

Weekly Report (8.30-9.5)*

Yanpei Cai[†]

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Summary for the past week

For the past week, I spent most of my time replicating the Networks of Beliefs (NB) framework in Python, while I also spent some time exploring possible extensions and modifications.

Recap

The NB theory integrates the individual's belief network and external social network to form a general framework of the individual's belief change. In this framework, the individual's belief network is composed of internal personal beliefs and social beliefs (perceived beliefs of other connected individuals), while the external social network characterises the relation between one's social belief and the other's actual belief in a directed way. The two networks, internal and external, are connected through individuals' social beliefs, which are, in turn, influenced by both their own personal beliefs and the actual beliefs of the others in their social circle.

The NB theory further assumes that:

- Individuals aim to reduce (potential) dissonance of different sources (personal, social, and external);
- Only felt dissonance influences an individual's belief change, and the extent to which potential dissonance translates into felt dissonance is determined by the amount of attention one pays to different potential dissonance.

The NB theory is implemented by adopting a computational Ising-like spin model within the statistical physics framework. Under the statistical physics framework, beliefs are considered as spins that take various values, potential dissonance (personal, social, and external) is represented as energy, and attention to different potential dissonance is seen as multiple inverse temperature parameters. Felt dissonance (personal and social) is characterised as a linear combination of different potential dissonances and their corresponding inverse temperature parameters. Moreover, exogenous influences are characterised as a parameter to individuals' beliefs, just as the external field effects to the Ising spins. Overall, the model provides a parsimonious and well-suited way to explain the interplay between individuals' beliefs and their external social environments.

[†] Artificial Intelligence and its Applications Institute, School of Informatics, The University of Edinburgh
Email Address: yanpei.cai@ed.ac.uk

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

Implementation in Python

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. (p.s. I made some mistakes with the implementations of updating dynamics and so am not able to show some results from simulations during this meeting.)

Plan for the next week

- I will fix the mistakes with the implementations of updating dynamics during this weekend, run some simulations, and send some results early next week.
- I plan to start accommodating the CDC budget cut contexts with the NB framework.
- More to add...