1 Overview

1.1 Purpose

The model is designed to explain the emergence of an unpopular norm on a social network structure by pluralistic ignorance.

1.2 State Variables and Scales

The model state is represented by a growing number of individual agents (which can represent individual persons, households, companies etc. as long as the decision rule provides an appropriate model of the entities decision making). Each agent has a private preference p, and has to choose a behavior c on entering the social network. In addition, the agent has m directed links to other agents.

The spatial dimension of the model is represented by the social network structure, and there are no further assumptions about the distribution of the agents in physical space. The time resolution is not specified precisely, since the modeled process of behavioral choice can be implemented on different time spans, depending on frequency and means of communication. Thus, the models temporal resolution depends on the domain of application.

1.3 Process Overview and Scheduling

The model encompasses two main processes: Network formation and choice of behavior. In each time step, the network is extended by a new agents according to preferential attachment.

Then the behavioral choice process runs for the newly added agent, using the information obtained by observing the neighbors linked to in the network formation process.

The whole model runs on discrete time, and the scheduling is deterministic.

2 Design Concepts

Emergence Two features emerge: A network with a scale-free degree distribution according to preferential attachment, and a distribution of individual behavioral choices. The defining output of the model is represented by the choice distribution.

Prediction The agents effectively estimate the mean of the preference distribution of the population, which can be read as a prediction, given that the whole population is not yet instantiated for most decision points.

Sensing Agents perceive the behavioral choices of their network neighbors upon entering, and they have introspective access to their own preference. However, other agents' preferences are invisible at all time.

Interaction Action in the model is one-sided. The newly entering agent chooses its action by observing other agents, which only passively provide information. The whole of a simulation run, howevern

Stochasticity Stochasticity enters the model at two stages: In the initialization of agents (see below) and in the preferential attachment process. The stochastic component in initialization serves as a device to sample preference profiles, while the randomness in preferential attachment represents lower-level psychological variation in neighbor choice.

Observation The simplicity of the model allows to log network structure, preference distribution and choice distribution along any given model run. Usually, however, it suffices to record the means of the relevant distributions to draw conclusions.

3 Details

3.1 Initialization

The social network is initialized with m_0 agents in the beginning, who choose their behavior without observing other agents, and form a complete network afterwards to facilitate preferential attachment. Preferences are draw uniformly at random from the discrete interval $[1, \ldots, 10]$.

3.2 Input

There is no direct input of empirical data.

3.3 Submodels

Preferential attachment is effectively defined by a probability distribution over the networks current nodes, denoting how likely a new link is created

with any given preexisting node. It is defined as

$$p_i = \frac{k_i}{\sum_j k_j} \tag{1}$$

where k_i is the degree of node i. Informally, the probability that a new node will attach itself is proportional to i's relative degree, that means relative on the total degree in

The agents decide on their behavior by a simple conformistic rule, minimizing

$$G_i(c_i) = -|\frac{1}{|\Gamma_i(N)| + 1}(p_i + \sum_{j \in \Gamma_i} c_j) - c_i| \tag{2}$$

where c_i and p_i denote the choice and the preference of i respectively and Γ_i is i's neighborhood on the network. Put simply, by maximizing this function, the agents try to minimize the average distance of their choice to their estimate of the population's mean preference.