Conformists and Anti-Conformists in Opinion Formation and Diffusion

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Introduction

Central question in opinion dynamics:
Given a society of agents in a network, given a mechanism of influence for each agent, how the behavior/opinion of the agents will evolve with time, and in particular can it be expected that it converges to some stable situation, and in this case, which one?

Explored by:

- Sociologists and Psychologists: Granovetter (1978), Abelson (1964), French Jr (1956), DeGroot (1974), Friedkin and Johnsen (1990), Taylor (1968).
- Physicists: Galam (2002; 2012), see a survey in Castellano et al. (2009).
- Economists: see the monograph of Jackson (2008), and the survey by Acemoglu and Ozdaglar (2011)).
- Computer Scientists and Probabilists: Gravner and Grieath (1998) and the survey by Mossel and Tamuz (2017).

Introduction

Most of these studies suppose agents follow the trend (*conformist*).
"Cooperative" networks

Anti-conformity behavior

- Anti-coordination models (Bramoullé et al. 2004)
- Congestion games (Rosenthal 1973)
- Fashion games (Cao et al. 2013)
- Sociophysics: Galam (2004), Nyczka and Sznajd-Weron (2013),Nowak and Sznajd- Weron (2019), Juul and Porter (2019), Touboul (2014) "contrarians" "hipsters"
- Structurally balanced networks: Altafini (2012, 2013)
  "Coopetitive" networks

Anti-conformism in the threshold model of collective behavior

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Main Results

Complete Networks:

- The opinion dynamic converges to either absorbing states or cycles.
- Uniform distributed threshold
  - odd number of anti-conformists: absorbing states coinciding;
  - even number of anti-conformists: no absorbing states but cycles of length 2;
- Gaussian distributed threshold: no cycle but absorbing states;
- More general distributed threshold: the necessary and sufficient conditions are given such that no absorbing state exists but a cycle; an upper bound is provided for the length of the cycle.

Main Results

Random Sampling Networks:

- For a homogeneous network, 15 possible absorbing classes can occur in the case with two thresholds μ_a and μ_c, including polarization, cycles, fuzzy cycles, fuzzy polarization, chaotic polarization and even chaos.
- For arbitrary degree distributions, only chaos can occur under mild assumptions.

The process converges to chaos (every state is possible) in most cases.

Remarks

- The presence of anti-conformists introduces instability in the process, causing a multiplicity of absorbing states and a variety of cycles, periodic classes and chaos.
- The model is highly sensitive, e.g., in the number of anti-conformists, the threshold values, etc.
- Cascades may occur: Introducing a small proportion of anti-conformists in a society may lead, not only to chaotic situations, but also to permanent opinion reversal.

Grabisch, M. Li, F. Dyn Games Appl (2019).
https://doi.org/10.1007/s13235-019-00332-0

The Transmission of Cultural Traits in Endogenous Social Networks

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Introduction

Key Questions:

- How to bias children's network optimally?
- How do traits evolve under this presumption?
- Under which conditions do heterogeneous or homogeneous societies emerge?

Emphasize the role of two *degrees of imperfect empathy relative to*

1. cost of network changes c^{Δ}, and
2. a desire to be integrated in the society c^{η}

Conclusion

- The dynamic may lead to polarization
  - extremists: delete links
  - integrated families: rather add links
- Cultural traits always converge, but not necessarily to a homogeneous society
- Extremists play a major role for the dynamics
- Small c^{η}, c^{Δ} leads to long term heterogeneity
- We can almost always find (intermediate) c^{η}, c^{δ} such that the traits of the whole society converge to that of an extremist subgroup
- Large c^{η} imply convergence to a homogenous society

Policy implications for reducing extremism:

- increase cost of network change; increase value of integration

Negative and positive influence among groups in continuous opinion dynamics

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Negative and positive influence among groups

$$x(k+1) = A \cdot x(k)$$

A link from i to j means that i listens to j; $N = G_1 \cup G_2$
Define the following different relationships among agents between two groups G_1 and G_2 in a signed graph:
Well studied:

- Conformists: graph with positive weights $a_{ij} > 0$
- Anti-conformists: graph with negative weights $a_{ij} < 0$
- Communitarian: structurally balanced graph (Altafini model sign-symmetric)

This paper

- Leadership polarization G_1: $a_{ij} > 0, \forall j \in G_1$ and $\forall i \in N$
- Mixed polarization (G_1 conf; G_2 anti-conf): $a_{ik} > 0$ and $a_{jk} < 0$ $\forall i \in G_1, \forall j \in G_2, k \in N$
- Etc.