Altruism in the (Social) Network

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This paper explores the role of social integration on altruistic behavior. To this aim, we develop a two-stage experimental protocol based on the classic *Dictator Game*. In the first stage, we ask a group of 77 undergraduate students in Economics to elicit their social network; in the second stage, each of them has to unilaterally decide over the division of a fixed amount of money to be shared with another anonymous member in the group. Our experimental design allows to control for other variables known to be relevant for altruistic behavior: framing and friendship/acquaintance relations. Consistently with previous research, we find that subjects favor their friends and that framing enhances altruistic behavior. Once we control for these effects, social integration (measured by *betweenness*, a standard *centrality* measure in network theory) has a positive effect on giving: the larger social isolation within the group, the more likely it is the emergence of selfish behavior. These results suggest that information on the network structure in which subjects are embedded is crucial to account for their behavior.

The so-called "Dictator Game" is a classic experimental protocol in which a subject (the "Dictator") is invited to decide unilaterally over the division of a fixed amount of money with another -usually anonymous- subject (the "Recipient").[1-5] The anonymity of the protocol may suggest that dictators may well keep all the money for themselves. However, this kind of selfish behaviour is rarely observed. In contrast, around 20% of the money is given to the recipient (this result being robust to a wide variety of experimental conditions) and such positive transfers are usually interpreted as an instance of *altruistic behavior*. This outcome is just an example of a more general observation: humans tend to behave cooperatively towards other unknown individuals. Some of the factors affecting the level of altruism (repeated interaction and reputation, among others) are now well understood.[6-9] However, it remains a level of cooperation that apparently cannot be explained by any of those variables.

This paper adds a new dimension to this discussion by exploring the role of *social integration* (measured by the degree of social proximity between subjects) on giving, that is, the *effect of socialization on altruism*. In recent years, a large number of Dictator Game experiments have focused on several social aspects, such as the degree of anonymity in the Dictator-Recipient and the Dictator-Experimenter relationships, induced by the experimental conditions, that may play a role as determinants of giving.[10-13] This literature unambiguously shows that the smaller the (social) distance between the parties involved, the larger the giving.

This evidence notwithstanding, to the best of our knowledge little attention has been paid to social network relationships to explain giving.[14-15] Our paper opens a novel line of research by exploring how the social network in which experimental subjects are embedded is related with their attitude to give. To this aim, we design a two-stage experiment in which, before being exposed to a standard Dictator Game, we ask subjects to elicit the social network characterizing their undergraduate class. Results are conclusive: on average, more *central* (i.e. highly integrated within the network) players give more, whereas the number of selfish "key players" is marginal. By the same token, "isolated" players behave selfishly, and subjects with a low degree of integration rarely show altruistic behavior.

METHODS. The experiment was conducted at the University of Granada (Spain) in January 2006. Subjects were first-year undergraduate students in Economics. Participation was voluntary. Given the high sensitivity to framing effects in this kind of experiments, we were extremely careful in preserving subjects-experimenter distance. To this aim, the experiment was conducted by assistants who did not have any previous contact with

the students (see supplementary materials for a detailed description of the experimental design and additional material).

STAGE 1: *A "benefit-your-friend" Incentive Device for Network Elicitation.* The protocol for network elicitation was extremely simple: subjects were asked to write down on a piece of paper the name of their classmate friends who "*may have the chance to be benefited later in the experiment*". At this stage, no information was provided about the type of decisions they would make afterwards, or what the possible benefit would be. However, since we were interested in subjects revealing the identity of *their closest friends*, the instructions clearly stated that they might be given the chance to benefit *only one* of the friends, randomly chosen within their list, so that the more friends they had listed, the lower the chance of benefiting any particular individual. Despite its simplicity, we obtained an average of 50.5% of corresponded links, that is, an extremely accurate mapping of social correspondences, when compared with more sophisticated protocols used for analogous purposes.[14]

STAGE 2: *Dictator Game.* Subjects received two 11.5x22 cm. (4.5x8.8 inch.) envelopes in their hand-out package. One envelope was empty, the other contained ten 50 eurocent coins. Subjects were informed that their task was to divide this endowment of 10 coins between them and another subject in whatever way they wished. Then, depending on the treatment, they knew from the instructions whether the recipient would be a friend taken from their own list (treatment "Friends" in Box 1) or someone from their class *with the exception* of their named friends (treatment "No Friends").

	Frame	No Frame
Friends		27
No Friends	25	25

Box 1. Observations per treatment

We also controlled for another experimental condition, *framing*, which has been the object of interest in experimental research.[10-13] Again, the protocol was remarkably simple: one half of the subjects who were facing a no-friend as Recipient, had an additional sentence framing the Dictator Game by stating that the Recipient "…*would rely on them...*".

RESULTS. To simplify the exposition and the comparison with other related papers, our results are presented in terms of the number of coins (from 0 to 10) chosen by the Dictator in favor of the Recipient. Fig. 1 reports the giving distributions in the three treatments: Baseline (i.e. "No Friends-No Framing"), Framing and Friends. While average behavior is more selfish in the baseline, the other two treatments exhibit a (significant) increase in altruism, with behavior more disperse in the Friend treatment.

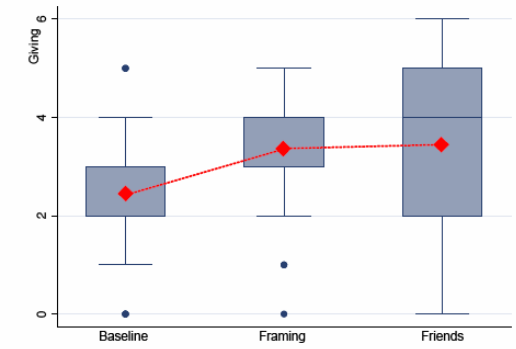


Fig 1. *Distribution of giving in the three experimental conditions.* "Box plot" graphic analysis. Within the box lie 50% of total observations (from the 25% to the 75% percentile). Adjacent lines trace the first upper and lower adjacent values; points denote outliers. Line within the box highlights the median. The broken red line connects the means of the three distributions. The first box shows observations on the Dictator Game from our Baseline (i.e. *No Friend-No Frame*) treatment. In this case, the Dictator keeps, on average, 8 coins for her and passes out only 2 to the Recipient. This result is in line with analogous experiments.[2-5] Very few subjects (3 out of 25) shared equally the €5; only 4 individuals behaved completely selfish, that is, kept all the money for themselves. The central box illustrates the *Framing* case. As Fig. 1 shows, the use of sentences framing the game enhances altruistic behavior, as the whole distribution "shifts" up, compared with the Baseline treatment. As a consequence, equal splitting becomes much more frequent (20% of total observations). The third box shows the giving distribution for the *Friend* treatment. In this case, average offers further increase, together with their variability: 25% of subjects pass (at least) half of the endowment, another 25% behave completely selfishly. Summing up, our two experimental treatments significantly enhance giving compared to the control condition, while we cannot reject the null hypothesis of no difference in giving between our "Framing" and "Friends" treatments (standard *t*-statistics, p=.85).

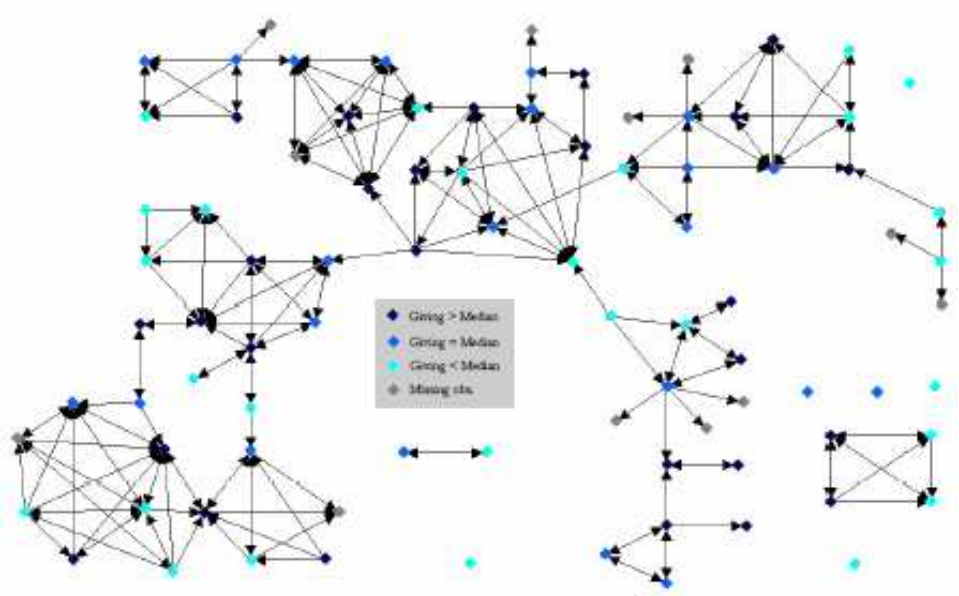
Stage 1 provides us with a mapping of the *directed* network (i.e. a network in which each link has a direction, from the eliciting to the elicited subject) of our experimental subject pool. The use of the "benefit-you-friend" incentive device yields a network of *close-friends,* to the extent to which subjects were aware of the potential drawbacks of naming too many friends. As a result, on average subjects named 2.7 friends (mode=3), which is lower than the values obtained in related works.[14] Five individuals did not name anybody, but other subjects

named up to 11 individuals; some of these individuals did not come to play the Dictator Game in Stage 2, but they are included in the dataset because they are a relevant to define the network.

In what follows, we shall apply a standard measure in network theory to test our working hypothesis that *altruism is (positively) correlated with social integration.* Among the classic measures provided by the literature,[15-16] we focus on the so-called *betweenness centrality*. Loosely speaking, betweenness centrality measures, for each individual, the relative frequency, among all shortest paths which connect any pair of subjects in the network, of paths which pass through that particular individual. In other words, betweenness is an index which measures how *central* is the individual within the network (or, the impact on the connection structure were that particular person be removed from the network –see the webpage for technical details).

Fig. 2 reports, together with the mapping of social relations derived from Stage 1, information about individual contribution with respect to the treatment median. A close inspection of Fig. 2 provides some intuition of our main result: *a*) more isolated subjects are more likely to give less; or *b*) more integrated subjects are more likely to be on or over the median of their corresponding treatment.

Fig 2. *Contributing within the social network.* Fig. 2 combines information from both stages of the experiment.



Elicited social links connect individuals in the network with an arrow (in the direction of the elicited friend). Each individual participating in Stage 1 is a diamond, whose color highlights whether that individual gave more or less than the corresponding treatment median. This figure maps into the social network subjects giving more than the treatment median, that is "altruists" (27 subjects), and subjects giving less that the median, that is "selfish" (26 individuals). Those subjects who were named by others but did not participate in Stage 2 are colored in grey.

Fig. 3 explores the effect of betweenness on the willingness to give. As the box-plots show, the higher the group level of betweenness, the more giving distribution shifts up.

Clearly, the analysis in Fig. 3 does not properly account for treatment conditions. To fix this problem, in Tab. 1 we estimate a standard order Probit regression, in which the probability of any possible level of giving (from 0 to 10) is regressed against individual betweenness *and* treatment conditions. While the estimated coefficient associated to the "Low" reference group is positive, but not significant (indicating that there is no significant difference in average contribution between Peripheral and Low subjects), the coefficient for the Central group is statistically significant (coeff. 0.51, p-value=.076), which means that *centrality matters*. Not surprisingly, both treatment conditions (with particular reference with Friends) are positive and significant. In sum, the regression analysis provides evidence that individuals who are central in their social network have a more altruistic behavior even after controlling for framing and friendship effects.

There is a caveat here. Our statistical exercise of Tab. 1 fixes a causal relation between altruism and network centrality, insofar we use betweenness within the list of regressors. This is consistent with the fact that the decision of giving is made *after* the network elicitation Stage 1 and, most likely, we can consider the social network depicted in Fig. 2 already well established at the time subjects had to make their contribution decision.

Fig. 3. *Network integration and giving.* Figure *3a)* partitions our subject pool in three subsamples, depending on their level of individual betweenness. The first 29 subjects are not integrated at all (*Peripheral*), as their betweenness is equal to zero. The remaining 48 subjects are partitioned in two groups of equal size (24 subjects each) *low*-integrated and *central*-players. In Fig. 3*a)* each subject is represented by a bar, whose height equals the corresponding level of betweenness centrality. By analogy with Fig. 2, the color of each bar identifies the level of each individual contribution with respect to the treatment median.

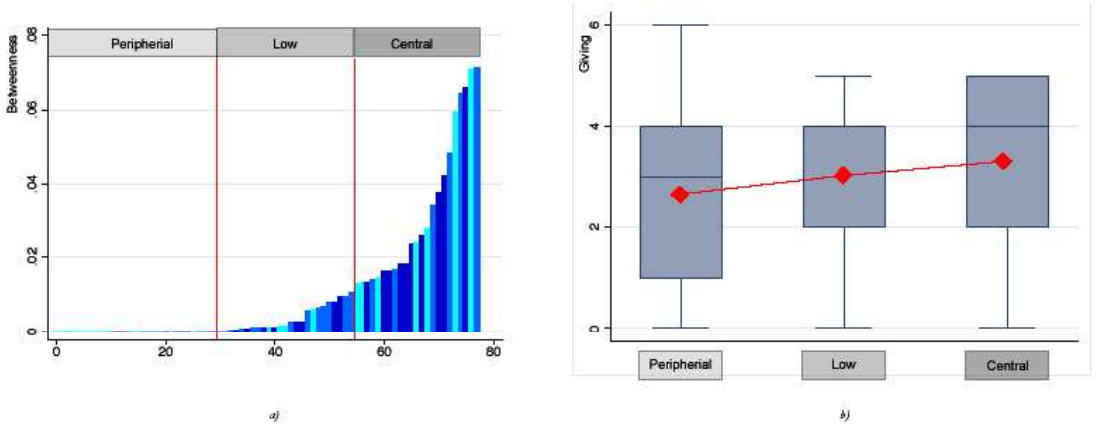


Figure *3b)* shows, again with the aid of box plots, the distribution of giving in the three subsamples. As the diagram shows, giving increases with integration (all mean differences are significantly different).

On the other hand, the basic question remains: *are subjects (on average) more altruistic because they are pivotal in their social network, or are they central exactly because they show (for whatever reason) a more altruistic attitude toward the rest of the group?* To answer this question, a more detailed investigation on which (demographic, social or psychological) characteristics are correlated with our network centrality measure, something we cannot do with our limited experimental evidence. What is clear is that our results unambiguously show that the social network architecture has to be included within the list of determinants of our subjects' behavior.

Tab. 1. *Ordered Probit analysis.* Estimated probability of any particular contribution as a function of betweenness reference group (Low, Central) and treatment conditions (Friend, Framing). All regressors are dummies. A dummy variable for individuals belonging to the "Peripheral" reference group is omitted, to avoid perfect collinearity in the data. In this respect, estimated coefficients have to be interpreted as difference in the probability of giving with respect to the benchmark (i.e. Peripheral) reference group. We do not need to take into account for treatment interactions, as we get data out of a block design (with three treatment conditions out of four, see Box 1).

Variable	Coeff.	Std. Err.	z	P>z
Low	.3309	.3003	1.10	0.270
Central	.5190	.2929	1.77	0.076
Friends	.8424	.3065	2.75	0.006
Frame	.6399	.2993	2.14	0.033

Number of subjects/observations=77. Log likelihood=-130.732. Wald χ^2_4 =10.22. Prob.> χ^2 =.0368.

DISCUSSION. This paper explores a new aspect on the determinants of altruistic behaviour: *social integration*. Most of previous experimental literature has focused on economic incentives, reputation effects, framing or between-subject relations to explain altruism. Altruism may be driven by self-interest and it has been shown that reputation, or the promise of future rewards, do indeed affect generosity. Framing effects and between-subject relations are also important factors for altruism (as our experiment confirms). However, the puzzle is that, even when all these factors have been accounted for, there is still some human cooperation that remains unexplained. Some work has pointed to socialization and cultural transmission of social values as a solution to this puzzle. There is experimental evidence with children showing that younger children are less generous/cooperatives in the dictator/public good games.[18-19] These results could be due to the fact that older children are more advanced in their socialization process and, in consequence, show a more altruistic behaviour. Along these lines, our research explores the idea that social integration may also be an important determinant for altruism. Note that this hypothesis is consistent with the evidence on children playing the

dictator game since older children also have, on average, a higher level of social capital. However, since socialization and transmission of values is more complex process, rather than just social capital accumulation, we test our hypothesis with subjects at the same stage of the socialization process but, nonetheless, with different centrality positions in their social network. The results are clear: social integration is related to altruistic behaviour. Our results do not exclude other preference-based explanations, like inequity aversion, which are well supported by the experimental evidence. Nevertheless, as we previously argued, there is no obvious link between preferences for fairness or inequity, and centrality within a social network so that social integration appears as an independent factor explaining altruism. Social integration, measured as centrality within the social network, is a feature distinctly human[11-13] which could explain why humans show a cooperative behaviour towards other individuals with no genetic relation to them, while this behaviour is not observed in other animals.

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Supplementary Information is linked at `http://www.ugr.es/~pbg/material/network.htm`

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