

# Weekly Report\*

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## Summary for the past week

First, I would like to express my sincere apology for being distracted from research due to personal circumstances. The past two weeks were extremely hard for me. However, I have managed to come back to the normal work pattern this week. This week I have managed to implement the Networks of Beliefs (NB) model in full detail and start to test some of the typical collective behaviours mentioned in the paper.

As what was previously discussed, I implemented the NB framework in Python without using the Mesa package, but using several classes. The system was set up by three classes: node level (for belief's types and values), individual level (for internal belief networks), and system level (for external social network). Each individual has an internal belief network which is composed of: (1) multiple individual belief nodes (with beliefs taking values from -1, -0.66, -0.33, 0, 0.33, 0.66, 1) that are connected with each other and a focal belief node; (2) a focal belief node (with belief taking value from -1, -0.66, -0.33, 0, 0.33, 0.66, 1) which is connected to all individual belief nodes and multiple social belief nodes; (3) multiple social belief nodes (with beliefs taking values from -1, -0.66, -0.33, 0, 0.33, 0.66, 1) represented the perceptions of focal beliefs of connected individuals in the external social networks. Individuals are connected in the external social network by: (1) one's focal belief node being directly connected (outwards) to social belief nodes of connected individuals; (2) one's multiple social belief nodes being directly connected (inwards) with focal belief nodes of connected individuals. Existing network models and their parameters are used to control the structures of the individual belief networks and external social network.

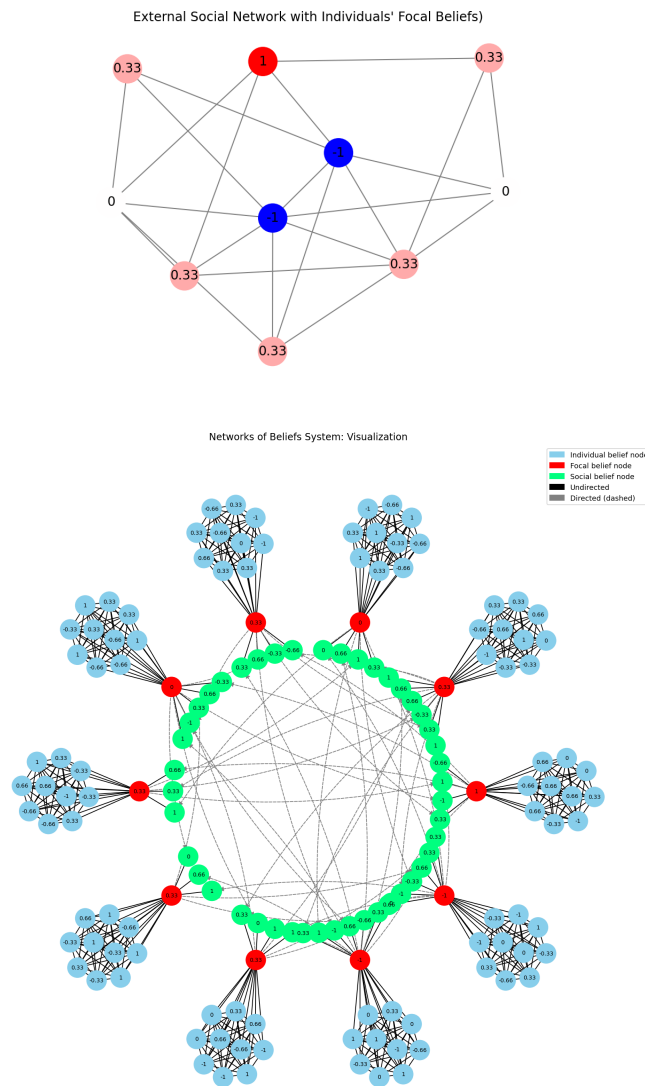
We focus on the focal beliefs changes of individuals in the system. The updating dynamics of one's focal belief is determined in an Ising-like way, by one's potential dissonances, attentions to potential dissonances, and felt dissonances. The distributions of focal beliefs of individuals in the system are measured for exploring patterns of collective behaviours. We run simulations based on the following facts: edge weights 0.4 for all interactions between personal beliefs (including the focal belief); edge weights 1.0 for all interactions between the focal belief and social beliefs; edge weights 1.4 for all (direct) interactions between one's social beliefs and other's focal beliefs; all attention parameters set to be 1.0; exogenous field strength set to be 0 (but to be tested at different levels). The internal belief networks (personal beliefs including the focal beliefs) are set to be fully-connected, while the external social network is tested with different network models (fully-connected based on the paper, but flexible in our context). We run each simulation of 100 iterations.

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\*This is a summary of the work was done in the past week.

Based on the results we currently have, consensus and polarization can be achieved in some cases, but not robust. Group radicalisation and minority influences have not been tested, but have been prepared to test. There are also a few more ideas that are planned to be tested. (see plan for the next week)



### Plan for the next week

- Look into the robustness issues of consensus and polarisation, see if there is any implementation mistakes.
- Test group radicalisation and minority influences.
- For minority influences, test the influences of degree, connectivity, and centrality of the minority node(s).
- Test the influences of heterogeneity of model parameters.
- For the CDC budget cut context, test the influences of exogenous field strength on different collective behaviours.