The Bubble Machine: An agent-based modelling tool to analyse the interplay between cognitive preferences, social network interactions and algorithmic curation

Author(s)
Fuckner, Marcio; Bašić, Suzana; Wiggers, Pascal; Westplat, Yuri; van Kersbergen, Rick; Firouzifard, Iman

Publication date
2022

Document Version
Final published version

The Bubble Machine: An agent-based modelling tool to analyse the interplay between cognitive preferences, social network interactions and algorithmic curation*

Marcio Fuckner[1], Suzana Bašić[1], Pascal Wiggers[1], Yuri Westplat[1], Rick van Kersbergen[1], and Iman Firouzifard[1]

Amsterdam University of Applied Sciences
https://www.amsterdamuas.com/
{marcio.fuckner,s.basic,p.wiggers,y.westplat, r.van.kersbergen, i.firouzifard}@hva.nl

1 Extended Abstract

Social networks and news outlets use recommender systems to distribute information and suggest news to their users. These algorithms are an attractive solution to deal with the massive amount of content on the web [6]. However, some organisations prioritise retention and maximisation of the number of access, which can be incompatible with values like the diversity of content and transparency.

In recent years critics have warned of the dangers of algorithmic curation. The term filter bubbles, coined by the internet activist Eli Pariser [1], describes the outcome of pre-selected personalisation, where users are trapped in a bubble of similar contents. Pariser warns that it is not the user but the algorithm that curates and selects interesting topics to watch or read. Still, there is disagreement about the consequences for individuals and society. Research on the existence of filter bubbles is inconclusive. Fletcher in [5], claims that the term filter bubbles is an oversimplification of a much more complex system involving cognitive processes and social and technological interactions. And most of the empirical studies indicate that algorithmic recommendations have not locked large segments of the audience into bubbles [3] [6].

We built an agent-based simulation tool to study the dynamic and complex interplay between individual choices and social and technological interaction. The model includes different recommendation algorithms and a range of cognitive filters that can simulate different social network dynamics. The cognitive filters are based on the triple-filter bubble model [2]. The tool can be used to understand under which circumstances algorithmic filtering and social network dynamics affect users' innate opinions and which interventions on recommender systems can mitigate adverse side effects like the presence of filter bubbles.

* Supported by SIDNfonds (www.sidnfonds.nl)

The resulting tool is an open-source interactive web interface, allowing the simulation with different parameters such as users' characteristics, social networks and recommender system settings (see Fig. 1). The ABM model, implemented in Python Mesa [4], allows users to visualise, compare and analyse the consequence of combining various factors. Experiment results are similar to the ones published in the Triple Filter Bubble paper [2]. The novelty is the option to use a real collaborative-filter recommendation system, and a new metric to measure the distance between the innate and final opinions of users. We observed that slight modifications in the recommendation system, exposing items within the boundaries of users' latitude of acceptance, could increase content diversity.

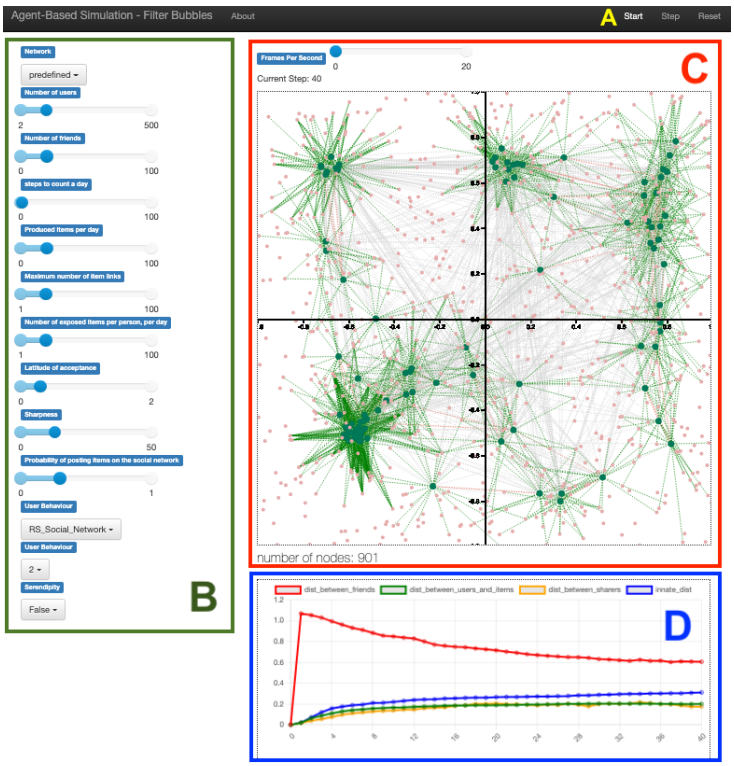

Fig. 1. An example of a running experiment: a) The top panel allows users to start, running steps and reset the experiment b) The left-hand side panel contains the simulation parameters, such as the number of users, number of friends, cognitive preferences, social network behaviour and the usage of recommender systems c) The central panel shows users, their connections with other users and news items. They are positioned in a two-dimensional attitude space. Each dimension could represent a polarised subject (e.g. left and right-wing political positions, pro and against vaccines) with values ranging from -1 to 1. d) The bottom panel shows real-time metrics, including the average distance between friends, sharers, news items, and innate distance

References

1. Pariser, E.: The filter bubble: What the internet is hiding from you. Penguin, New York, NY (2011)
2. Geschke, D., Lorenz, J., Holtz, P.: The triple-filter bubble: Using agent-based modelling to test a meta-theoretical framework for the emergence of filter bubbles and echo chambers. British Journal of Social Psychology (2019), 58, 129–149
3. Möller, J., Trilling, D., Helberger, N. , and van Es, B.: Do Not Blame It on the Algorithm: An Empirical Assessment of Multiple Recommender Systems and Their Impact on Content Diversity. Information, Communication and Society 21, no. 7 (2018): 959–77
4. Mesa: Agent-based modeling in Python, https://mesa.readthedocs.io/. Last accessed 2 Sep 2022
5. Fletcher, R.: The truth behind filter bubbles: Bursting some myths. Digital News Report - Reuters Institute (2020). https://reutersinstitute.politics.ox.ac.uk/news/truth-behind-filter-bubbles-bursting-some-myths. Last accessed 2 Sep 2022
6. Haim, M., Graefe, A, Brosius, H: Burst of the Filter Bubble?: Effects of Personalization on the Diversity of Google News. Digital Journalism 6, no. 3 (2018): 330–43