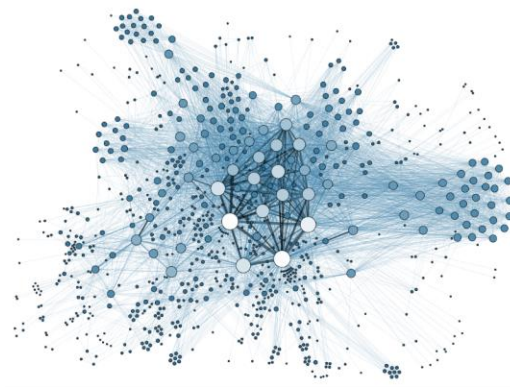




# Thanks



\$\$\$



# Network structure and money flow as drivers of conspiracy thinking

**Gent Serifi, Anja Sjöström, Jose Luis Ocana Pujol, Christopher Witzany**

**05.12.2022**

Back up slides

# Case study: Flat Earth

- Timeline<sup>1,2</sup>:
  - Back to mid XIX century England, religious fundamentalists
  - Flat Earth Society founded in 1971 in California
  - Society reestablished on 2004
  - First Youtube videos in 2014
- Most people in Flat Earth Conferences converted recently by Youtube<sup>1</sup>
- Different demographics, more sensitive to science-based arguments<sup>2</sup>

<sup>1</sup> Olshansky, A.; Peaslee, R. M.; Landrum, A. R. Flat-Smacked! Converting to Flat Earthism. *Journal of Media and Religion* **2020**, *19* (2), 46–59. <https://doi.org/10.1080/15348423.2020.1774257>.

<sup>2</sup> Paolillo, J. C. The Flat Earth Phenomenon on YouTube. *First Monday* **2018**. <https://doi.org/10.5210/fm.v23i12.8251>.

# Summary survey results

	US	US	UK
% agree	10	12	3
N (unweighted)	1134	1476	2039
Num categories answers	3	4	4
Inverse correlation with age?	Yes	Yes	Yes
More extreme than COVID vaccine hesitancy	Yes (microchips)	Yes (harmful effects not disclosed to the public)	Yes (autism)

Anecdotal evidence from Italy and Brazil: 5-8%

[https://d25d2506sfb94s.cloudfront.net/cumulus\\_uploads/document/waya2tqcg8/YG-Archive-ScienceBIANO-110219.pdf](https://d25d2506sfb94s.cloudfront.net/cumulus_uploads/document/waya2tqcg8/YG-Archive-ScienceBIANO-110219.pdf)

<https://carsey.unh.edu/publication/conspiracy-vs-science-a-survey-of-us-public-beliefs>

[https://d25d2506sfb94s.cloudfront.net/cumulus\\_uploads/document/xj7rpmvws8/econTabReport.pdf](https://d25d2506sfb94s.cloudfront.net/cumulus_uploads/document/xj7rpmvws8/econTabReport.pdf)

<https://www1.folha.uol.com.br/ciencia/2019/07/7-dos-brasileiros-afirmam-que-terra-e-plana-mostra-pesquisa.shtml>

<https://www.censis.it/rapporto-annuale/la-societ%C3%A0-irrazionale>



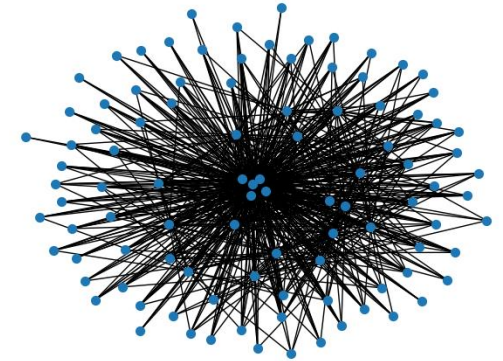
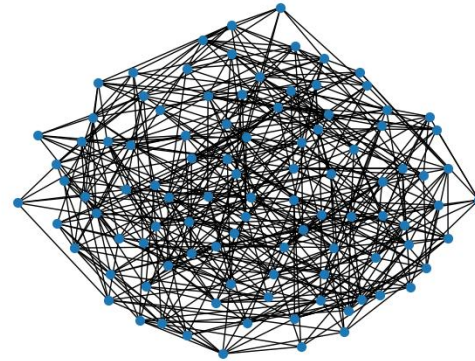
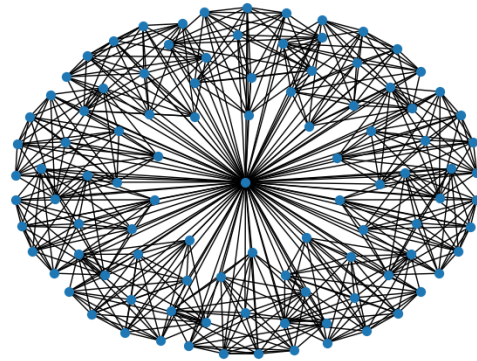
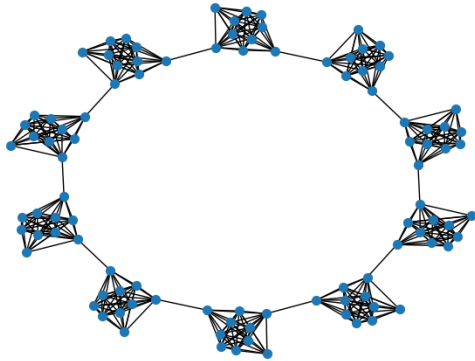
# Summary introduction: towards R1

- Public perception thinks we live in the golden age of conspiracy theories
- Lack of data to support it, academics that examined it claim that there is none. Only looked to the social media era.
- Some of this theories are very old (see flat earth) and there are reports that the way people got converted and their motivations are very different.

Our contribution:

“What if the society perception is right, conspiracy theories like flat earth have become more dominant, but it is only visible by comparing different points in history far away enough?”

# Networks are engineered to have the same density, assuming



Clustering coeff

$$C_i = \frac{2e_i}{k_i(k_i - 1)}$$

Ask Nino gepy

<b>0.94</b>	<b>0.99</b>	<b>0.16</b>	<b>0.78</b>
0.09	0.11	0.10	0.11

Density

$$d = \frac{2m}{n(n-1)},$$

m=nodes, n=edges

# Dunbar's numbers of social connections



Friend—ship  
Be—friend  
Girl—friend  
Friend—ly  
Good—friend  
Best—friends  
Friend—request  
Old—friend

## Friends

Understanding the Power of our  
Most Important Relationships

Robin  
Dunbar

Dunbar, R. I. M. Coevolution of Neocortical Size, Group Size and Language in Humans. *Behav Brain Sci* **1993**, 16 (4), 681–694. <https://doi.org/10.1017/S0140525X00032325>.

Back up slides

# Literature

Paper on whether CT have increased:

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0270429>

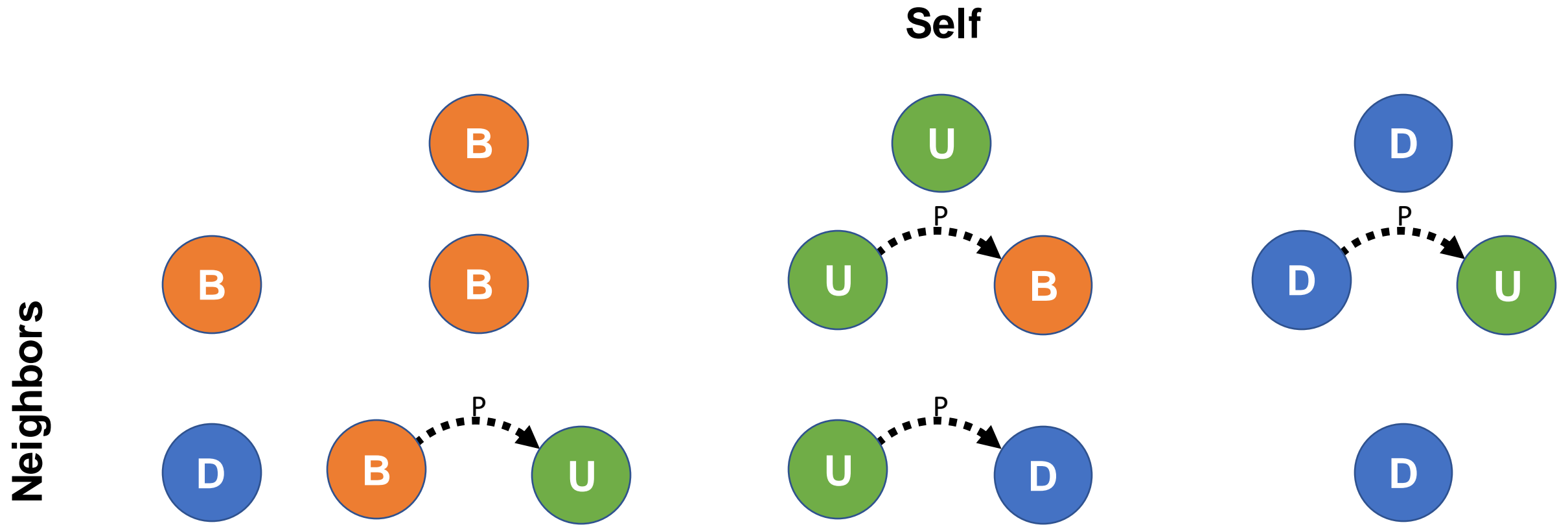
Paper on Flat-Earth conversion and history:

**Flat-Smacked! Converting to Flat Earthism**

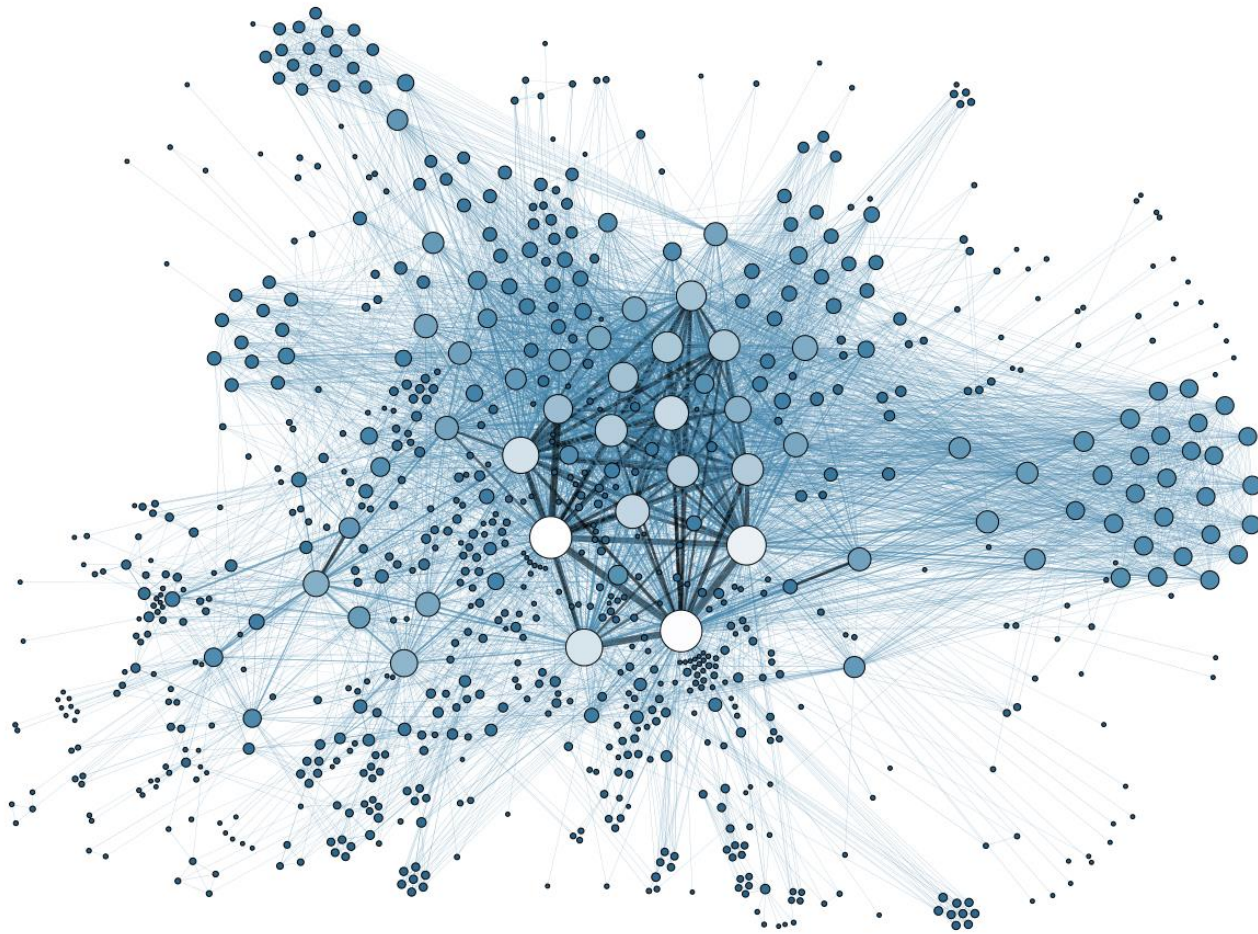
<https://www.tandfonline.com/doi/full/10.1080/15348423.2020.1774257?scroll=top&needAccess=true>



# Agent based modelling







Society is:

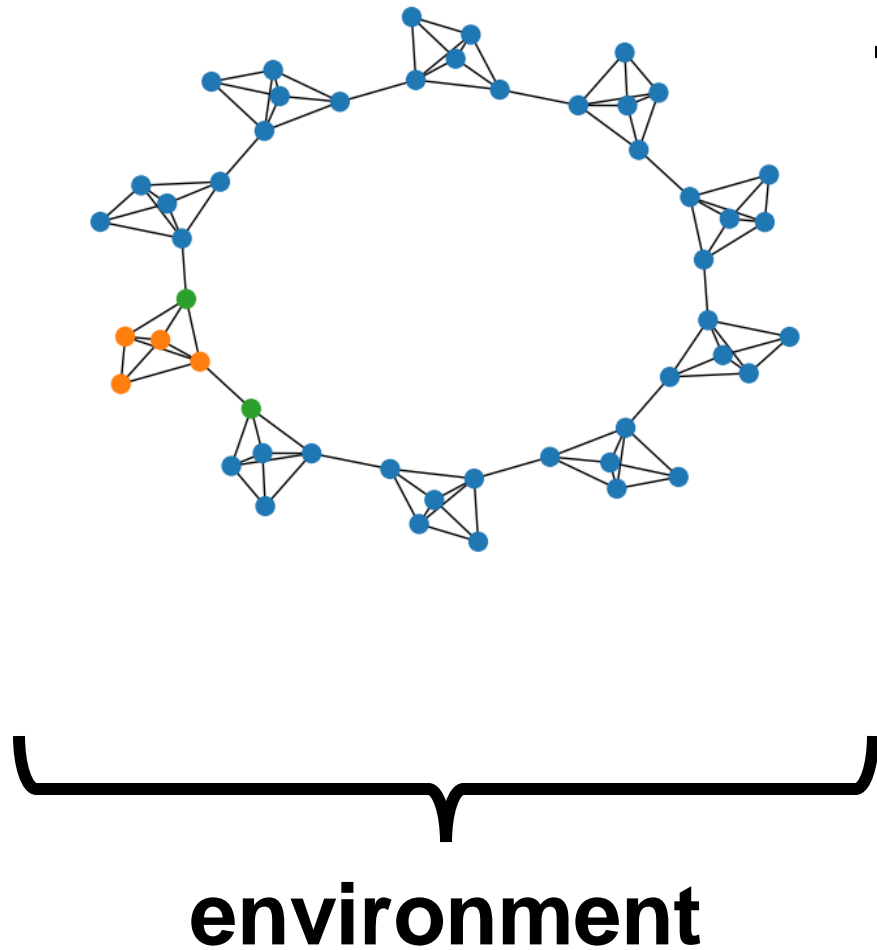
- More connected
- More educated
- More informed

...than ever.

And still

3-12% of the population  
believe in flat earth.

# Agent based modelling



— agent

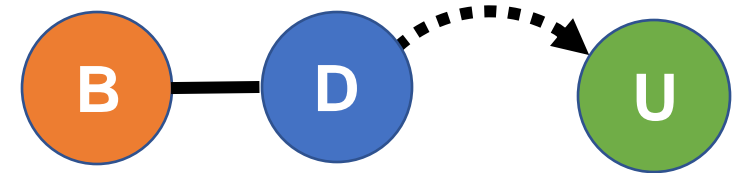
properties:

- opinion (believe, disagree, unsure)

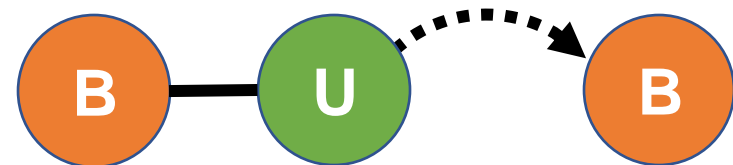
actions:

- stochastic opinion change

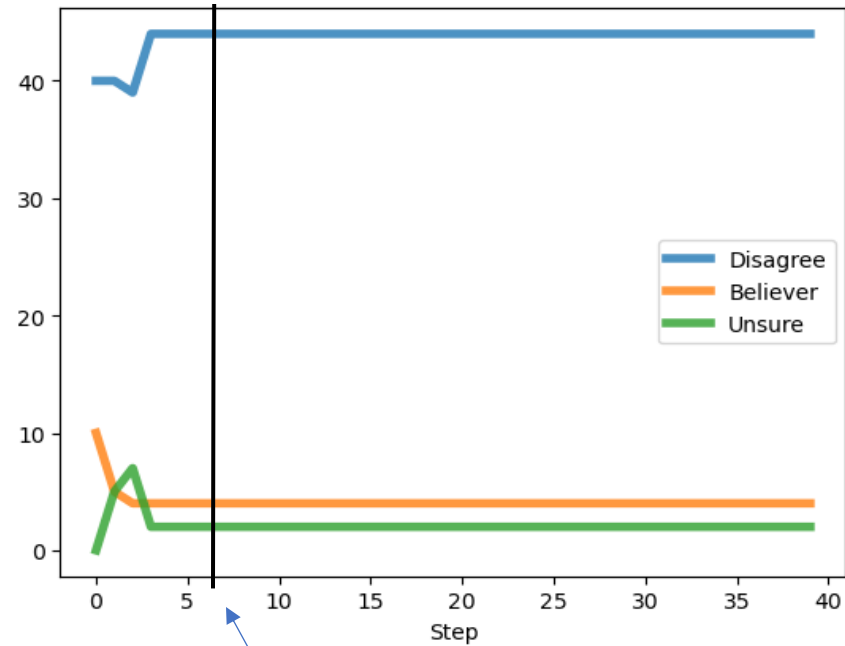
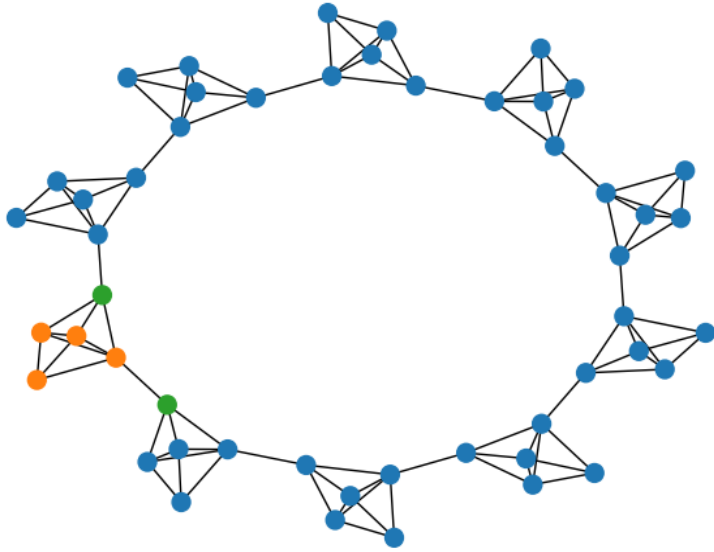
Step 1



Step 2



# How to phase diagram



Implementations

Cut off steps for  
phase diagram

# Agent based modelling

