The Life and Death of Social Networks: A network formation model for opinion dynamics

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One of the most robust effects governing social life is homophily and triadic closure. We like people similar to ourselves, and we find new connections through our existing connections. These two effects can combine to self-reinforcing processes of shaping both social networks of social agents as well as their opinions. Here I investigate a stylized agent-based model of opinion dynamics. I find that the model can generate realistic social networks while simultaneously producing realistic opinion distributions.

opinion dynamics | computational social science | agent-based modeling

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Your introduction goes here!Please start your introduction without including the word "Introduction" as a section heading (except for math articles in the Physical Sciences section); this heading is implied in the first paragraphs.

Sections: Theory, Methods, Results, Discussion...

1. Theory

One of the most robuts mechanisms governing social networks is the tendency of similarity to breed connection. This effect is often characterized as homophily. The effect of homophily results in neighbourhoods within social networks, which are homogeneous with regard to sociodemographic, behavioral and political characteristics. This has dramatic implications as one's social world defines what pieces of information, opinions and interactions that an individual have. The most clear example is echo chambers in social media networks. In echo chambers, homophily can lead to a distortion of what kind of information is presented to each individual.

It is examples like those from echo chambers that clearly illustrates that the principles of homophily not only influences who we make connections with, but also how we think. Several studies have pointed to the fact that one's peer group is an important influence on one's behavior. For instance, shared political beliefs predict more behavioral involvement with one another.

Homophily and its effects become especially potent as they can create self-reinforcing mechanisms when combined with tie-formation principles such as triadic closure. Triadic closure refers to tie formation between "friends of friends" in a network. For instance, if $A \leftrightarrow B$ and $B \leftrightarrow C$, then this small system would achieve triadic closure by forming the edge $C \leftrightarrow A$. When new ties are found via triadic closure,

To see why homophily and triadic closure can create self-reinforcing homophily effects, notice the following. Due to homophily, the probability of A being similar to B will be higher than When they find new connections via triadic closure i.e. "friends of friends", In such cases, any social agent will have a protensity to like agents which are more similar to themselves. Moreover, they find new connections primarily by finding them via "friends of their friends".

Homophily and its effects become especially potent when social agents can be influenced by their peers. This social influence can potentially explain how

A. Network Formation.

A.1. Social Networks. Here the presentation of the important characteristics of social networks should be included and why they come about. These include the high transitivity, clustering, communities, and exponential degree distributions.

A.2. Candidate Models. A special focus on the Herding Friends (animal model) as well as the how random are random friends. Other papers could also be good here.

A.3. The problems with current models. Calibration with data and how to test models. Models with fixed networks won't cut it.

B. Social Influence. Including some of the basic literature (Axelrod)

B.1. Shaping opinions. Introduce the evidence from psychology and computational literature to show why the assumptions in the model make sense

B.2. Models of Social Influence. Report the evolution of models and where to place this model in all of the literature

C. A network formation model for social influence. Explain the importance of making both a network formation and opinion dynamics model in one go

Significance Statement

Authors must submit a 120-word maximum statement about the significance of their research paper written at a level understandable to an undergraduate educated scientist outside their field of speciality. The primary goal of the Significance Statement is to explain the relevance of the work in broad context to a broad readership. The Significance Statement appears in the paper itself and is required for all research papers.

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2. Methods

A. Model specification. Explain the different parameters of the model

B. Model fitting. explain how the model was calibrated (Bayesian Hyperparameter Optimization)

3. Model investigation

Get familiar with the different parameters and their interpretations

A. The effect of randomness. How randomness affects the distribution of opinions, as well as the network

B. The effect of the boundary threshold. How the boundary threshold affects the distribution of opinions, as well as the network

C. The effect of homophily. How homophily affects the distribution of opinions, as well as the network

D. Important interactions. Point to some of the important interactions (possible Golden zones)

4. Results

A. Network generation.

B. Opinion generation.

5. Discussion

6. Conclusion

Use section and subsection commands to organize your document. LaTeX handles all the formatting and numbering automatically.

7. Figures and Tables

Figures and Tables should be labeled and referenced in the standard way using the `\label{}` and `\ref{}` commands.

Figure **??** shows an example of how to insert a column-wide figure. To insert a figure wider than one column, please use the `\begin{figure*}...\end{figure*}` environment. Figures wider than one column should be sized to 11.4 cm or 17.8 cm wide. Use `\begin{SCfigure*}...\end{SCfigure*}` for a wide figure with side captions.

Tables. In addition to including your tables within this manuscript file, PNAS requires that each table be uploaded to the submission separately as a "Table" file. Please ensure that each table .tex file contains a preamble, the `\begin{document}` command, and the `\end{document}` command. This is necessary so that the submission system can convert each file to PDF.

Equations. Authors may use 1- or 2-column equations in their article, according to their preference.

To allow an equation to span both columns, use the `\begin{figure*}...\end{figure*}` environment mentioned above for figures. Using only `\begin{figure*}...\end{figure*}` keeps the equation in a two collum format

Table 1. Character Level Combat Outcomes

	Dependent variable:		
	Combat Amount	Combat Variability	Combat Skill
	(1)	(2)	(3)
Man - Male	0.042^{***}	5.659^{***}	0.031^{***}
	(0.002)	(0.056)	(0.0004)
Woman - Female	-0.026^{***}	1.529^{***}	0.011^{***}
	(0.005)	(0.143)	(0.001)
Woman - Male	0.010	0.375	0.005^{*}
	(0.009)	(0.272)	(0.002)
Player Age	-0.077^{***}		-0.003^{***}
	(0.001)		(0.0002)
Mil. Label	0.135^{***}		0.060^{***}
	(0.002)		(0.0004)
Constant		-97.425^{***}	
		(0.046)	
Char. Order FEs	Y	N	Y
Create Date FEs	Y	N	Y
Observations	576,430	576,430	576,430
R^2	0.028	0.018	0.089

*

p<0.05, ** p<0.01, *** p<0.001

This table reports coefficients and standards errors from ordinary least squares regressions. In all models we can reject the null that *Woman - Female* and *Woman - Male* are equivalent with $p < .01$. In models 2 and 3 we can reject the null that the gender gaps within sex are equivalent ((*Woman - Male*) - (*Woman - Female*) = *Man - Male*) with $p < .001$.

$$\begin{aligned}(x+y)^3 &= (x+y)(x+y)^2 \\ &= (x+y)(x^2+2xy+y^2) \\ &= x^3+3x^2y+3xy^3+x^3.\end{aligned} \quad [1]$$

References

References should be cited in alphabethical order; this will be done automatically via bibtex, e.g. **?**, and **?**. All references should be included in the main manuscript file.

ACKNOWLEDGMENTS. Please include your acknowledgments here, set in a single paragraph. Please do not include any acknowledgments in the Supporting Information, or anywhere else in the manuscript.