Homophily and Common Knowledge in a Threshold Model of Collective Action

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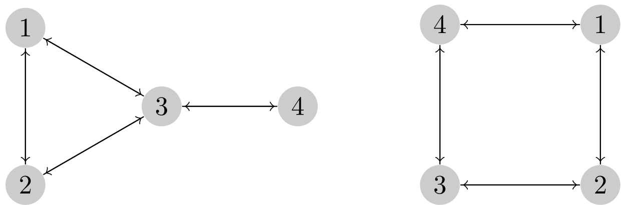
We consider a model in which agents decide to commit to participate a collective action such as a revolt based on their inference on the behavior of other members of the society. The model is based on the collective action framework developed in *Chwe, Michael (2000).* An agent's commitment to the action requires the inferred quantity of agents that will be committing to the action to be above the threshold of the agent. The inference mechanism, and the decision to commit or not, is instantaneous for all members of the society, thus the model is not a typical (dynamic) diffusion model widely covered in the literature (Centola and Macy (2007)). The key point of inference is the formation of the common knowledge between each given pair of agents regarding each other's action. Agents can only observe the threshold values of the others that they have communication links with. For agent i to infer that agent j will commit, i has to infer (through her links) that there are sufficient (that is above the threshold of agent j) number of agents linked with j that will be committing to the action. This multiplicity of inference, while introducing a computational complexity, differentiates the application of the model to rather interesting situations.



(a) Kite (b) Square

Figure 1:

For a simple illustration of the effects of communication structure on collective action, consider two societies with communication networks as in Figure 1 where thresholds of agents are identical and equal to 3. Our inference mechanism suggests that society structured as a *kite* will have agents $1, 2$ and 3 will commit to the collective action while agent 4 will not. The intuition is that agents 1,2 and 3 can form the common knowledge that if each of them commits others will have sufficient incentive to commit themselves, and vice versa. However, for agent 4, which can observe only agent 3, such inference is not possible, that is, 4 does not have enough information to guarantee that 3 will commit to the collective action, thus 4 herself will not commit. On the other hand in the society that is configured as a *square*, shown in figure 1b, the collective action will not emerge at all. Although each agent still observes two others (like the members of the triangle in the previous society), they know that their neighbors are not directly linked, thus the common knowledge will not form. Note that both societies have same number of communication links between agents.

Collective action models generally focus on the diffusion of participation decisions of agents given a jump start by a few agents with zero or very low thresholds. Chwe's model is more adequate for modeling the collective action problems in which diffusion is rather difficult as in the case of strikes or political protests against authoritarian regimes. In the cascading or diffusion models, agents have time to observe their neighbors while the agents who have already decided to participate do not bear any costs before the remaining agents join. In reality, once a few agents signal that they are strikers or rebels, firms or directors readily punish them In our model, the collective action decision is simultaneously taken by all agents in the society.

We argue that differentiating the underlying social networks from random to small world networks does not suffice to capture the "social" dimension of collective action problems. People are different than computer agents in simulations, they tend to associate with alikes. Homophily is fundamental in social networks. Communities form up as agents link up with similar agents. In the collective action (revolt) setting, the similarities of agents manifest themselves in terms of thresholds.

Society involve two or more communities. These communities differ in terms of their average threshold levels; say one community is more radical with a low level of average thresholds and the other is more conservative with a high level of average thresholds. Within the communities we allow a certain dispersion of individual thresholds.

Each community is also linked with the others through "weak", across community, links. A community can be more or less cohesive depending on the intensity of these "weak" links that individual actors keep intact. These weak links can be formed up in various contexts such as random meetings in parties or over internet forums.

Our main contributions cover the interactions of community structures and threshold distributions. We vary the degree of homophily as well as the threshold levels within and across the communities.

We partition a society with 100 agents into two equal groups. The degree of each agent is set to 10 and the threshold of first group is fixed at 3. We check the effects of two parameters on the percentage of agents that commit to the collective action. We change the in-between probability (probability of having a link within one's own group relative to an agent outside the group) of agents from 70 percent to 95 percent with 1 percent intervals. In-between probability is a proxy for the degree of homophily. We also change the threshold value of the second group from 3 to 7 with unit intervals. Above setting gave us 150 parameter combinations to test. For each parameter setting we generate 10 random homophily graphs and calculate the percentage of agents that commit to the collective action.

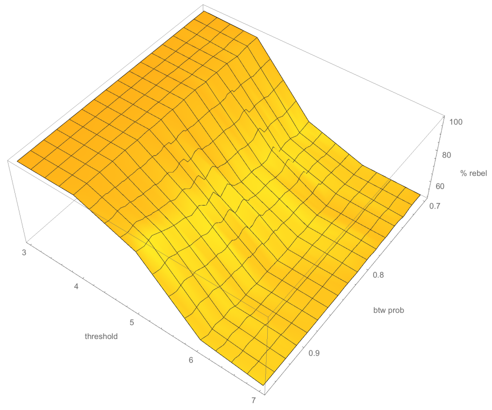


Figure 2: Homophily and Thresholds

Figure 2 illustrates the results of the simulation. We find that homophily enhances collective action. The degree of homophily has a non-linear effect in conjunction with varying threshold levels in one of the communities.

Bibliography

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