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Prosocial norms and degree heterogeneity in social networks

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ABSTRACT

We provide empirical evidence to support the claims that social diversity promotes prosocial behavior. We elicit a real-life social network and its members' adherence to a social norm, namely inequity aversion. The data reveal a positive relationship between subjects' prosociality and several measures of centrality. This result is in line with the theoretical literature that relates the evolution of social norms to the structure of social interactions and argues that central individuals are crucial for the emergence of prosocial behavior.

1. Introduction

The emergence and maintenance of prosocial behavior has been widely analyzed. Recently, the literature has pointed out the important role of heterogeneity in some of its forms [1–6].

Following Nowak and May's [7] seminal contribution, there is a growing body of literature that advocates *network interaction* as a key element for the evolution of social norms [1,8–10]. Some papers have explored the role of specific network architectures in promoting the stability of prosocial traits. Santos and Pacheco [3] were the first to stress the role of scale-free networks, specifically those in which degree follows a power-law distribution [11]. More recently, it has been shown that degree heterogeneity, which is characteristic of the power-law distribution, is the key element for social norms to thrive in such networks [4,12–17]. The underlying intuition is that norms promoted by central individuals are easier to spread than norms promoted by peripheral members of the population. Hence, cooperation can stabilize if central positions are occupied by individuals adhering to the norm. If evolution has indeed evolved this way we should find a relation between network position of humans and their prosocial behavior.

In this paper, we analyze the relationship between network centrality and a specific prosocial norm, *inequity aversion*, defined as subjects' willingness to promote a fair outcome at their own cost [18,19]. There is a large body of interdisciplinary and cross-cultural evidence that people have social preferences to reduce inequity [20–24], and recent neural evidence has confirmed the existence of egalitarian motives in humans [25].

To this aim, we elicit the social network within a group of undergraduate students and collect information about their inequity aversion by way of simple experimental protocols. Our data set consists of a network of almost 300 individuals. For a subset of these 300 individuals inequity aversion is measured by their willingness to even off an unequal prize allocation.

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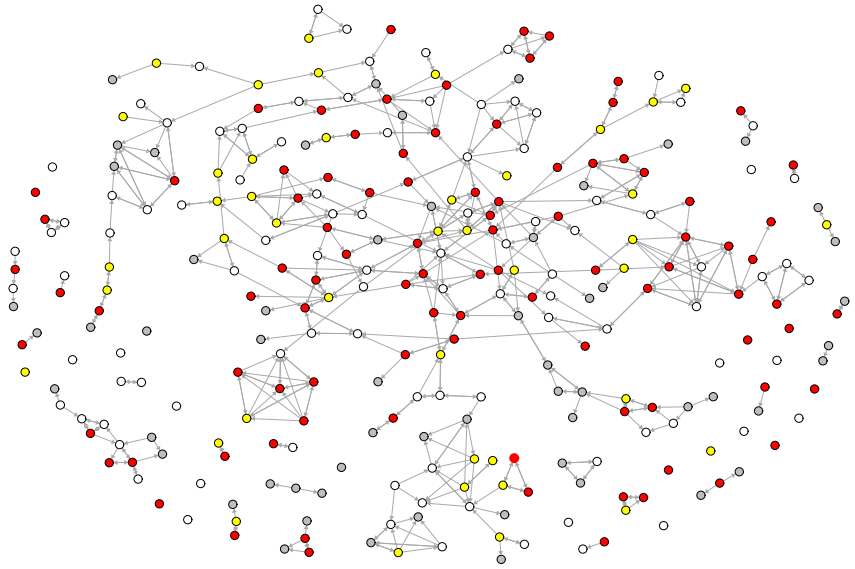

Fig. 1. The elicited network of participants. Nodes represent participants, edges represent friendship-relationships. Colors reflect the level of inequity aversion (IA). Red, above-median IA. Yellow, median IA. White, below-median IA. Grey, IA not elicited.

In this respect, the evidence reported here is consistent with previous research on the relationship between connectivity and social norms. Brañas-Garza et al. [26] find positive association between network centrality and unconditional altruism. Along similar lines, Cassar [27] reports the results of a laboratory analysis in which more connected subjects cooperate more in the Prisoner's Dilemma (even though network architecture is artificially created in the lab).

2. Methodology

The participants in our study were first-year undergraduate students at the University of Granada, Spain. The experiment consisted of several sessions. In this analysis, we use data from two of these sessions: (i) network elicitation and (ii) inequity aversion elicitation.

1. *Network elicitation*. We elicit the (directed) social network of a class of first-year undergraduate students in economics. A total of 291 students (out of the 360 registered) either participated in the elicitation or were named as friends by participants. Subjects were asked to write down the names of friends in the class whom they may have the chance to benefit in later phases of the experiment (without any specific information on how this would be implemented). With the objective of eliciting mostly strong links, the instructions clearly stated that subjects might be given the chance to benefit only one of their friends. Given that the beneficiaries were randomly selected from each subject's list, the more friends they listed, the lower the chance of benefiting any specific friend. Despite the relative simplicity of the protocol, we obtained an average of 42.2% bidirectional links. This procedure resulted in a very accurate mapping of social correspondences when compared to more sophisticated protocols used for analogous purposes [26,28,29].

As shown in Fig. 1, the elicited network shares features of typical social network architectures [30]. More precisely, there is a giant component encompassing 201 (69%) network vertices, the second largest component only contains 11 nodes and there are 24 (8%) unconnected nodes. The average (undirected) degree is 2.74 neighbors (SD 1.85). The clustering coefficient (i.e. the average fraction of links of a node that are linked themselves) is 0.34. Notice that the expected clustering in a randomly generated network of the same size and connectivity would be roughly $2.74/291 = 0.0094$, two orders of magnitude lower than the observed level. We also observe a tendency of highly connected nodes to be interconnected (the correlation between the degrees on both sides of a link is 0.36) and relatively small distances (the average and maximum distance and diameter in the giant component are 7.77, SD 3.64, and 24, respectively).

2. *Inequity aversion elicitation*. Since network and inequity aversion elicitations were performed in different sessions, not all subjects attended both phases of the experiment. Overall, we were able to collect both network and inequity aversion measures for 169 subjects of our sample. The social norm elicitation comprises two stages.

Stage 2.1. In this stage, subjects have to fix the allocation of 10 experimental points between two subjects [25,31]. The purpose of this stage is to artificially generate inequity since only one of the two subjects receives the entire endowment, while the other gets nothing. We ran Stage 2.1 under two treatment conditions. In the first treatment, the individual who decides the allocation, the Dictator, is one of the two recipients. This yields a variant of the classic *Dictator Game*, where a player decides the payoff distribution between herself and the recipient [32]. The only difference with regard to the standard