

26TH FEBRUARY 2026

COEVOLUTION OF OPINIONS AND EPI-DEMICS ON NETWORKS.

Tim Van Wesemael

INTRODUCTION

- Opinion dynamics
- Many models
- Watts threshold: adopt if fraction of neighbours exceeds threshold

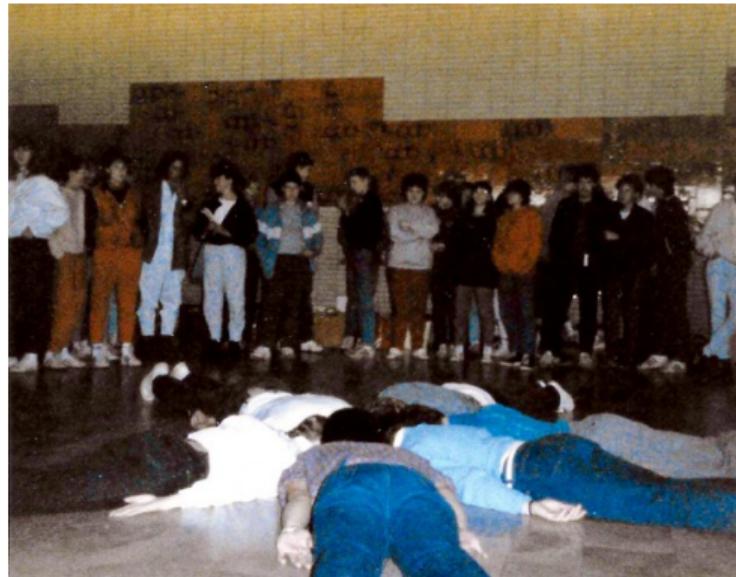
SOCIAL CONTAGION

- Many social phenomena
 - Ideas
 - Memes
 - Adoption of innovation
 - ...
- Diffusion or epidemic-like? (*viral spread*)



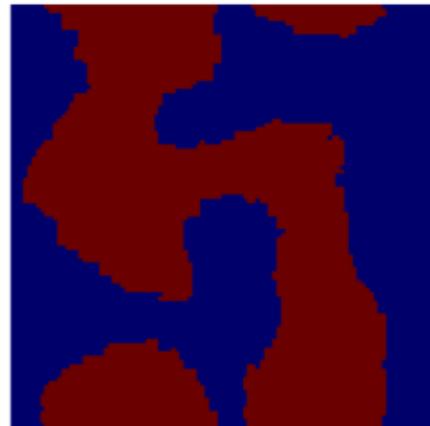
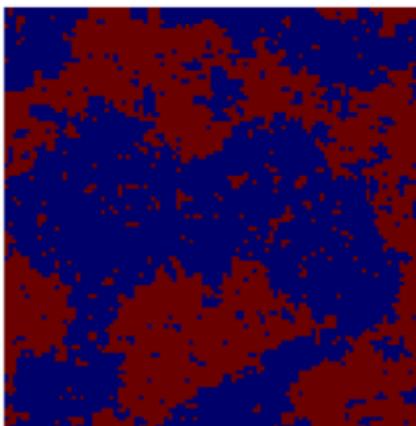
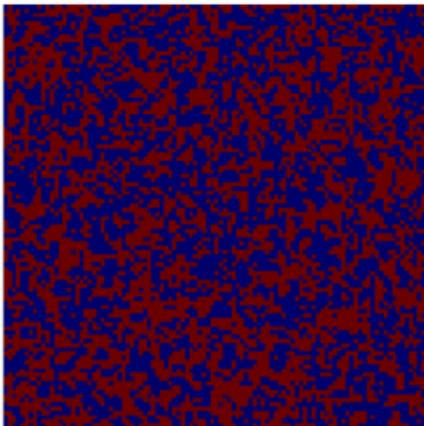
SOCIAL CONTAGION

- Many social phenomena
 - Ideas
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 - ...
- Diffusion or epidemic-like? (*viral spread*)
- In many ways not!



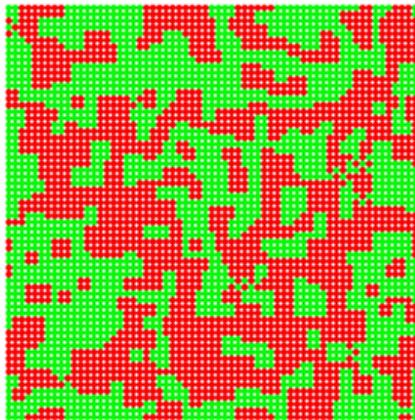
DISCRETE OPINION DYNAMICS

- Like magnets? Ising model!
- $H = - \sum_{i,j} J_{ij} \sigma_i \sigma_j - \mu \sum h_j \sigma_j$ with $\sigma_i \in \{-1, +1\}$
- Allows for microscopic interactions through J_{ij}



DISCRETE OPINION DYNAMICS

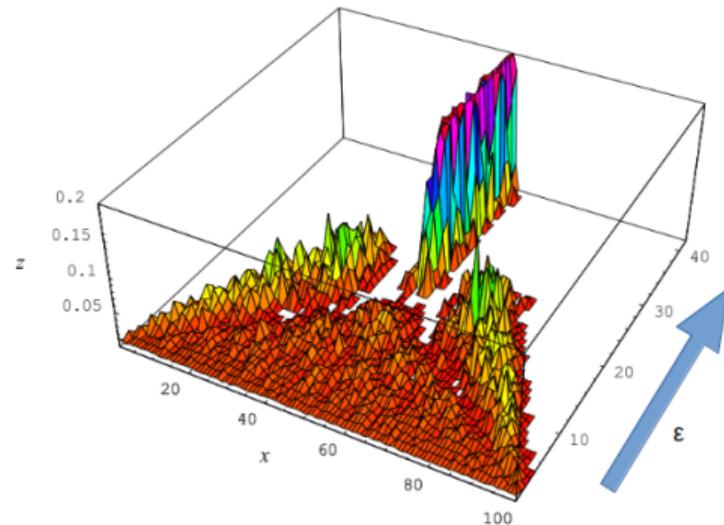
- Or complex contagion?
- Interactions with the contagion are not independent
- Threshold model: adopt if number of contagious neighbours reach threshold



CONTINUOUS OPINION SPACE

Bounded confidence

- Diffusion-like
- Only adjust to opinion that is close enough to yours ($< \epsilon$)
- Fragmentation → polarization → consensus



(Hegselmann, 2002)

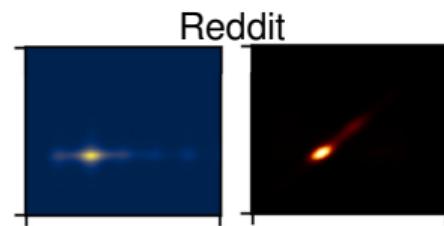
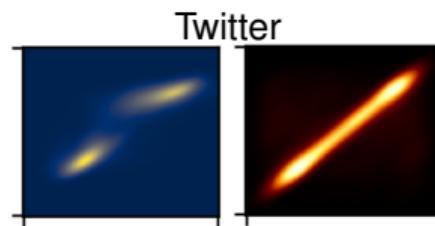
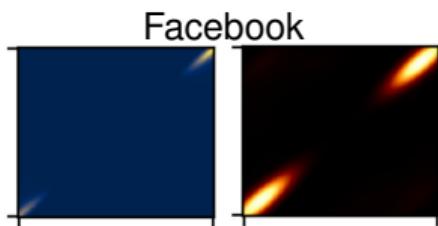
DATA-DRIVEN APPROACHES

- Only a small fraction of models have been validated with empirical data
- Observationally, complex contagions have been identified, such as the adoption of a politically motivated profile picture (State, 2015)
- Small-scale randomised experiments confirmed these results (Centola, 2015)



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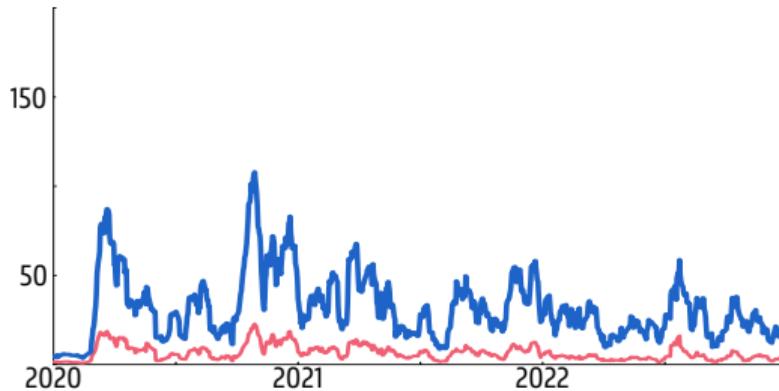
REDDIT

- Social network size
- 18th most visited
- Semi-anonymous
- Hierarchical structure

The screenshot shows the Reddit homepage with the URL "www.reddit.com". The top navigation bar includes links for "ABOUT", "FAQ", "LOGOUT", "LOG IN", "LOG OUT", "SEARCH", "HOMEPAGE", "CHOOSE FORM", "MULTIPOSTING", "PICS", "WORKSHOPS", "SUBMISSIONS", "HIGHLIGHTS", "NEWS", "MEMES", "VIDEOS", "BY EUROPE", "SPICE", "MUSIC", "TELEVISION", "GAMING", "COMICBOOKS", "MOTOCROSS", "MOTORCYCLES", "LIFECODES", "DINERCODES", "CARTOONCODES", "GIFS", "TRV", "BOOKS", "JOBS", "PUBLICATIONS", and "HOME". A search bar at the top right allows users to "Search" or "Log in / Log out / Create account". Below the search bar is a login form with fields for "username" and "password", and a "log in" button. To the right of the login form is a "Submit a new link" button and a "Get Reddit Premium" button with the text "Get Reddit Premium". The main content area displays a list of posts from the "AskReddit" subreddit. The first post is titled "What isn't the f*** many people think it is?" with 2,011 upvotes. The second post is "What's a dating preference that you think is socially unacceptable?" with 1,774 upvotes. Other visible posts include "I'm a b****. I'm a b****.", "For those who grew up with it, what did you consider a luxury?", "AITA for telling my wife's sasquatch after she just let her friends go up on me?", "Sorry not sorry", "Photographs capture an intense fight between two ferocious bears.", "AITA for giving my granddaughter a DNA test.", "Argentina has non-negotiable sovereignty over the Falklands", "TFLU by telling my girlfriend my type.", and "Behold: Starfleet is still being worked on by 250 d***s". Each post includes a thumbnail image, the title, the number of upvotes, and a "report" link.

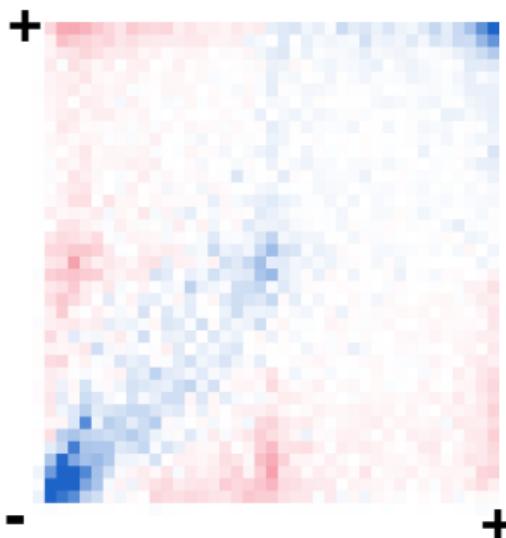
GOALS

- Empirical sources for contact reduction
- Data-driven models for social dynamics
- Identification of conversation polarization



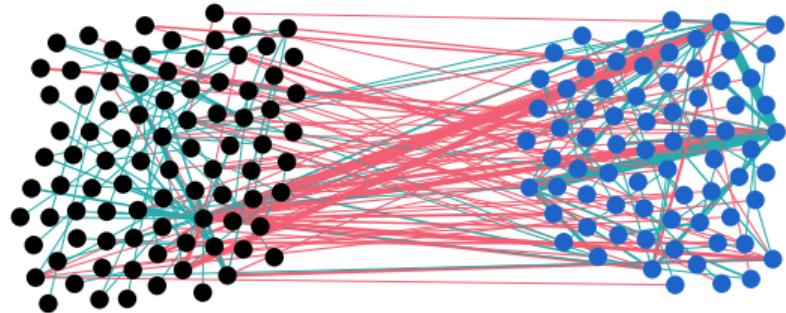
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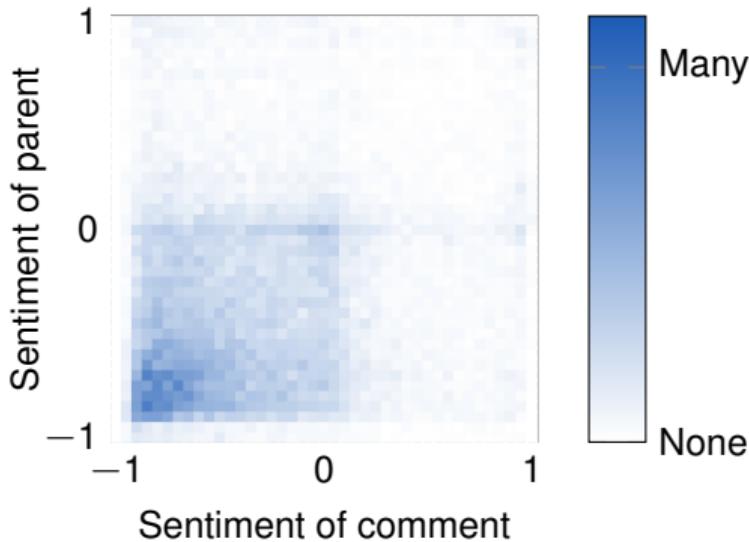


THE DATASET

- r/Belgium community
- 01/2020 - 07/2022
- COVID topics by keyword selection and pretrained BERT model
 - Lockdown
 - Mask
 - Vaccination
- Sentiment by pretrained BERT model

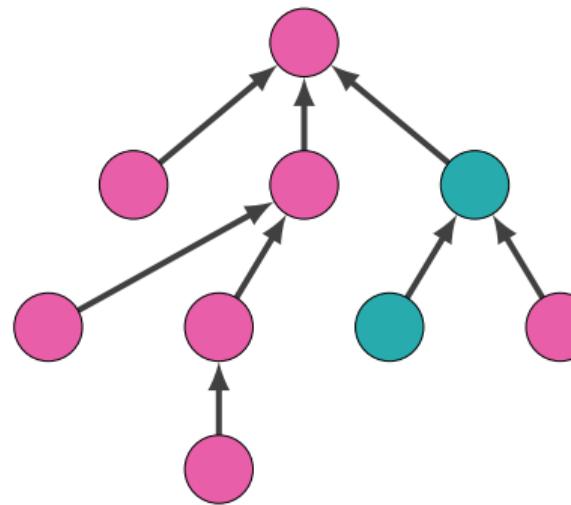
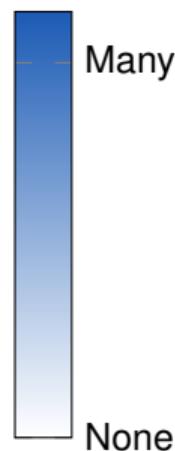
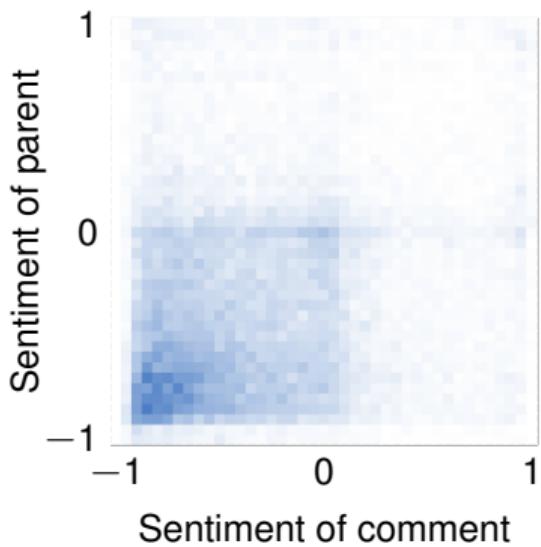
	Users	Comments	Submissions
Total	28559	645280	10362
Lockdowns	9987	94494	1009
Masks	6824	48500	437
Vaccination	5552	41700	590

SENTIMENT INTERACTIONS: VACCINATION



- Homophily!
- Replies have similar levels as parent

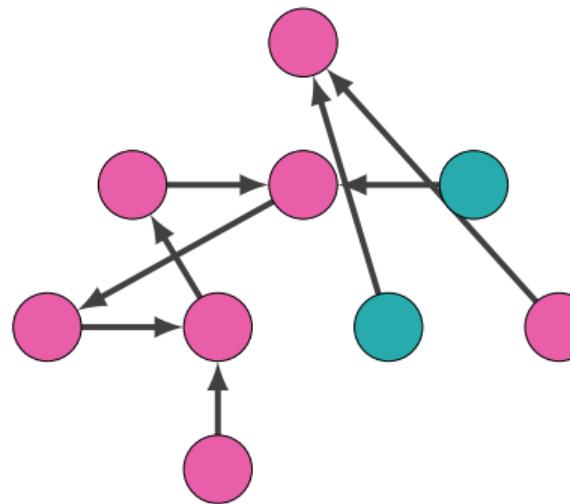
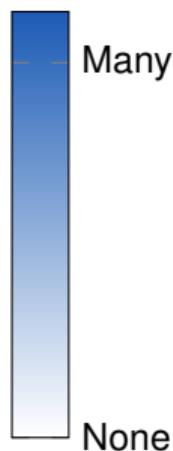
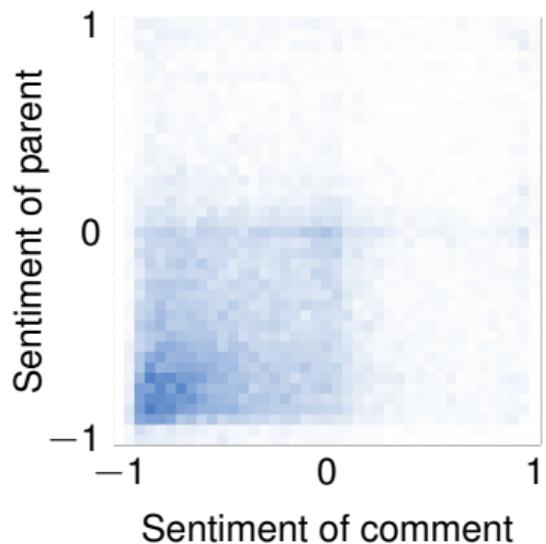
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■ Expected if everyone is negative

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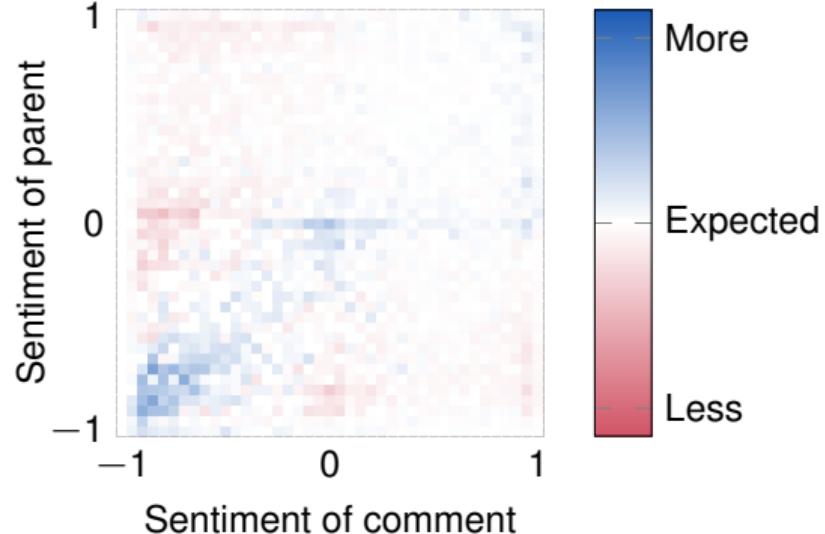
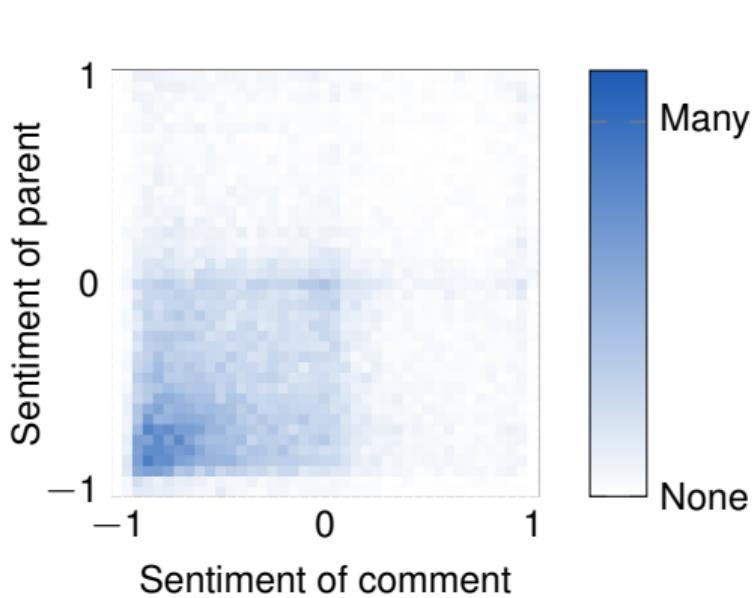
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- Compare to random realisation

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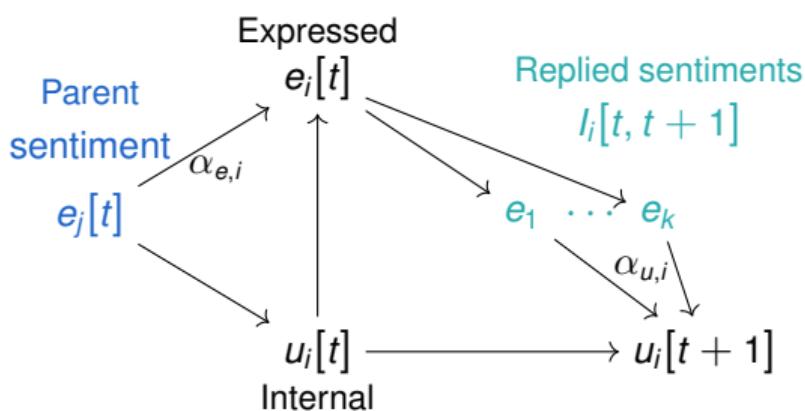
- Expected if everyone is negative
- Compare to random realisation
- Homophily confirmed

SIEBC MODEL

- Smooth
- Internal-Expressed
- Bounded Confidence

$$e_i[t] \sim B_{\alpha_{e,i}, \epsilon_i}(u_i[t-1], e_j[t])$$

$$u_i[t] \sim \bigotimes_{e_k \in I_i[t-1]} B_{\alpha_{u,i}, \epsilon_i}(u_i[t-1], e_k)$$

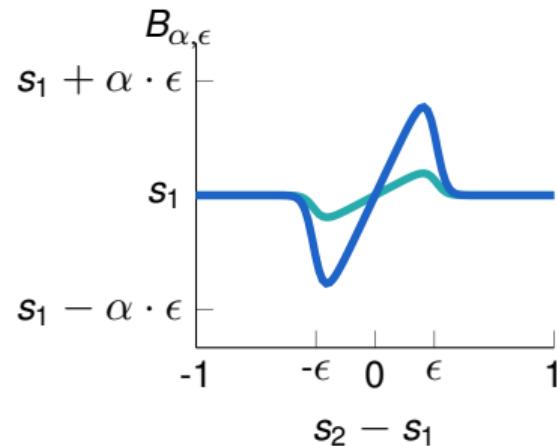
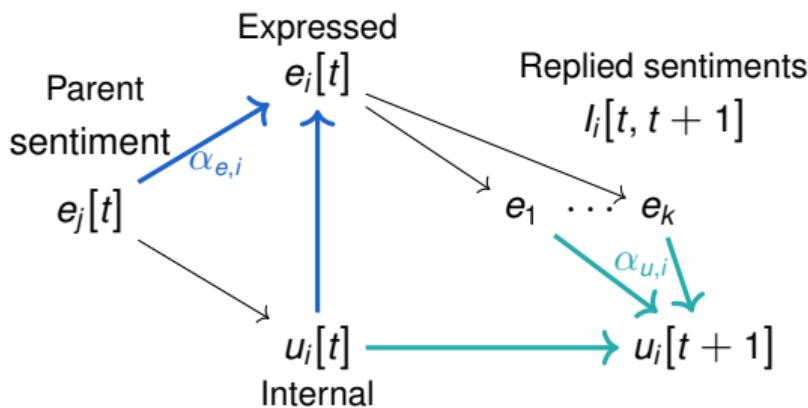


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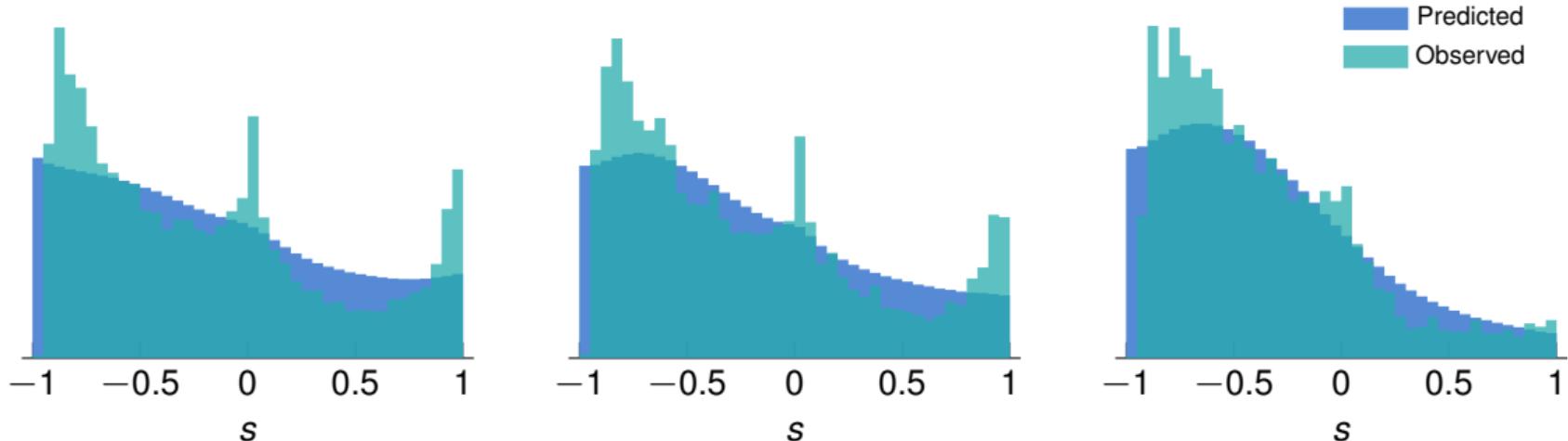
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RECONSTRUCTION OF SENTIMENT DISTRIBUTIONS



- Lockdowns
- Okay attempt at predicting difficult distributions
- Homophily present in predicted sentiments as well
- Masks
- Vaccination

EXPRESSED SENTIMENT UPDATE IS STRONGEST

