

# Echo Chamber In Effect: An Opinion Formation Simulation



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## Background

Opinion formation is the study of how individuals, and in general the public, process interactions and informations to form their opinion. Such topic is especially interesting in the age of misinformation and political polarization. Previous models in this topic have taken either an individual-based approach (cellular automata) or a group-based approach (mean field). For the sake of simplicity, I used the group-based approach in this simulation.

## Research questions

How does one's opinion change in reaction to exogenous (breaking news & events) and endogenous factors (conflicts with others)? And how does the surrounding community influence such process?

## Approach

$O_i$   $[-1,1]$  represents one's opinion level. Interactions will not destroy the two extreme boundaries.

$C_i$   $[0,1/2]$  represents one's compromise level, i.e how much their opinion will change after interacting with others. Compromise level will be smaller if their starting opinion is more extreme, and vice versa.

$$C_i = 1 - \sqrt{|O_i|}$$

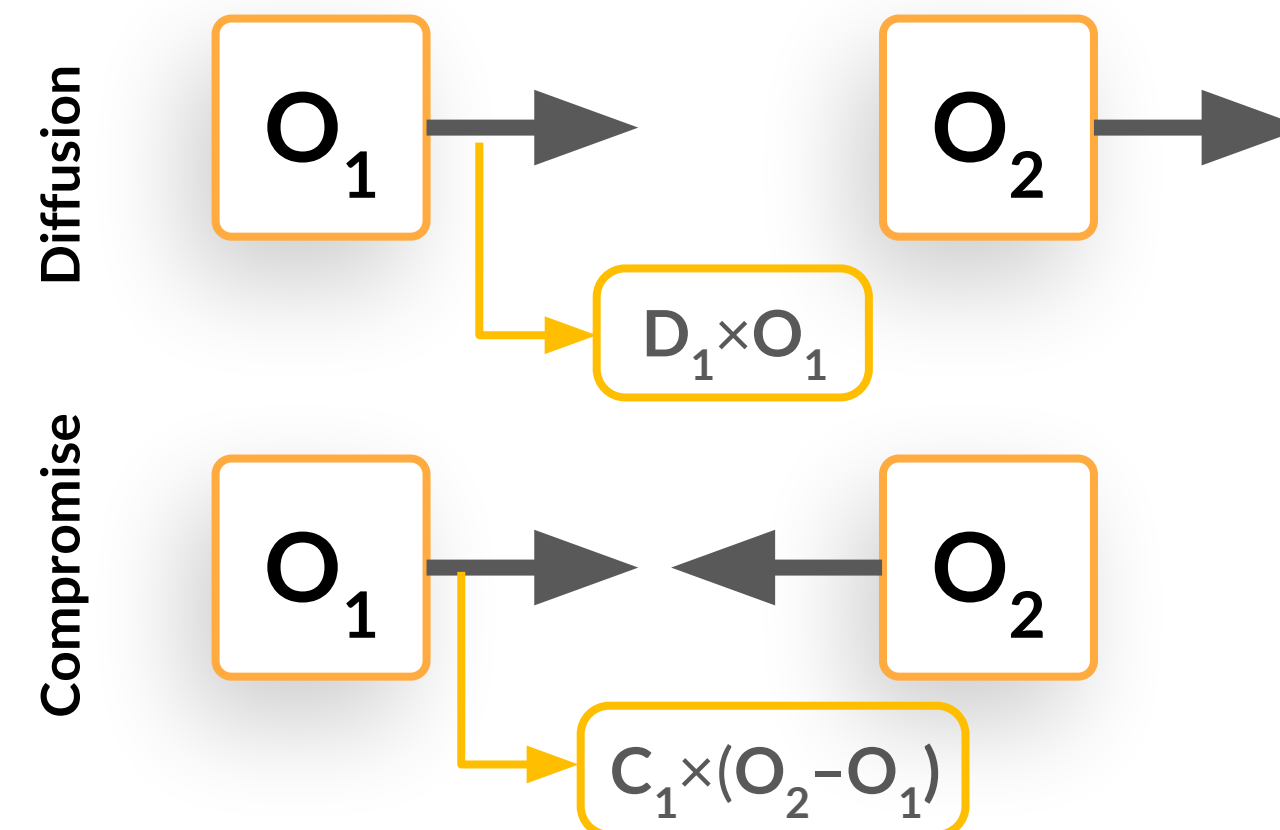
$D_i$   $[0,2]$  represents one's diffusion level, i.e how much their opinion will change after hearing a positive or negative news. Diffusion level will be smaller if the news is opposite sign to their opinion, and vice versa.

$$D_i = 1 + O_i \quad (O_i \times N \geq 0)$$

$$D_i = 1 - O_i \quad (O_i \times N < 0)$$

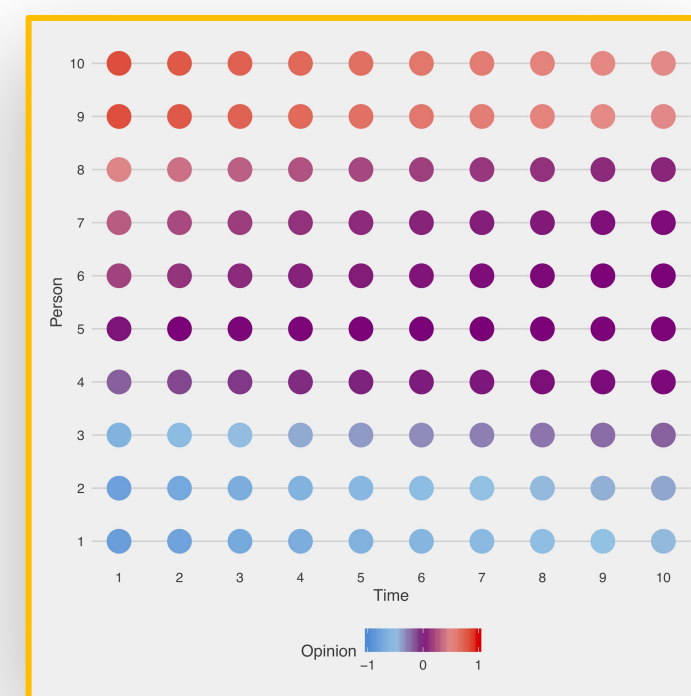
$N$ , represents a news event. The value of  $N$  denote how much the opinion of a neutral person ( $O_i=0$ ) will change after hearing it.

## Simplified model

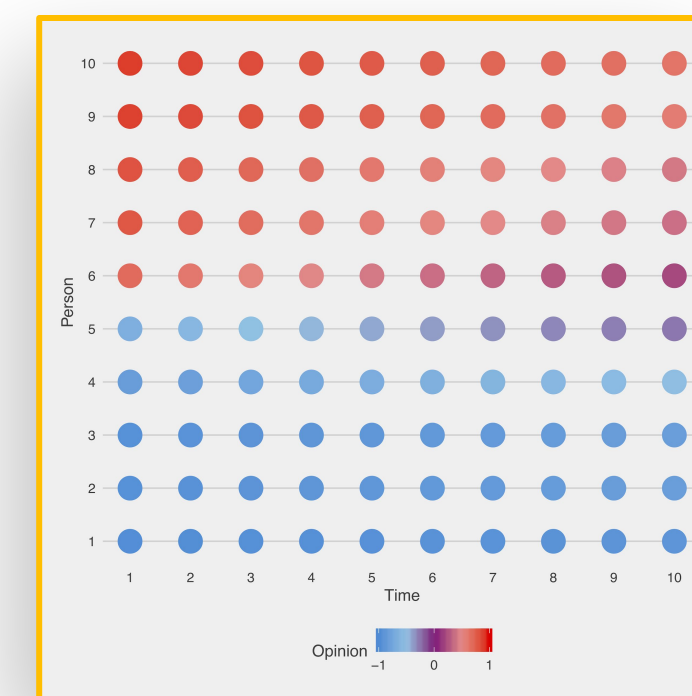


## Results

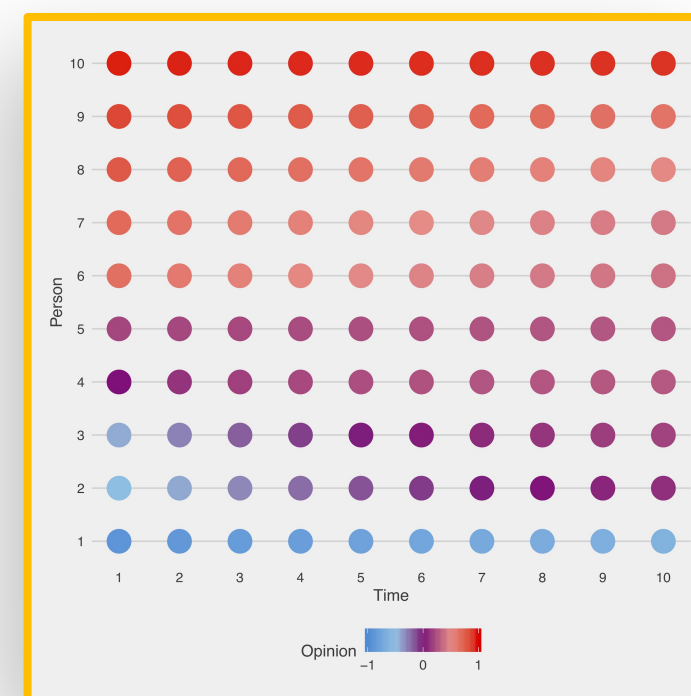
### Compromise



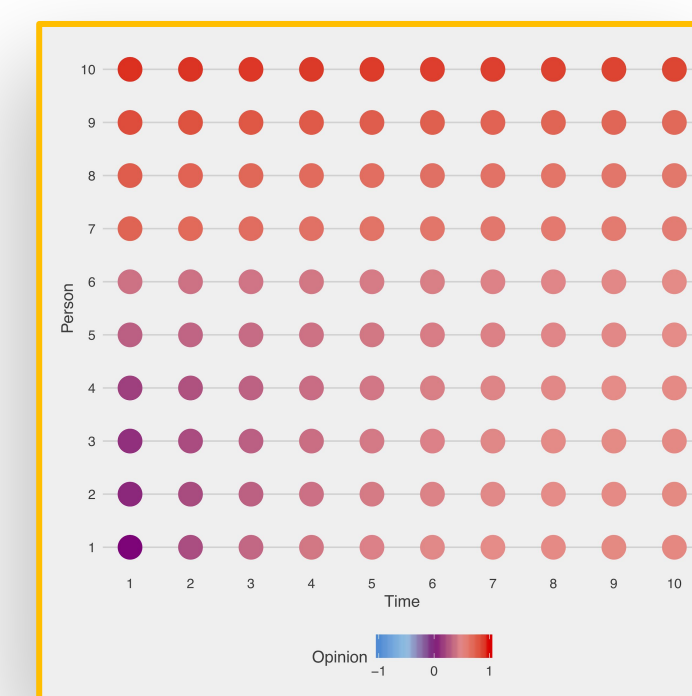
Mixed population



Mixed, polarized population

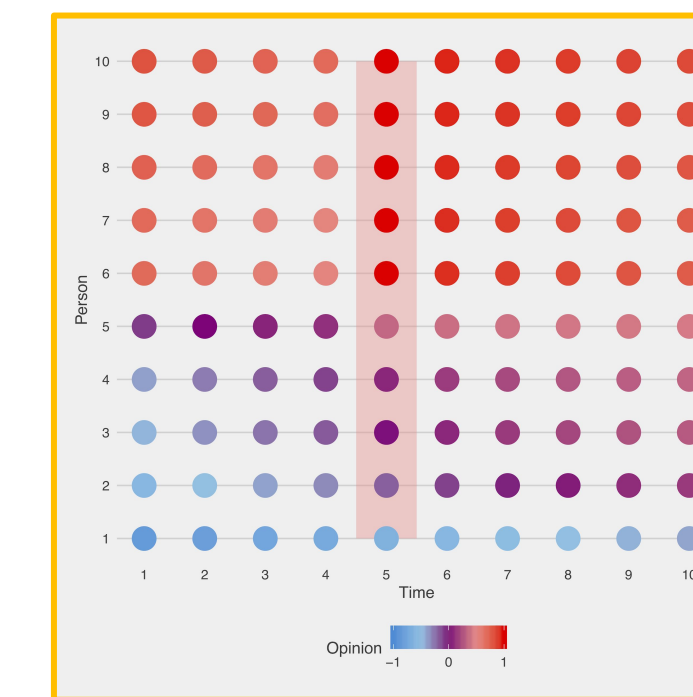


Majority-minority population

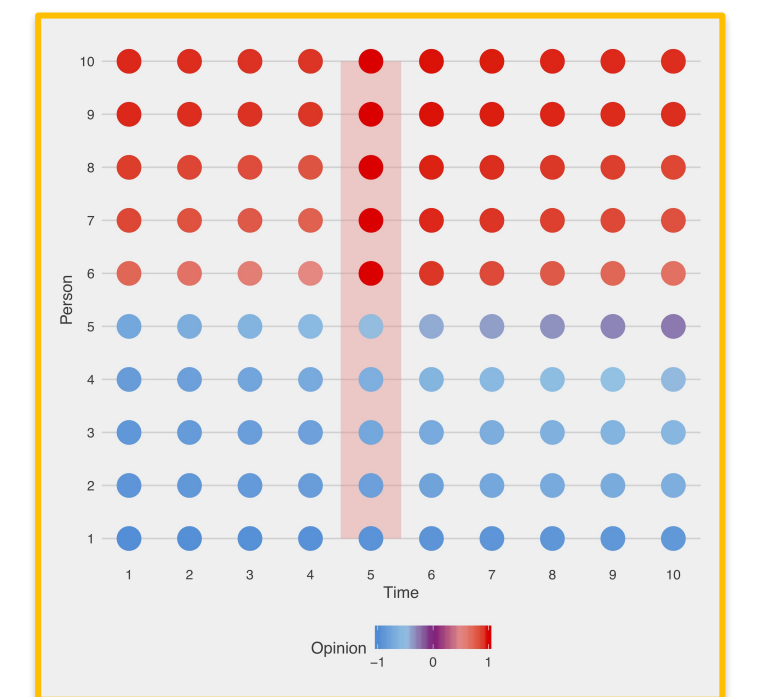


Homogeneous population

## Diffusion (n=0.3)



Mixed population



Mixed, polarized population

## Conclusion

The simulation demonstrates the echo chamber through process of compromising: being surrounded by people who have the same opinion as ours will further strengthen our opinion compared to being surrounded by a people with mixed opinions.

People with strong & extreme opinions will therefore influence the opinion of their group as they are less likely to change their opinion after interactions with others.

In addition, news events with a negative/positive connotation are less influential in a highly polarized population as it further strengthen the corroborated opinions and are less likely to affect contradicted opinions.

## References

- [1] Toscani, Giuseppe. "Kinetic models of opinion formation." *Communications in mathematical sciences* 4.3 (2006): 481-496.
- [2] Evans, Tucker, and Feng Fu. "Opinion formation on dynamic networks: identifying conditions for the emergence of partisan echo chambers." *Royal Society open science* 5.10 (2018): 181122.

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