

Cultural Polarization and the Role of Extremist Agents: A Simple Simulation Model

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Abstract. Cultural dynamics can be heavily influenced by extremists. To better understand this influence, temporal dynamics of an arbitrary cultural belief are simulated in a simple computational model. Extremist agents, holding an immutable and extreme belief, are used to examine the process of polarization – adoption of the extremist belief by the entire population. Two possible methods of counteracting polarization are examined, removal of the extremist agent and introducing a counter-extremist which holds an immutable belief at the opposite extreme. Eliminating the extremist agent is only effective at the onset of cultural transition, while introducing a counter-extremist is effective at any time and will lead to a dynamic intermediate belief. Finally, a parameter governing the society's willingness to adopt new beliefs is varied. As it decreases, extremist agents are unable to polarize a society. Instead the population breaks permanently into two or more belief groups. The study closes with a possible pathway for extremists to nevertheless polarize a society not open to new beliefs.

Keywords: extremism, cultural transitions, consensus, networks, social simulation.

1 Introduction

Though conflict is an inextricable component of social organisms, humans are unique in that culture plays a central role in many conflicts [1]. To address conflict and to better understand social dilemmas more generally it is important to understand the dynamics of cultural beliefs and how those dynamics may be influenced. Previous studies have examined social diffusion of ideas [2], norms [3], innovations [4], social values [5], and diseases [6]. Others have focused on how the topology of the network governing a society influences the rate, dynamics, and efficacy of diffusion [7-11].

This study is largely a continuation of work presented in [11], which addresses cultural consensus and sources of perpetuated conflict. In the current paper, the effects of extremist agents are examined. Given a continuum of values representing an arbitrary cultural belief or norm, extremist agents hold a belief at one endpoint of the continuum and the belief cannot be changed. Because extremist agents may be sources of incitation to violence or other socially disruptive behavior it is important to

understand how they affect cultural dynamics and how they might respond to counter measures.

This study uses very simple and highly abstract social simulations to better understand how extremist agents affect the timing and ability of a population to become polarized. It further tests and contrasts two intuitive methods of preventing polarization: removing extremist agents from a population and introducing a counter-extremist.

2 Simulation Description

The base-case simulation initiates by embedding N agents in one of four social network structures. Each agent holds a single arbitrary belief that is assigned an initial random value, with uniform probability, on $[0, 1]$. The model then proceeds through a number of pairwise interactions until the population either converges to a single, universal belief or the simulation reaches the maximum allowable number of interactions.

During a single interaction, a member of the population is selected at random and paired randomly with one its immediate neighbors as defined by the network type. Let a_0 and b_0 represent the initial belief values of two interacting agents so that the initial difference between their beliefs is

$$T = |a_0 - b_0| \quad (1)$$

The interacting agents influence each other's beliefs so that they are updated to a_1 and b_1 respectively. In this study, the new values are equal to each other and to the mean of their original beliefs

$$a_1 = b_1 = (a_0 + b_0) / 2 \quad (2)$$

Given enough interactions, the population will converge to a single belief equal to the mean value of the initial population [11, 12].

A population level parameter D , determines whether the beliefs of two interacting agents are sufficiently similar for the agents to influence each other. This threshold represents the willingness of agents to adjust their beliefs towards others. One might also consider this parameter the degree to which a society is "open-minded" or dogmatic. During a pairwise interaction, the difference between agent beliefs T is compared to the threshold D . If the difference is too great, the interaction ends without any changes in beliefs

$$\begin{aligned} T \leq D: a_1 &= b_1 = (a_0 + b_0) / 2 \\ T > D: a_1 &= a_0 \text{ and } b_1 = b_0 \end{aligned} \quad (3)$$

In the first series of simulations, $D = 1$ so that all agents change their beliefs when interacting with an agent that holds a different belief. In later treatments D is varied to understand how and when polarization is affected by a population's willingness to adopt new beliefs.