

An Agent-Based Model of Political Polarization Without Party Influence or Centralized Messaging

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Extended Abstract

Political polarization – reflected in echo chambers, entrenched views, and the vilification of those with differing opinions – can be harmful to a democratic society, even as experts differ on its definition and on the extent to which it exists in Western nations[2, 4, 10, 12, 14]. Polarization can inhibit the reaching of consensus and compromise upon which a democracy is built. It affects not only political actors, but also the interpersonal relationships among the rank and file citizens of a country which bolster and strengthen society[5, 10].

One particularly intriguing aspect of the polarization phenomenon is the degree to which members of society form “opinion clusters”: sets of opinions on seemingly unrelated issues that nevertheless correlate strongly with each other. In the U.S., for example, consider how likely someone who identifies as “pro-choice” is to also be in favor of raising the national minimum wage, or restricting gun ownership, or imposing a carbon tax. These links between opinions are correlatively strong, despite the fact that the issues have little to do with each other.[1, 8]

We coin the term **issue entanglement** to refer to the tendency of individuals who agree on one issue to also agree on other, unrelated issues. Two possible explanations for the presence of issue entanglement are ideological coherence – namely, the theory that these seemingly unrelated issue positions do in fact stem from some consistent worldview – and media influence: a small number of outlets broadcast sets of opinions, and information consumers who are influenced primarily by one outlet will naturally adopt most of its broadcast opinions.

In this work, however, we present an agent-based model, inspired by the opinion dynamics literature[3, 6] which soundly demonstrates that neither of these two proposed causes are necessary to produce widespread issue entanglement throughout a society. All that is required is (1) a body of agents, each of whom holds continuous-valued opinions on several unrelated issues, and who interact pairwise on an arbitrary social network, and (2) a straightforward extension of the well-known homophily effect from social psychology[11].

The key dynamic of the model is termed **cross-issue influence** (or “**CI2**”). It somewhat resembles the mechanism of “bounded confidence” models such as [7] and [13] in which agents whose opinions on an issue are already close to one another will update those opinions to be even more like-minded. The CI2 mechanic, however, operates *across* issues. If agent A encounters agent B, and discovers that B is similar to A on one issue, A will adjust its opinion on a *different* issue to be more like B. This is homophily, but of a different sort: if I discover that you and I think alike on the issue of immigration, I’m more likely to view you as generally trustworthy, and thus be convinced by your view on vaccines.

We implemented the model in Python, using the Mesa agent-based modeling framework[9]. Figure 1 demonstrates a typical output of the simulation, depicting all pairs of agents over time. Each line represents the number of pairs of agents who have k opinions (out of ten) in common, with darker lines indicating more shared opinions. By the end of the simulation, the two agents in every possible pair either agree on everything or agree on nothing. All ten issues have become completely entangled, and the society is completely polarized.

This is true even in the absence of any centrally-controlling mechanism, and even though the abstract issues in the model are completely decoupled. The simulation nearly always produces

two groups (or “**clusters**”) of cookie-cutter agents: every agent agrees on every issue with all other agents in its cluster, and disagrees on every issue with all agents in the other cluster.

The model suggests that rigidly-polarized issue entanglement may be an inevitable consequence of a free society, even when no invested actors are actively encouraging it. We discuss the profound implications of this result, the limitations of the model, and the ways in which entrenched issue entanglement might be mitigated without compromising the free interchange of ideas.

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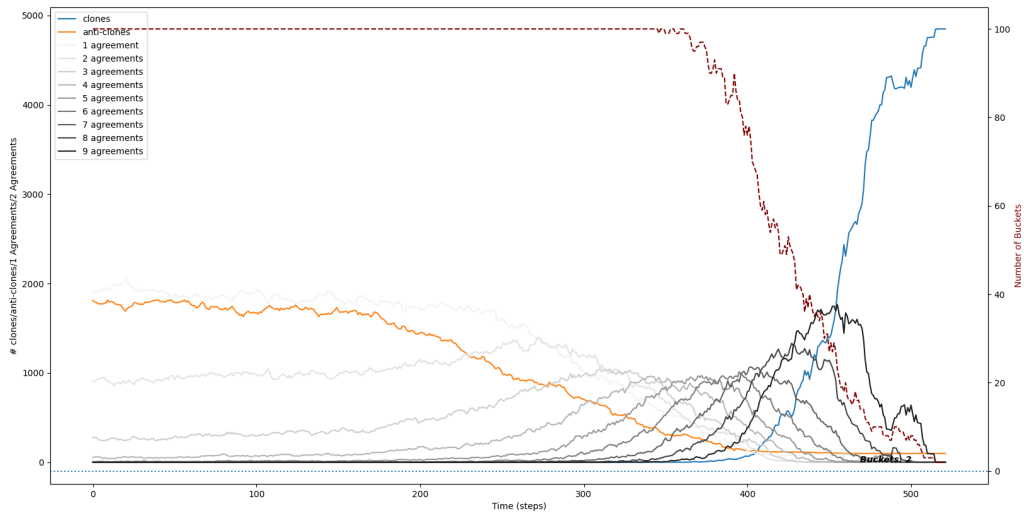


Figure 1: A census of agent pairs who agree on a given number of issues (out of ten total), as the simulation proceeds. The dashed line depicts the number of “clusters”; i.e., the number of distinct opinion profiles among the model’s agents. At the simulation’s start, no two agents are alike, so every agent is in its own cluster. By the time the CI2 process has swept through society, there are only two clusters left. All ten issues have become completely entangled, and the society has become completely polarized. To further illustrate the phenomenon, the figure also shows the number of “clones” (pairs of agents who agree on all issues) and “anti-clones” (pairs of agents who *disagree* on all issues.)