Games and Economic Behavior 69 (2010) 249–257

Contents lists available at ScienceDirect

Games and Economic Behavior

www.elsevier.com/locate/geb

Altruism and social integration ☆

Pablo Brañas-Garza [a], Ramón Cobo-Reyes [a], María Paz Espinosa [b], Natalia Jiménez [a], Jaromír Kovářík [b], Giovanni Ponti [c,*]

[a] GLOBE: Universidad de Granada, Campus la Cartuja, 18011 Granada, Spain
[b] Universidad del País Vasco, Av. Lehendakari Aguirre 83, E-48015 Bilbao, Spain
[c] Università di Ferrara and Universidad de Alicante, Campus San Vicente, E-03080 Alicante, Spain

ARTICLE INFO

Article history:
Received 15 September 2008
Available online 20 November 2009

JEL classification:
C93
D85

Keywords:
Altruism
Centrality
Social network experiments

ABSTRACT

We report on a two-stage experiment in which (i) we first elicit the social network within a section of undergraduate students and (ii) we then measure their altruistic attitudes by means of a standard Dictator game. We observe that more socially integrated subjects are also more altruistic, as betweenness centrality and reciprocal degree are positively correlated with the level of giving, even after controlling for framing and social distance, which have been shown to significantly affect giving in previous studies. Our findings suggest that social distance and social integration are complementary determinants of altruistic behavior.

© 2009 Elsevier Inc. All rights reserved.

1. Motivation

The so-called "Dictator Game" is a classic experimental protocol by which a subject (the "Dictator") takes decisions unilaterally over the division of a fixed amount of money with another – usually anonymous – subject (the "Recipient"). The anonymity of the protocol may suggest that Dictators keep all the money for themselves. However, this selfish behavior is rarely observed in the lab. In contrast, about 20% of the money is given to the Recipient under a wide variety of experimental conditions.[1] This evidence is usually interpreted as an instance of *altruistic behavior*.

In recent years, a large number of Dictator Game experiments have highlighted several factors as determinants of giving. These include two effects which are of interest for this paper[2]:

1. *framing effects*, that is, the way in which the Dictator's decision problem is presented to subjects. One particular instance is the presence of "non-neutral" sentences highlighting the Recipient's dependency on the Dictator's choice[3];

☆ We are indebted to Matthew Jackson and an anonymous referee for comments and suggestions that considerably improved this paper. This paper was written while Giovanni Ponti was visiting the Department of Economics of LUISS Guido Carli, in Rome. He thanks Daniela Di Cagno and John Hey for hospitality and insightful discussions. The usual disclaimers apply. Financial support from MEC (SEJ2006-06309/ECON; SEJ2007-62081/ECON; SEJ2007-62656/ECON and ECO2009-09120), Generalitat Valenciana (GV06/275), Gobierno Vasco (IT-223-07) and Junta de Andalucía (P07-SEJ-02547) is gratefully acknowledged.

* Corresponding author.
E-mail addresses: pbg@ugr.es (P. Brañas-Garza), ramonc@ugr.es (R. Cobo-Reyes), mariapaz.espinosa@ehu.es (M.P. Espinosa), natjj@ugr.es (N. Jiménez), jaromir.kovarik@ehu.es (J. Kovářík), giuba@merlin.fae.ua.es (G. Ponti).

[1] See, among others, Eckel and Grossman (1996) and Bolton et al. (1998).

[2] We also control for gender, since it has been observed that women tend to be more generous than men (see, for example, Eckel and Grossman, 1998; Andreoni and Vesterlund, 2001 and Croson and Gneezy, 2009).

[3] See List (2007) for a survey and Brañas-Garza (2007) for an experimental study.

0899-8256/$ – see front matter © 2009 Elsevier Inc. All rights reserved.
doi:10.1016/j.geb.2009.10.014

2. *social distance effects,* that is, the degree of anonymity – induced by the experimental conditions – of the Dictator–Recipient and Dictator–Experimenter relationships.[4]

As we just mentioned, the usage of the term "social distance" here refers to the amount of information provided to the Dictator on the identity of the Recipient and/or the Experimenter. However, in some recent papers, namely Jones and Rachlin (2006), Leider et al. (2009) and Goeree et al. (forthcoming), the same concept of social distance indicates, instead, how "close" subjects are (e.g. whether they are "friends", "friends of friends" and so on) in their own "real-life social network". In this case, social distance is measured by way of some elicitation protocol in an independent stage of the experiment. In this respect, all the cited papers show that *altruistic behavior is significantly decreasing in the social distance between the Dictator and the Recipient.*

These findings provide interesting insights on how social network architecture influences giving. However, all these studies look at the Dictator–Recipient relationship isolated from the complex network layout both subjects (especially the Dictator) are embedded in. In this respect, the above literature leaves open the question as to whether altruism is not only related to the Dictator–Recipient distance, but also to subjects' overall position (call it *social integration*) within the network.[5]

The idea that altruism is related to social integration has been put forward by the theoretical literature on the coevolution of social networks and prosocial norms, showing that specific network structures may contribute to the stability of prosocial behavior (Eshel et al., 1998; Boyd and Richerson, 2002; Marsilli et al., 2004; Nowak, 2006). From a micro perspective, Fosco and Mengel (2008) set up an evolutionary model by which, in the steady state, prosocial and selfish individuals coexist, with the latter located "at the periphery" of the network.[6]

The main objective of this paper is precisely to test the conjecture that *more socially integrated individuals exhibit, on average, more altruistic behavior.* To this aim, we relate the altruistic attitudes of an undergraduate section of Economics students of the Universidad de Granada to their real-life social-network position in a two-stage experiment in which (i) we first ask subjects to elicit the underlying social network of their section and then (ii) obtain an indirect measure of their altruism by means of a standard Dictator Game.

Three different experimental treatments allow to isolate this social integration effect to those related to framing and social distance. Even after controlling for the latter, social integration plays a significant role in explaining altruism, both from a *local* (i.e. at the level of each subject's neighborhood) and a *global* (i.e. at the level of the social network as a whole) perspective.

The dependent variables for our statistical exercise are the absolute level of giving in the Dictator Game and a binary index which identifies the more "selfish" subset of subjects (i.e. those giving nothing, or the minimum amount). We use three treatment conditions which differ across the "frame" and "social distance" dimensions. Our two dependent variables are then regressed – together with treatment conditions – against some classic measures of integration used in network theory, such as

1. **In-degree:** the number of links leading to any given node (in our case the number of subjects who name subject i as a "friend");
2. **Out-degree:** the number of links starting from any given node (in our case the number of friends named by subject i);
3. **Reciprocal degree:** the number of bidirectional links (elicited friendships which are mutual);
4. **Betweenness centrality:** the index which measures how "central" each subject is by counting the number of shortest paths connecting any pair of nodes in the network which pass through that particular subject. To obtain this index, we need to look *at the entire network architecture*, instead of simply considering the local properties of a given node.

These indices measure the *embeddedness* (or *integration*) of a subject within a social network. More precisely, degree measures reflect the integration of each subject within her local neighborhood, while betweenness centrality reflects each subject's integration within the social network as a whole.

Our experimental evidence confirms the above literature showing that frame and social distance are important determinants of giving behavior. However, we also show that these variables are never significant in explaining the probability of belonging to the selfish sub-group of subjects. By contrast, we observe that betweenness centrality and reciprocal degree have a significant impact on subjects' willingness to give and also on the probability of observing selfish behavior. Our results suggest that the effect of individual network position on giving is *complementary* to the effect of social distance, previously analyzed in the literature.

[4] See, among others, Hoffman et al. (1994, 1996), Bohnet and Frey (1999), Burnham (2003), Brañas-Garza (2006) and Charness and Gneezy (2008).

[5] Goeree et al. (forthcoming) also consider network effects analogous to ours, as controls. However, their main focus is on the social distance effect, and its interaction with subjects' individual characteristics (such as height or shyness). In this respect, the inclusion in their regressions of individual characteristics might shade the social integration effects we analyze here.

[6] See Fig. 1 in Fosco and Mengel (2008), which sketches one of these (simulated) steady-state equilibria, whose overall structure is remarkably similar to that of Fig. 1 in this paper. Along similar lines, Cassar (2007) reports a significant effect of the number of neighbors (that is, a local measure of centrality) on cooperation, in an experiment in which subjects play simple 2×2 games under different (exogenously given by the experimental conditions) network structures.

The remainder of the paper is arranged as follows. In Section 2 we present the experimental design, while our experimental results are reported in Section 3. Finally, conclusions are drawn in Section 4, followed by Appendix A containing further statistical evidence.

2. Design

2.1. Subjects

The experiment was conducted at the Universidad de Granada. Subjects were first-year undergraduate students in Economics belonging to the same section (of about 100 students in total). Subject recruitment was voluntary, and exclusive to this section (i.e. nobody else outside the section was invited to participate to the experiment). The experiment was announced in class and 79 students agreed to participate.

Since first-year students from different sections do not share a single class hour, and all our subjects had been attending the same set of first-year courses for an entire semester, we are confident that our subject pool had been developing a social network within all section members, as social interaction across (within) sections is much weaker (stronger). This, in turn, implies we have clearly defined group bounds, which, together with the high participation, enables us to elicit the underlying social network of the group under scrutiny.

2.2. Stages

The experiment was designed as a 2-stage protocol as follows:

Stage I: *network elicitation*. The protocol for network elicitation was extremely simple. We asked the 79 subjects participating to Stage I to write down the name of their friends from the same section on a piece of paper, since "*there is a chance that one of them will later benefit in the experiment*".

In Stage I no information was provided about the type of decisions subjects would have to make afterwards, or what the possible benefit would be. However, since we were interested in subjects revealing the identity of their "close" friends, the instructions clearly stated that they might be given the chance to benefit "*only one of their friends*", randomly selected from their elicited list. Therefore, the higher the number of friends they would list, the lower the chance of benefiting any particular one.[7]

Given our specific elicitation protocol, we may be capturing the network of people who would like to benefit each other. As a result, we do not capture links to friends whom our subjects would not like to see benefited, while we might capture links to people our experimental subjects would like to benefit without being friends. Nevertheless, since benefiting each other is an essential feature of friendship relationships and we explicitly asked for naming "*friends*", we interpret the elicited graph as the friendship network. In particular, our elicitation device yields a network of "close-friends", since subjects were (made) aware of the fact that naming many friends would reduce the probability of favoring any one of them.

In total, our 79 participating subjects named 79 people (all of them belonging to the same section, with 11 subjects not present/not willing to participate to the experiment), creating 220 links across our subject pool.[8]

Stage II: *Dictator Game.* In Stage II our 79 participants were divided into 3 groups depending on the treatment (see Section 2.3 below). Each group carried out Stage II simultaneously. For all the treatments, subjects received two 11.5×22 cm (4.5×8.8 in.) envelopes in their hand-out package. One envelope was empty, while the other contained 10 fifty-eurocent coins. We asked subjects to divide this 10-coin endowment between themselves and another subject in whatever way they wished.[9]

2.3. Treatments

In Stage II, we had three block-design treatments structured according to the following two dimensions:

1. **Friends/No Friends.** Depending on the treatment, subjects knew from the instructions whether the recipient would be a friend randomly drawn from their own list (treatment "Friends") or someone from their section with the exception of the friends they had named (treatment "No Friends").
2. **Frame/No Frame.** Half of the subjects who faced a non-friend as a Recipient had an additional sentence framing the Dictator Game which stated that the Recipient "… *would rely on them*…".[10]

[7] This feature of the mechanism was actually explicitly mentioned in the instructions by stating: "*Feel free to name as many friends as you wish. However, please remember that the higher the number of friends you list, the lower the chances are of benefiting a specific friend of yours.*"

[8] In the analysis that follows (see Fig. 2 below), we remove those 11 subjects from the social network, as we focus only on participating students, because we have no information about whether these links would have been reciprocated by the non-participating students, or about the giving decisions of these absent individuals. The whole analysis has been replicated including the non-present students in network measures and the results do not change. The analogous to Fig. 2, including the removed links, can be found at http://www.ugr.es/~pbg/material/network.htm.

[9] The experimental instructions can be found at http://www.ugr.es/~pbg/material/network.htm.

[10] This particular language has been shown to affect giving (Brañas-Garza, 2007).

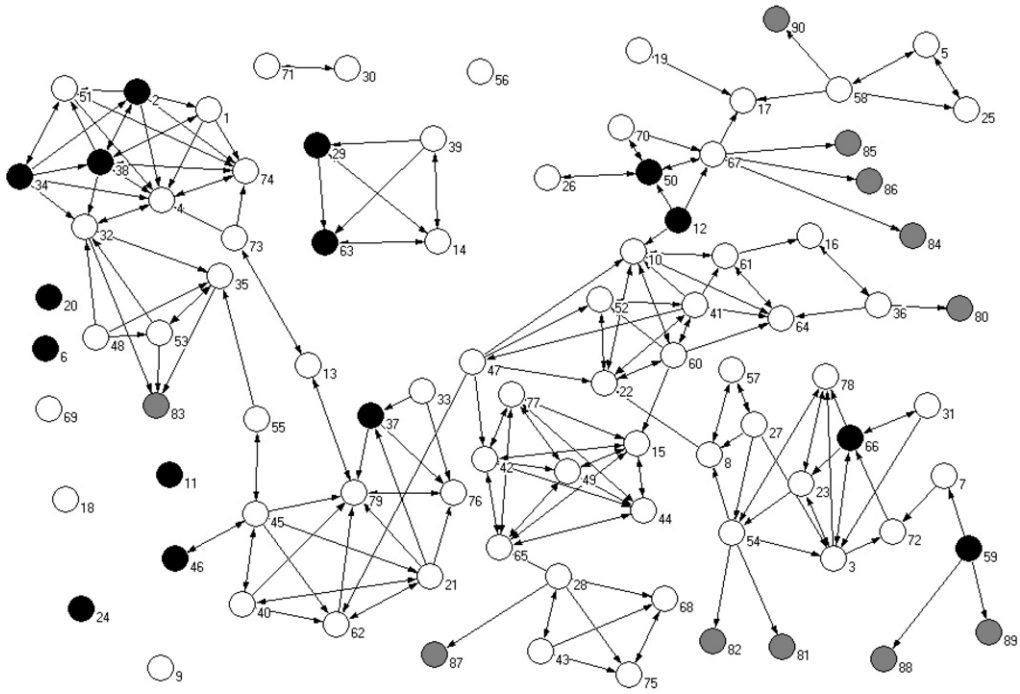


Fig. 1. Network architecture and contribution profiles.

Thus, we have the following three treatments: Treatment 1 (No Friend/No Frame, "Baseline" hereafter), Treatment 2 (No Friends/Frame, "Frame" hereafter) and Treatment 3 (Friends/No Frame, "Friends" hereafter), with 26, 26 and 27 subjects, respectively.[11]

Every participant in Stage II played as a Dictator and was also a potential Recipient. In Baseline and Framing treatments the role of Recipients was randomly assigned from the section list, excluding the named friends, while in the Friends treatment one subject from the list of friends was randomly drawn.

We were extremely careful about preserving anonymity in the Dictator–Recipient and subject-experimenter relationships, to avoid at best any effect of the personal (and privately known) features of those relationships we could not properly control for. For this reason, the experiment was conducted by assistants who had no previous contact with our subjects and, in contrast with previous literature, when subjects play with a friend the recipient is randomly chosen from the list of friends.

On average, subjects earned 4.5 euros (including a show-up fee of 2 euros). All payments were distributed at the end of Stage II.[12]

3. Results

3.1. Stage I: elicitation protocol

Fig. 1 provides us with a mapping of the directed network (from the subject naming a friend to the named subject) of our experimental subject pool.

On average, subjects named 2.78 friends – including non-participating students. This number is significantly lower than those of the relevant literature (the average outdegrees are around 10 and 4.4 for Leider et al., 2009 and Goeree et al., forthcoming, respectively).[13] On the other hand, the degree of reciprocation in our data is slightly higher than 50%. This percentage is substantially higher than those reported in other studies: 36.7% in Leider et al. (2009) and 30% in the *National Longitudinal Survey of Adolescent Health* (Add Health hereafter, Goodreau, 2007).

[11] The introduction of the two treatments serves to see whether the effect of network position still matters even if framing and social distance play a role. Therefore, we did not test the joint effect of framing and social distance in the experiment.

[12] Since Recipients have been drawn randomly from the complete section list in the Baseline treatment and from the friend list in the Friends treatment, some Recipients were absent at the time Stage II was run. These subjects were contacted and paid later.

[13] The histograms for indegree and outdegree, as well as reciprocal degree and betweenness, can be found at http://www.ugr.es/~pbg/material/network.htm.

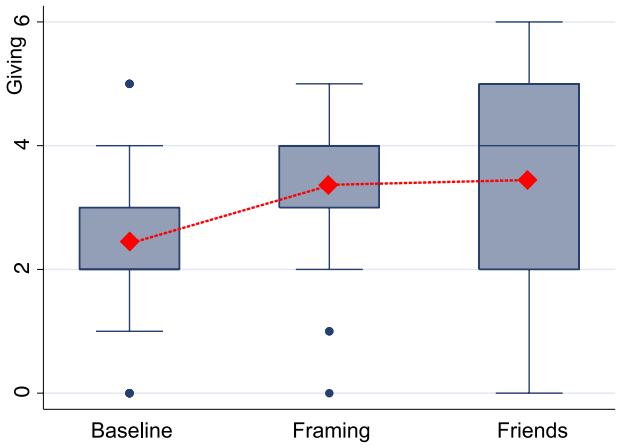


Fig. 2. Distributions of Dictators' giving in Stage II.

Higher reciprocity, together with lower average degrees, suggests that our elicitation mechanism was rather successful in the elicitation of "closer relationships". Although we did not distribute any financial reward in Stage I, we were extremely clear in the instructions that, in the development of the experiment, "*only one of their friends*" could possibly be benefited. A completely different design strategy was taken, for example, by Leider et al. (2009), by means of an elicitation protocol which would pay-off 50 cents for each reciprocated link in the list, i.e. a mechanism by which subjects' financial rewards are non-decreasing in the number of elicited links and strictly increasing in the number of reciprocated links. Not surprisingly, this also translates into an elicited social network with a higher number of elicited links and a lower frequency of reciprocated ones.

There are two other salient features of our network architecture. First, most of the nodes are embedded in a giant "component" (i.e. they are connected through some path). Second, the architecture of this component is a combination of *interlinked clusters*, either in the form of stars or (almost) complete graphs. A more detailed analysis shows that our network resembles standard social network structures, that is, relatively low average distances, and high clustering compared with a random network (Watts and Strogatz, 1998). The average distance between reachable nodes, that is between the nodes in the giant component, is 5.4, abstracting from the directionality of links. Since this number is of the order of logarithm of the size of the network ($\log(79) \simeq 4.369$), we can say that in our network average distances are low. The average clustering coefficient (i.e. the relative frequency of neighbors who are directly linked themselves) is 0.38 (st. dev. 0.29). In a large randomly generated network with n nodes and average degree of $\bar{d}$, the expected clustering coefficient would be roughly $\frac{\bar{d}}{n}$. For a random network with our size and connectivity, we would get a clustering coefficient of 0.03, that is, a coefficient of an order of magnitude lower that the clustering observed in our elicited network. Additionally, we find that our network shows positive assortativity: those who are more social tend to be connected to social individuals. Most of these features have been found in other empirical social networks.[14]

3.2. Stage II: Dictator Game

Fig. 1 also provides a sketch of our main result: *more socially integrated subjects give more*. The black nodes correspond to "selfish" individuals, i.e. subjects who give nothing or the smallest possible amount (about 19% of our subject pool), while the white nodes are subjects who give more than one. Abstracting from the direction of nodes, note that, in general, the position of the black nodes in the graph is either peripheral (subjects 6, 20, 24, 46, and 59) or they are embedded in completely connected clusters (2, 29, 34, 37, 38, 50, 63, and 66). In both cases, the potential removal of these nodes does not have a large effect on the (inter)connectivity of the remaining nodes, that is, these nodes are not crucial for the network architecture.[15]

Fig. 2 shows the "box plots" representing the distribution of Dictators' offers in Stage II (integers from 0 to 6, given that no subject contributed with more than 6 coins) in the three treatments.[16] As Fig. 2 shows, the Dictator keeps, on average, 8 coins for himself and gives 2 to the Recipient in the Baseline treatment. In this treatment, very few Dictators (11%) share

[14] See Goyal (2007). Using the coefficient of assortativity proposed by Newman (2002), we find positive assortativity in our data ($r = 0.19$ for in-degree and rises to $r = 0.50$ for reciprocal degree). Even though positive assortativity is observed in many social networks, Jackson (2008, Chapter 3.2.4) correctly points out that there are too many exceptions, and makes a call for a more systematic analysis of this issue.

[15] Even though the removal of subject 50 would disconnect subject 26, this effect is weak on the overall connectivity of the network. An exception seems to be subject 12, who creates a bridge between two components. However, she names three nodes as her friends, but none of these links is actually reciprocated.

[16] The boxes show 50% of the total observations (from the 25% to the 75% percentile). Adjacent lines trace the first upper and lower adjacent values, while points denote outliers. The line within the box denotes the median. The broken line connects the means of the three distributions.

Table 1
Regressions for giving and selfishness.

	Altruism [1a]	Selfish [1b]	Altruism [2a]	Selfish [2b]	Altruism [3a]	Selfish [3b]	Altruism [4a]	Selfish [4b]
In-degree	.228	−1.179*	–	–	–	–	–	–
	(.424)	(.695)	–	–	–	–	–	–
Out-degree	–	–	−.361	−.240	–	–	–	–
	–	–	(.478)	(.765)	–	–	–	–
Rec. degr.	–	–	–	–	1.001**	−1.750**	–	–
	–	–	–	–	(.454)	(.805)	–	–
Between.	–	–	–	–	–	–	1.037**	−1.790***
	–	–	–	–	–	–	(.473)	(.712)
Female	.959**	−1.035	1.123**	−1.271**	.678	−.963	.666	−.875
	(.451)	(.630)	(.464)	(.646)	(.463)	(.641)	(.466)	(.653)
Friends	1.788***	−.835	1.649***	−.600	2.028***	−1.226	1.900***	−1.018
	(.546)	(.730)	(.559)	(.729)	(.556)	(.786)	(.550)	(.765)
Fram.	1.409***	−1.385*	1.278**	−1.150	1.620***	−1.718**	1.480***	−1.483*
	(.513)	(.814)	(.515)	(.806)	(.522)	(.868)	(.511)	(.851)
Cons.	–	.281	–	−.198	–	.594	–	.644
		(.641)		(.606)		(.701)		(.690)

Standard errors between parentheses. $N = 79$ ($p > x^2 < .05$).
* Highlight significance at $p = .1$, respectively.
** Highlight significance at $p = .05$, respectively.
*** Highlight significance at $p = .01$, respectively.

their endowment equally, while 19% of them behave completely selfish, keeping all the money for themselves. These results are in line with analogous experiments and make us confident that eliciting the network before playing the Dictator Game did not significantly affect Dictators' behavior in Stage II.[17]

Framing seems to enhance altruistic behavior as the entire distribution of Treatment 2 "shifts" up compared with the Baseline. As a consequence, equal splitting becomes much more frequent (19% of total observations) in the Framing treatment. With regard to Treatment 3 (Friends), average offers further increase, as it does their variability. In this latter case, 37% of subjects give (at least) half of the endowment. Standard t-tests show that giving is significantly greater in the Friends and Framing treatments, compared with the Baseline ($t = -2.524$, $p = .007$ and $t = -2.437$, $p = .009$, respectively; one-tailed tests). Non-parametric Mann–Whitney tests also indicate that the distribution are not equal ($z = -2.486$, $p = .013$ and $z = -2.434$, $p = .015$, respectively).

By contrast, the difference in giving between the Framing and Friends treatments is not statistically significant ($t = -.222$, $p = .825$ for two-tailed t-test and $z = -.705$, $p = .4807$ for Mann–Whitney test). From Fig. 2 we can see that average giving is virtually the same in both treatments; the only real difference is their variability.

Goeree et al. (forthcoming) report 36% greater giving to first-order neighbors with respect to more distant individuals, while Leider et al. (2009) observe an increase of 52% in giving to first-order neighbors, rather than strangers. In our data, Dictators give 49% more to their friends with respect to any random subject at a social distance larger than one, that is, an increase which lies in between the values we just reported. In this respect, our network elicitation mechanism does not seem to induce any specific behavioral bias in the Dictators' decisions, compared with the related literature.

Clearly, the analysis of Fig. 1 does not properly account for treatment conditions. In Table 1 we perform a regression analysis including gender, treatment and network regressors. Network centrality is captured through binary indices which take value 1 if the corresponding subject is characterized by a level above the median of the corresponding centrality measure (in-degree, out-degree, reciprocal degree and betweenness) and 0 otherwise.[18]

We run two sets of regressions. In regressions [1a] to [4a] we use *altruism* as a dependent variable, whereas regressions [1b] to [4b] analyze *selfishness*. Each of the four models considers one network measure (in-degree, out-degree, reciprocal degree and betweenness). More precisely,

[1a] to [4a]. The probability of any possible level of giving (an integer from 0 to 6) is estimated by an ordered logit regression using network measures, female and treatment dummies (Friends and Framing) as explanatory variables.
[1b] to [4b]. The probability of belonging to the sub-group of "selfish" subjects is estimated by a logit regression using network measures, a constant, female and treatment dummies as explanatory variables.

In Table 1, the coefficients in regressions [1a] to [4a] measure the average increase in the log-odds of giving more for subjects with network measures above the median, while in regressions [1b] to [4b] they measure the percentage increase in the odds of belonging to the "selfish" subgroup.

[17] See, among others, Hoffman et al. (1996) and Eckel and Grossman (1996).
[18] We use dummies to better capture non-linearities in the underlying relations. Analogous results can be obtained using the indexes and the indexes squared.

We begin by noticing that our treatment variables (Friends and Framing) have a large and significant impact on equations [1a] to [4a], while they are (almost) never significant at 5% confidence in regressions [1b] to [4b]. In other words, our treatment variables affect the level of giving, but they have no effect on the probability with which any given subject belongs to the group of the most selfish individuals. Remember that our treatment variable Friends proxies social distance, in the sense that, when Friends = 1, the Dictator shares his endowment with a subject at "distance one" from him, whereas the distance between the Dictator and the Recipient is larger when Friends = 0. In this respect, our estimates confirm previous results in the literature: people are more altruistic toward socially closer individuals. Similar considerations apply for the framing effect.

In the regressions, out-degree and in-degree are never significant at 5%. By contrast, betweenness centrality and reciprocal degree coefficients are always significant. The positive signs of the coefficients in regressions [3a] and [4a] show that these measures of integration have a positive effect on the level of giving, while the negative sign of the coefficients of these variables in regressions [3b] and [4b] indicates that a subject with a high reciprocal degree or betweenness is less likely to be selfish. The odds of giving more are $e^{1.037} = 2.83$ times greater for individuals whose betweenness is above the median, while they are 2.72 larger for agents whose reciprocal degree is above the median, holding other variables constant. Concerning the likelihood of belonging to the group of most selfish individuals, above-median individuals in betweenness or reciprocal degree are roughly 83% less likely to give nothing or the smallest possible amount.

To interpret these results, remember that betweenness is a "global" measure of a subject's social integration, while the degree measures concern integration at a local level. In-degree and out-degree reflect local integration, either as it is perceived by others (the number of subjects who consider i as a friend), or by the subject herself (the number of subjects that i considers as friends). Finally, reciprocal degree encompasses both these aspects, as it requires consistency between i's perceptions and those of her elicited friends, given the additional requirement of reciprocity.[19] In this respect, our results indicate that only "strong" measures of social integration matter for altruism, both at the local (reciprocal degree) and the global (betweenness centrality) level.

Given the complementary role of social distance and centrality in giving behavior, we check whether this social integration effect interacts with that of social distance. Table 2 (in Appendix A) shows that this is not the case in any of regressions from Table 1, as the dummy for the interaction between the corresponding measure of centrality and Friends is never significant. We also run the same regressions as in Table 1 excluding the observations from the Friends treatment. As Table 3 (in Appendix A) reports, our findings are not driven by the Friends treatment, and still hold even when subjects deal only with non-friends.

It is worth noting that the elicited network represents a network of individuals within a given frame (i.e. university social ties). Naturally, individuals have social ties outside our frame, which we do not observe (family, friends outside College, work, sports practice, etc.). Peripheral individuals in the network analyzed here may be more central in different networks. An interesting issue for further research is how individual centrality and behavior relates across different networks.

4. Discussion

This paper explores the relationship between social integration and altruistic behavior. Our results show that social network architecture matters for altruism at both the local and the global level. We control for other significant factors already highlighted by the literature such as gender, framing or social distance. Even after controlling for these variables, social integration remains an important factor for giving and selfish behavior.

Our statistical exercise in Table 1 would seem to suggest a causal relationship between network centrality and altruism, since network variables are in the list of regressors.[20] This estimation strategy follows the empirical literature on network/peer effects in which network architecture is a primitive of the economic environment. Nevertheless, the authors of this literature are well aware of the fact that subjects' individual characteristics may also influence their position in the network, making it difficult to disentangle the "pure network effect" from individual heterogeneity (Durlauf, 2004).

In the context of our data set, the same dilemma can be posed as follows: *are subjects (on average) more altruistic because they are pivotal in their social network, or are they pivotal because they show (for whatever reason) a more altruistic attitude toward the rest of the group*? In our experimental protocol, even though the decision of giving was made *after* the network elicitation and the social network of Fig. 1 was already well established at the time subjects had to make their contribution decision, it is clear that both the social abilities and the social norms of the subjects, *as well as* personality traits, were determined long before the experiment.[21] Our interpretation of the results is that given the social abilities and norms of the individuals, they formed a social network in their class and *in that social network* we measured their willingness to share a given endowment. Our analysis allows us to state that their behavior in sharing the endowment (i.e. their generosity) with other network members is related to their position in that network, even though it is not possible to definitely establish causality.

A very similar problem is faced by Calvó-Armengol et al. (2009), who estimate peer group effects in education patterns of a sample of US adolescents. The richness of the Add Health database allows them to mitigate this endogeneity problem

[19] Reciprocity is actually one of the requirements listed by Granovetter (1973) to distinguish between "weak" and "strong" ties.

[20] This is also the same estimation strategy followed in all the relevant literature cited in this paper.

[21] Note also that Stage 1 decisions contribute to the matching protocol of Stage 2 (and in this sense, network elicitation affects giving decisions, albeit indirectly).

by controlling for proxies of "leadership" and "self-esteem" which are correlated with the variable of interest, but also can affect subjects' position in their social network. Our data does not allow us to replicate such an estimation strategy. However, experimental methods could allow us to control network dynamics and their coevolution with subjects' behavioral traits in more detail. The analysis of this question is left for future research.

Appendix A

Table 2
Regressions for giving and selfish with interactions.

	Indegree centr.		Out-degree centr.		Rec. degree centr.		Betweenness centr.	
	Altruism [5a]	Selfish [5b]	Altruism [6a]	Selfish [6b]	Altruism [7a]	Selfish [7b]	Altruism [8a]	Selfish [8b]
Centrality	.241	−1.353	−.743	−.240	1.109**	−1.750**	1.086**	−1.790***
	(.456)	.892	(.485)	(.765)	(.484)	(.805)	(.449)	(.712)
Centr. × Friends	.227	.321	1.473	[a]	−.071	[a]	−.149	[a]
	(978)	(1.493)	(1.138)		(.930)		(1.088)	
Female	.775	−.984	.959**	−1.271**	.505	−.963	.639	−.875
	(.486)	(.618)	(.481)	(.646)	(.520)	(.641)	(.486)	(.653)
Friends	1.500*	−.884	1.081	−.600	1.912**	−1.226	1.716*	−1.018
	(857)	(.872)	(.718)	(.729)	(.810)	(.786)	(1.038)	(.765)
Fram.	1.246***	−1.367	1.026**	−1.150	1.489***	−1.718**	1.432***	−1.483*
	(.497)	(.887)	(.508)	(.806)	(.482)	(.868)	(.494)	(.851)
Cons.	–	1.259	–	−.198	–	.594	–	.644
		(1.036)		(.606)		(.701)		(.690)

[a] Variable dropped.
Standard errors parentheses. $N = 79$ ($p > \chi^2 < .1$).
* Highlight significance at $p = .1$, respectively.
** Highlight significance at $p = .05$, respectively.
*** Highlight significance at $p = .01$, respectively.

Table 3
Regressions for Non-Friends treatments.

	Altruism [9a]	Selfish [9b]	Altruism [10a]	Selfish [10b]	Altruism [11a]	Selfish [11b]	Altruism [12a]	Selfish [12b]
In-degree	.289	−1.347	–	–	–	–	–	–
	(.516)	(.904)						
Out-degree	–	–	−.814	.497	–	–	–	–
			(.546)	(.957)				
Rec. degr.	–	–	–	–	1.351**	−1.566	–	–
					(.578)	(.988)		
Between.	–	–	–	–	–	–	1.271**	−1.914**
	–	–	–	–	–	–	(.514)	(.886)
Female	.646	−1.068	.952	−1.391	.264	−1.018	.478	−1.048
	(.641)	(.779)	(.614)	(.869)	(.702)	(.776)	(.634)	(.805)
Fram.	1.415**	−1.369	1.187**	−.932	1.733***	−1.598*	1.646***	−1.509*
	(.595)	(.893)	(.599)	(.864)	(.585)	(.978)	(.603)	(.817)
Cons.	–	1.383	–	.924	–	1.493	–	1.530
		(1.215)		(1.181)		(1.203)		(1.349)

Standard errors between parentheses. $N = 52$ ($p > \chi^2 < .1$).
* Highlight significance at $p = .1$, respectively.
** Highlight significance at $p = .05$, respectively.
*** Highlight significance at $p = .01$, respectively.

References

Andreoni, J., Vesterlund, L., 2001. Which is the fair sex? Gender differences in altruism. Quart. J. Econ. 116, 293–312.
Bohnet, I., Frey, B.S., 1999. Social distance and other-regarding behavior in Dictator Games: Comment. Amer. Econ. Rev. 89, 335–339.
Bolton, G.E., Katok, E., Zwick, R., 1998. Dictator Game giving: Rules of fairness versus acts of kindness. Int. J. Game Theory 27, 269–299.
Boyd, R., Richerson, P.J., 2002. Group beneficial norms can spread rapidly in a structured population. J. Theoret. Biol. 215, 287–296.
Brañas-Garza, P., 2006. Poverty in Dictator Games: Awakening solidarity. J. Econ. Behav. Organ. 60, 306–320.
Brañas-Garza, P., 2007. Promoting helping behavior with framing in Dictator Games. J. Econ. Psych. 28, 477–486.
Burnham, T.C., 2003. Engineering altruism: A theoretical and experimental investigation of anonymity and gift giving. J. Econ. Behav. Organ. 5, 133–144.
Calvó-Armengol, A., Patacchini, E., Zenou, Y., 2009. Peer effects and social networks in education. Rev. Econ. Stud. 76, 1239–1267.
Cassar, A., 2007. Coordination and cooperation in local, random and small world networks: Experimental evidence. Games Econ. Behav. 58, 209–230.
Charness, G., Gneezy, U., 2008. What's in a name? Anonymity and social distance in dictator and ultimatum games. J. Econ. Behav. Organ. 68, 29–35.
Croson, R., Gneezy, U., 2009. Gender differences in preferences. J. Econ. Lit. 47 (2), 448–474.

Durlauf, S., 2004. Neighborhood effects. In: Henderson, J.V., Thisse, J.F. (Eds.), In: Handbook of Regional and Urban Economics, vol. 4. North-Holland, Amsterdam, pp. 2173–2242.
Eckel, C., Grossman, P.J., 1996. Altruism in anonymous Dictator Games. Games Econ. Behav. 16, 181–191.
Eckel, C., Grossman, P.J., 1998. Are women less selfish than men?: Evidence from dictator experiments. Econ. J. 108, 726–735.
Eshel, I., Samuelson, L., Shaked, A., 1998. Altruists, egoists and hooligans in a local interaction model. Amer. Econ. Rev. 88, 157–179.
Fosco, C., Mengel, F., 2008. Cooperation through imitation and exclusion in networks. Mimeo, Universidad de Alicante.
Goeree, J., McConnell, M., Mitchell, T., Tromp, T., Yariv, L., forthcoming. The 1/d Law of Giving. Amer. Econ. J.: Microeconomics.
Goodreau, S.M., 2007. Advances in exponential random graph (p*) models applied to a large social network. Social Network 29, 231–248.
Goyal, S., 2007. Connections. An Introduction to the Economics of Networks. Princeton Univ. Press, Princeton.
Granovetter, M.S., 1973. The strength of weak ties. Amer. J. Sociol. 78, 1360–1380.
Hoffman, E., McCabe, K., Shachat, K., Smith, V.L., 1994. Preferences, property rights, and anonymity in bargaining games. Games Econ. Behav. 7, 346–380.
Hoffman, E., McCabe, K., Smith, V.L., 1996. Social distance and other-regarding behavior in Dictator Games. Amer. Econ. Rev. 86, 653–660.
Jackson, M., 2008. Social and Economic Networks. Princeton Univ. Press, Princeton.
Jones, B., Rachlin, H., 2006. Social discounting. Psychol. Sci. 17, 283–286.
Leider, S., Mobius, M., Rosenblat, T., Quoc-Anh, D., 2009. Directed altruism and enforced reciprocity in social networks. Quart. J. Econ. 124 (4), 1815–1851.
List, J., 2007. On the interpretation of giving in Dictator Games. J. Polit. Economy 115, 482–493.
Marsilli, M., Vega-Redondo, F., Slanina, F., 2004. The rise and fall of a networked society: a Formal model. Proc. Natl. Acad. Sci. USA 101, 1439–1442.
Newman, M.E.J., 2002. Assortative mixing in networks. Phys. Rev. Lett. 89 (20), 208701.
Nowak, M., 2006. Five rules for the evolution of cooperation. Science 314, 1560–1563.
Watts, D.J., Strogatz, S.H., 1998. Collective dynamics of 'small-world' networks. Nature 393, 440–442.