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Social Networks and Trust: not the Experimental Evidence you may Expect

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Abstract

We run a laboratory experiment were 'friendship' networks are generated endogenously within an anonymous group. Our experiment builds on two phases in sequence: a network formation game and a trust game. We find that in those sessions where the trust game is played before the network formation game, the overall level of trust is not significantly different from the one observed in a simple trust game; in those sessions where the trust game is played after the network formation game we find that the overall level of trust is significantly lower than in the simple trust game. Hence surprisingly trust does not increase because of 'enforced reciprocity' and moreover a common social history does affect the level of trust, but in a negative manner. Where network effects matter is in the choice of whom to trust: while we tend to trust less on average those with whom we have already interacted compared to total strangers, past history allows us to select whom to trust relatively more than others.

Keywords: network formation, trust game, experiments

JEL classification: C91, C92, L140

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1 Introduction

Do we trust friends better than strangers? Most of us do. But why? Are they trustworthy because they are our friends, or are they our friends because they are trustworthy?

A long-standing puzzle in experimental economics if why do we trust at all. While trust among strangers is difficult to reconcile with rationality and has typically been offered behavioural explanations in the literature, in a repeated interaction setting such as the one represented by friendship trust can be fully

reconciled with rationality. We can think of at least two possible explanations: if we anticipate that we are going to have future occasions to interact we may rationally choose to behave cooperatively in fear of future retaliation (enforced reciprocity); on the other hand, we know our friends and on the basis of their past behaviour we are able to tell if they are trustworthy and likely to reciprocate in the future.

Leider et al (2007) run a large scale field experiment where they map real friendship networks among university students and measure trust as a function of the social distance between them. They find that being friends increases the level of trust above what could be explained by altruistic preferences (*absolute trust*) and argue that *differential trust* is caused by repeated interaction.

We run a laboratory experiment were 'friendship' networks are generated endogenously within an anonymous group. While these networks do not replicate the complexity of real world friendship, they nevertheless possess the features of repeated interaction that have been claimed to explain differential trust. Compared to field experiments, the laboratory setting has the clear advantage to be able to control the endogeneity of the network formation and therefore to disentangle the differential trust that can be attributed to repeated interaction from any other possible explanation that may affect both trust and friendship formation[1].

Our experiment builds on two phases in sequence: a network formation game, where experimental subjects make choices on potentially beneficial network connections, and a trust game. The trust game is played only once, while the network formation game is a repeated game with a random stopping rule. We run two treatments: one with the trust game followed by the network formation game and one with the sequence played the other way around. As a control, experimental subjects play the trust game on its own.

If the higher level of trust documented across friends occurs because of enforced reciprocity, then subjects should trust and reciprocate more in those sessions where they know that a network formation game follows the trust game. Similarly, if one trusts friends more because a common social history has revealed them as trustworthy, we expect to find higher level of trust in those sessions where the trust game follows the network formation game. None of these two expectations finds support in our results. We find that in those sessions where the trust game is played before the network formation game, the overall level of trust is not significantly different from the one observed in a simple trust game: hence we do not appear to find support for the claim that we may trust friends more because we fear future retaliation. In those sessions where the trust game is played after the network formation game we find that the overall level of trust is significantly lower than in the simple trust game: hence a common social history does affect the level of trust, but in a negative

[1] Attractiveness, for example, affects the level of trust (Eckel and Wilson, 2006); cultural differences (Bornhost et al, 2004a), gender (Bohnet and Zeckhauser, 2004; Eckel and Grossman, 2006; Alesina and La Ferrara, 2002, Eckel and Wilson, 2003) and race (Glaeser et al, 2000) have an impact on the level of cooperation among experimental subjects. Naturally friendship formation may also be influenced by the same variables.

manner. Where network effects matter is in the choice of whom to trust: while we tend to trust less on average those with whom we have already interacted compared to total strangers, past history allows us to select whom to trust relatively more than others.

1.1 Literature review

Since a seminal article by Berg, Dickhaut and McCabe (1995), an extensive experimental literature has developed aiming to document and explain trust. Complementing experimental with survey data, a large literature starting from Glaeser et al (2000) also attempts to measure trust and to identify its empirical correlates in variables such as gender (see also Bohnet and Zeckhauser, 2004; Eckel and Grossman, 2006; Alesina and La Ferrara, 2002, Eckel and Wilson, 2003), race (see also Fershtman and Gneezy, 2001), family status, social status and connections (the already cited Leider et al, 2007, but also Goeree et al, 2007). This literature is so vast that we do not attempt a review here and we focus instead on those contributions to which our paper and results can be more directly compared.

The trust game that we consider here is different from the standard trust game in many respects. While the usual setting involves two subjects with distinct roles (sender and recipient), here we allow 6 subjects to choose simultaneously whom to trust with an offer. Hence in our setting: subjects choose whom to trust; they play both roles in the trust game; each subject may receive offers from more than one sender (and potentially reciprocate with each of them). Some of these features have already been considered in the literature, but not all of them within the same setting. Eckel and Wilson (2003) find that choosing the partner in a trust game increases both the level of trust and reciprocity. Burks, Carpenter and Verhoogen (2003) show that playing both roles in the trust game reduces the level of trust. They attribute this finding to a *reduced responsibility effect*: senders do not take full responsibility for their recipients' final winnings, being aware that they will in turn play as senders.

The main innovation in our setup is in the fact that a one-shot trust game module is combined with a network formation phase. When network formation is played first, the trust game is no longer anonymous since participants know each other from the network formation game[2]. From this point of view our trust game shares common features with the experimental literature on 'partners versus strangers': in a public good game, Andreoni and Croson (2001) test the behaviour of players in a repeated game (partners) and in a repeated single-shot game (strangers) and find that strangers cooperate significantly more than partners. If the network game follows the trust game, overall interaction is no longer one-shot as there is a continuation after the trust game. Bornhorst et al (2004b) study a finitely repeated trust game and find that level of trust is higher than in one-shot games and declines over time. They attribute this finding to learning.

[2] Real world identities are never revealed, but experimental subjects are identified by the same label across the two games.

2 Experimental Design

The experiment was run at the Center for Experimental Economics at Roma Est (CESARE, LUISS) with a sample of 108 undergraduates in Economics. Each subject participated in only one session and none had previously participated in a similar experiment. Subjects were randomly matched in groups of 6 and invited to reach the laboratory at different times. Upon arrival, each group was distributed detailed instructions[3] for the experiment and seating was assigned by the experimenters. The instructions were read aloud and time was allowed for questions. In a questionnaire run at the end of the session students confirmed that both the instructions and the experimental design were clear. The experiment was conducted by using a computerised setup[4] and communication among subjects in the room was prevented both by appropriately distanced seating and invigilation.

Each session lasted approximately 40 minutes and was composed of two phases in sequence: a trust game and a network formation game. At the beginning of each session subjects were informed that the experiment consisted of the two phases in sequence and they were told that the computer would inform them which of the two phases to play first. They were also informed that at the end of the session they had to complete a questionnaire[5].

We run a total of 18 sessions in 3 treatments: 6 sessions with network formation first; 6 sessions with trust game first and 6 control sessions with trust game only. Subjects total earnings were determined by the sum of the profits in each phase and were paid using a conversion rate of 100 points per euro.

2.1 The network formation game

The experimental implementation of the network formation game is as in Di Cagno and Sciubba (2007) and follows the theoretical framework in Goyal and Joshi (2003). The idea is that agents can propose links to one another. Proposals of links are unilateral, but links are established only if mutually agreed. The purpose of establishing links is that agents earn benefits for each other participant that they are able to reach through their network: benefits are earned not only through those that are reached directly, but also through those that agents reach indirectly, through the connections made by others. While only direct links are costly, all connections, both direct and indirect, are beneficial in the same way. Hence the aim for a profit maximising agent is to reach as many nodes as possible with the minimum number of direct links (the equilibrium network is minimally connected: all agents are included and there are no redundant links). Players pay a cost for established links, but not for unmatched proposals.

Sessions consisted of a minimum of 15 rounds, with a random stopping rule

[3] See appendix.

[4] We thank Andrea Lombardo (InformaRoma) for developing very nice software.

[5] See appendix.

determining the end of the experiment[6]. The initial screen for each participant is shown in figure 1a.

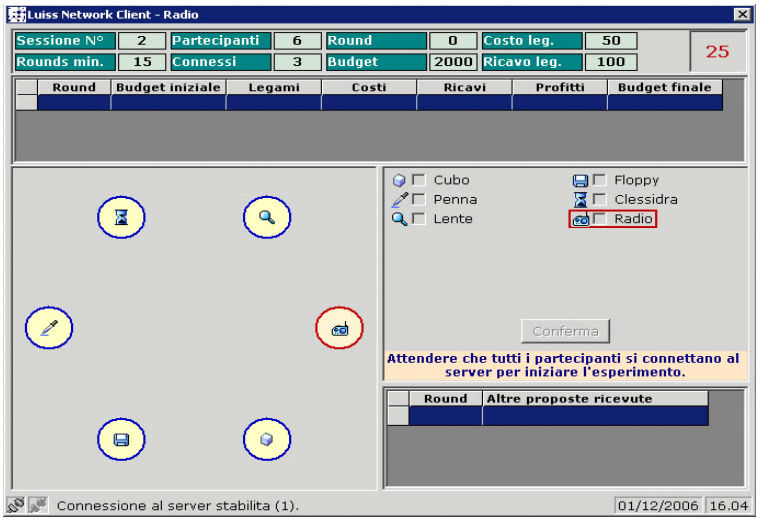

Figure 1a: The initial screen.

Participants are represented on the screen by different symbols which we considered neutral in that they do not provide subjects any particular clue when deciding to establish a link with another player in the group[7]. Subjects do not know their symbol (or the other participants' symbols) in advance and can identify themselves on the screen because their symbol is circled in red. The screen also displays the relevant parameters for the session at play. In particular the initial endowment that participants have at their disposal, the unitary cost for established links and the unitary benefit for reached nodes.

In each round subjects are asked to submit (anonymously and independently) their choice of intended links: they can do so by ticking the relevant boxes on the right-hand side of the screen. After all subjects have confirmed their choices, the computer checks which links are mutually desired and activates them. At the end of each round payoffs are computed and displayed on the screen. Great care was put in making sure that all information available to experimental subjects was provided in a user-friendly way. For this reason the graphical interface was designed so that actual links were visualised on the screen as a graph, rather than as a list of activated ties, or as a matrix of 0/1 connections.

[6] At the end of round 15 (and of each additional round after that), a lottery administered by the computer decided if an additional round had to be played. The probability of new rounds was fixed at 50%. The lottery was visualised on participants' screens as two flashing buttons, one red (with a NO sign) and one green (with a YES sign).

[7] In this setting we want to avoid any salient coordination device that induces coordination on a particular network. In the pilot for a network formation experiment (see Di Cagno and Sciubba (2005)) we labeled participants with A,B,C,D,E,F and we found that the alphabetical ordering was explaining most of the networking decisions. See also Galizzi and Bernasconi (2005) and Falk and Kosfeld (2003).

As an example, Figure 1b shows the participants' screen at the end of round number 4. It displays the graph of all active links, total revenues, costs and profits in the round. It also provides information on unmatched proposals: each subject is informed of those players who have proposed a link to them but whom they have not reciprocated. At any time during the experiment participants have access to a great deal of information on past history: by clicking on the bar corresponding to each round they are able to visualise the graph of active links, profits obtained, and all other information relevant to that round.

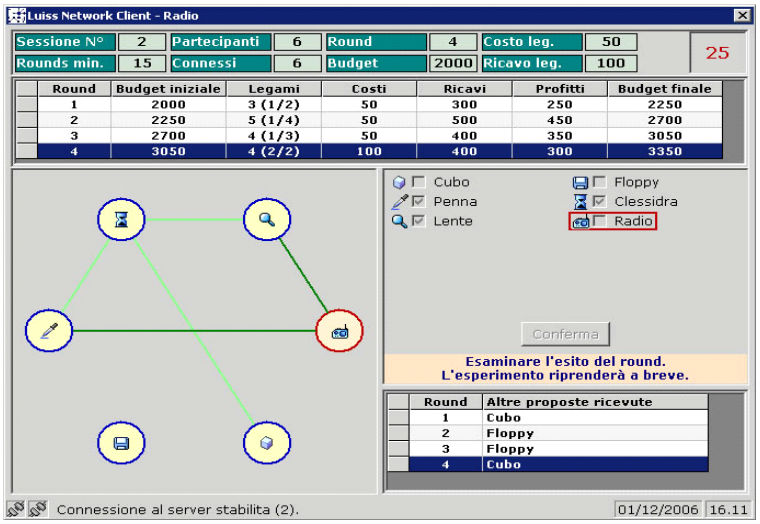

Figure 1b: The participants' screen at the end of round 4.

2.2 The trust game

The trust game is played by a group of 6 subjects. This is the same group that plays the network formation game and each participant in the group is identified by the same icon that also identifies him/her in the network formation game (which may precede or follow).

All subjects are freshly endowed with 1000 experimental units and have the possibility to choose to donate any integer amount between 0 and 1000 to one and only one subject of their choice within the same group. When the trust game is played before the network formation game, the trust game is completely anonymous. When the trust game is played after the network formation game, participants have observed others' past behaviour in the network formation phase.

Offers are collected by the computer, multiplied by 3 and shown on the screen of the receivers.

Receivers observe the icon corresponding to the donors and have the possibility to reciprocate by sending back a sum between 0 and the amount received (in turn, equal to 3 times the offer made by the donor). When more than one

offer is received, beneficiaries have the opportunity to reciprocate with each individual donor according to the same rules. Subjects are aware that the trust game is played only once. In those sessions where the trust game is played first, subjects are also aware that a network formation game will follow and that the same identities will be carried over.

2.3 Treatments

We run a total of 18 sessions: 6 sessions with network formation first (treatment 1); 6 sessions with trust game first (treatment 2); and 6 control sessions with trust game only (control).

For the network formation phase we used two sets of parameters: in particular 6 sessions (3 from treatment 1 and 3 from treatment 2) involved a lower cost of link formation; 6 sessions (3 from treatment 1 and 3 from treatment 2) involved a higher cost of link formation. Initial endowment and unitary benefit were kept constant across sessions. In the trust game phase the initial endowment was kept equal to 1000 throughout. In more detail, parameters for all sessions are presented in the table below:

	Subjects	**Phase played first**	**Network phase**			**Trust phase**
			Initial endowment	*Unitary cost*	*Unitary benefit*	*Initial endowment*
Treatment 1						
Sessions 1-3	6	Network	500	90	100	1000
Sessions 4-6	6	Network	500	120	100	1000
Treatment 2						
Sessions 7-9	6	Trust	500	90	100	1000
Sessions 10-12	6	Trust	500	120	100	1000
Control Treatment						
Sessions 13-18	6	-	-	-	-	1000

All relevant parameters were equal across participants and displayed on the screen at any time throughout the experiment.

2.4 Questionnaire

At the end of all sessions the computer administered a simple multiple-choice questionnaire to gather basic demographic information and trust indicators for the experimental subjects. The complete questionnaire is in the appendix. Summary statistics for the answers obtained are reported below.

TREATMENT	1	2
What is your sex? (% female)	36.11	13.89
Have you a brother or a sister? (% yes)	63.89	66.67
Where are you from? (% north, % center, % south)	2.78	5.55
	54.89	52.78
	33.33	41.67
Are you satisfied with the amount you earned during the experiment? (% no)	52.78	44.44
Were the instructions and the experiment clear? (% no)	36.11	27.78
Do you think that you would have earned more if you had more experience with this game? (% yes)	19.44	13.89
Do you like to share things with your friends? (% no)	25	19.44
You have forgotten your watch in the university lavatories. Do you expect that you will find it there when you go back? (% no)	50	83.33
You have lost your wallet on a bus. Do you expect it will be given back to you? (% no)	58.33	69.44
You are sharing a lottery ticket with some friends, but the ticket is with them. In case you win, do you expect that your friends will share the prize? (% no)	16.67	8.33

We tested whether demographics and reported trust indicators matter in explaining observed differences across the two treatments, however we could not detect any significant role of these variables (see tables in the appendix).

3 Results

3.1 Network formation

Tables 1 and 2 provide some descriptive statistics for the network formation phase. In particular table 1 groups sessions by treatment and table 2 groups sessions by cost parameters. While the study of how behaviour in the trust game may affect subjects's choices in the network formation stage is outside the scope of the present paper, it is nevertheless interesting to notice that there do not seem to be obvious ways in which the network formation phase differs across the two treatments. The average number of proposals and links established by each subject does not seem to differ across treatments (2.22 proposals and 1.37 links in treatment 1, versus 2.38 proposals and 1.34 links in treatment 2). The number of connections that is secured through a single direct link is higher when the network game follows the trust game (2.03 in treatment 2 versus 1.75 in treatment 1). This may be interpreted as a higher level of efficiency attained whenever trust is established before link formation starts: if more connections are attained on average through fewer direct links, this implies that there are fewer redundant links. However it is not clear whether this is due to improved coordination, since the indication that we have by comparing the ratios of proposals to links goes in the opposite direction: in treatment 1 it takes 1.59 proposals on average to secure a link; when the trust game is played first (treatment 2) it takes subjects 1.8 proposals instead. Also, average profits earned by subjects in the network formation phase in the two treatments are 2382 and 1800 in treatments 1 and 2 respectively. Hence network formation does not seem to be more efficient when trust is played first.

More in general we do not detect any major differences in the way in which

networks are formed across treatments and in both cases the results conform to the ones obtained in Di Cagno and Sciubba (2007) where no trust game was played.

Session	Rounds	Links	Connections	Conn/Links	Proposals	Prop/Links
1	15	2.13	4	1.88	3.12	1.46
2	20	1.8	4.15	2.31	2.72	1.51
3	20	1.23	2.43	1.98	2.23	1.81
4	18	1.24	1.3	1.05	2.32	1.87
5	18	0.57	0.68	1.19	0.6	1.05
6	18	1.26	2.67	2.12	2.34	1.86
avg		**1.37**	**2.54**	**1.75**	**2.22**	**1.59**
var		0.29	1.95	0.26	0.74	0.10
7	15	1.29	2.69	2.09	2.59	2.01
8	17	1.73	3.61	2.09	2.87	1.66
9	16	1.54	3.17	2.06	2.79	1.81
10	19	1.46	3.51	2.40	2.3	1.58
11	15	1.02	1.8	1.76	1.78	1.75
12	20	0.98	1.75	1.79	1.94	1.98
avg		**1.34**	**2.76**	**2.03**	**2.38**	**1.80**
var		0.09	0.68	0.06	0.20	0.03

Table 1: Descriptive statistics on network formation, by treatment.

Table 2 shows that as far as network formation is concerned most of the action lies in cost differences: in low cost sessions (1-3 and 7-9) the number of proposals and links are significantly higher than in high cost sessions (4-6 and 10-12). As expected profits are much lower in high cost sessions (average profit 886) than in low cost ones (average profit 3297).

Session	Rounds	Links	Connections	Conn/Links	Proposals	Prop/Links
1	15	2.13	4	1.88	3.12	1.46
2	20	1.8	4.15	2.31	2.72	1.51
3	20	1.23	2.43	1.98	2.23	1.81
7	15	1.29	2.69	2.09	2.59	2.01
8	17	1.73	3.61	2.09	2.87	1.66
9	16	1.54	3.17	2.06	2.79	1.81
avg		**1.62**	**3.34**	**2.06**	**2.72**	**1.71**
var		0.11	0.49	0.02	0.09	0.04
4	18	1.24	1.3	1.05	2.32	1.87
5	18	0.57	0.68	1.19	0.6	1.05
6	18	1.26	2.67	2.12	2.34	1.86
10	19	1.46	3.51	2.40	2.3	1.58
11	15	1.02	1.8	1.76	1.78	1.75
12	20	0.98	1.75	1.79	1.94	1.98
avg		**1.09**	**1.95**	**1.72**	**1.88**	**1.68**
var		0.10	1.01	0.27	0.45	0.11

Table 2: Descriptive statistics on network formation, by cost parameters.

Figures 2a and 2b provide typical examples of network formation for low cost (session 2 displayed here) and high cost (session 12 displayed here) sessions.

There are a few features that are common across low cost sessions and worth noticing: the number of links that subjects succeed in establishing increases after the first few rounds; although there is a tendency to include more and more subjects in the network, some remain isolated at times; some links are recurrent over time (see, for example, the link between subjects 1 and 4, and 1 and 5); some subjects emerge as 'hubs' for a star network across agents (in session 2 subject 1 takes this role). Session 12 is quite typical of high cost sessions, with a much lower number of links established: as for low cost sessions, we notice here that the few persistent links are across the same subjects (link between 4 and 6; and between 1 and 6).

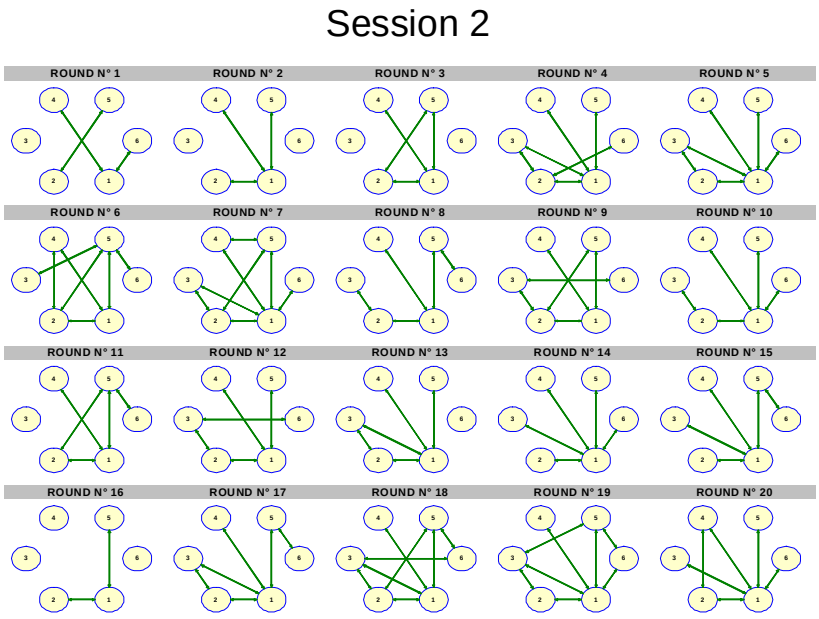

Figure 2a: Network formation in session 2 (treatment 1, low cost).

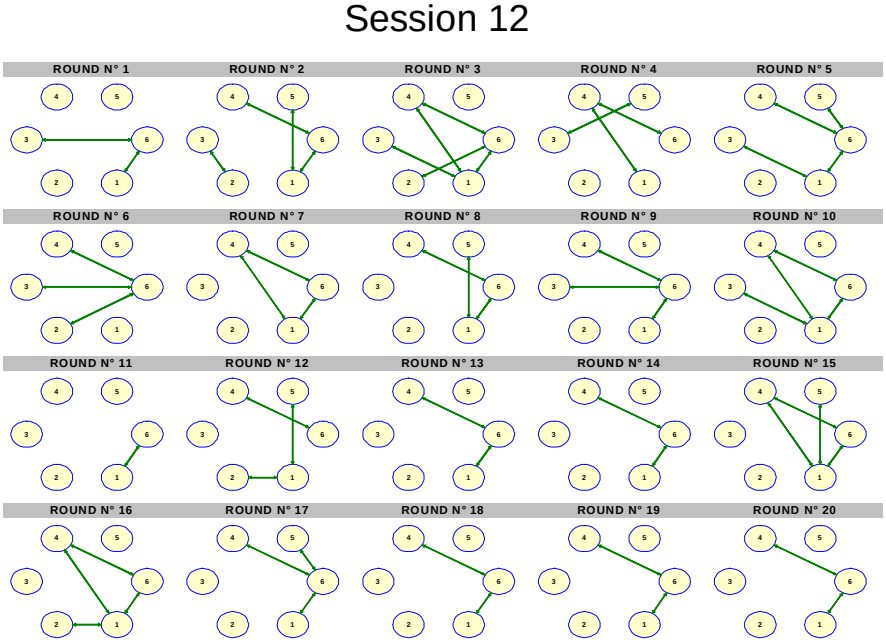

Figure 2b: Network formation in session 12 (treatment 2, high cost).

3.2 Trust game

We run 6 control sessions where subjects played our version of the trust game only. Interestingly the results obtained here show that the modified framework does not change the main qualitative results that have been long established by the experimental literature. All subjects made a positive offer, ranging from a minimum of 100 to a maximum of 1000. On average subjects donated slightly more than half of their endowment (average offer of 578); 20 over the 36 recipients reciprocated the offer and those who did sent back an average amount equal to 50% of the offer received.

Results are shown in table 3 and figure 3.

Session	Proposer	Recipient	Offered	Sent Back	Ratio
TG1	1	5	600	300	0.50
TG1	2	4	300	200	0.67
TG1	3	5	100	100	1.00
TG1	4	3	100	200	2.00
TG1	5	4	100	100	1.00
TG1	6	3	200	300	1.50
TG2	1	5	1000	0	0.00
TG2	2	3	500	800	1.60
TG2	3	1	400	400	1.00
TG2	4	3	500	600	1.20
TG2	5	4	300	100	0.33
TG2	6	3	300	400	1.33
TG3	1	3	1000	0	0.00
TG3	2	1	800	800	1.00
TG3	3	1	1000	0	0.00
TG3	4	5	1000	0	0.00
TG3	5	6	700	0	0.00
TG3	6	1	700	600	0.86
TG4	1	2	1000	0	0.00
TG4	2	3	500	0	0.00
TG4	3	4	750	0	0.00
TG4	4	5	800	0	0.00
TG4	5	6	850	500	0.59
TG4	6	1	700	0	0.00
TG5	1	2	500	100	0.20
TG5	2	5	500	300	0.60
TG5	3	6	120	0	0.00
TG5	4	1	200	50	0.25
TG5	5	3	100	150	1.50
TG5	6	1	300	0	0.00
TG6	1	2	930	0	0.00
TG6	2	3	850	50	0.06
TG6	3	4	900	0	0.00
TG6	4	5	1000	700	0.70
TG6	5	1	300	0	0.00
TG6	6	1	930	0	0.00
AVG			578.61	187.5	0.50

Table 3: Trust game, control treatment.

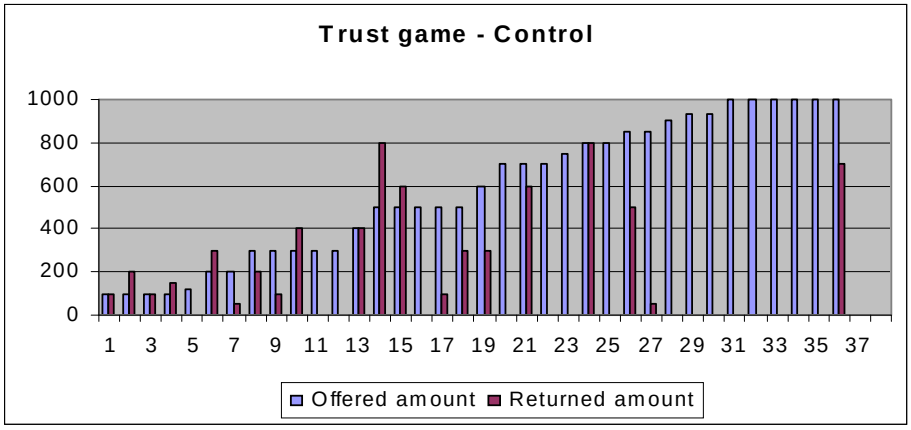

Figure 3: Trust game, control treatment.

The most striking result from treatment 1 is that when the trust game is played after the network formation game subjects trust significantly less than in the control treatment: the average offer is equal to 232 (whereas it is 579 in the control); moreover while all subjects made a strictly positive offer in the control treatment, here 7 (over 36) subjects decided not to offer anything to anyone. For reciprocity the results are not too dissimilar for what we have in the control: 21 out of the 29 subjects who received a positive offer reciprocated by sending back an average of 48% of the donation received. Results for treatment 1 are shown in table 4 and figure 4.

Session	Proposer	Recipient	Offered	Sent back	Ratio
1	1	2	0		
1	2	4	500	500	100%
1	3	1	100	0	0%
1	4	2	450	200	44%
1	5	6	100	10	10%
1	6	5	300	200	67%
2	1	2	0		
2	2	3	200	0	0%
2	3	6	100	40	40%
2	4	6	100	50	50%
2	5	1	100	150	150%
2	6	1	0		
3	1	2	100	100	100%
3	2	3	800	400	50%
3	3	1	0		
3	4	5	300	300	100%
3	5	6	100	100	100%
3	6	4	100	50	50%
4	1	2	0		
4	2	4	400	100	25%
4	3	2	0		
4	4	1	400	400	100%
4	5	4	300	100	33%
4	6	2	100	50	50%
5	1	5	400	0	0%
5	2	1	0		
5	3	2	500	500	100%
5	4	6	500	100	20%
5	5	3	400	400	100%
5	6	3	100	100	100%
6	1	5	300	0	0%
6	2	5	100	0	0%
6	3	5	900	100	11%
6	4	3	200	0	0%
6	5	3	300	0	0%
6	6	1	100	0	0%
AVG			**231.94**	**136.21**	**0.48**

Table 4: Trust game, treatment 1.

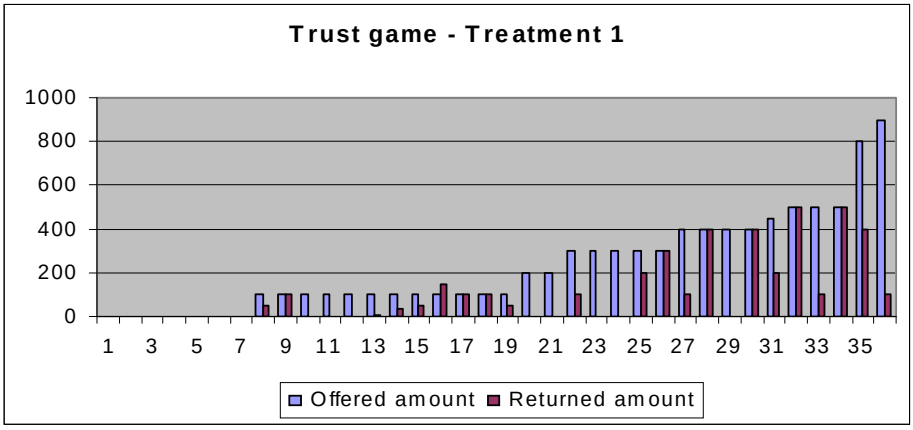

Figure 4: Trust game, treatment 1.

Per contrast, the results from treatment 2 are equally unexpected but for the opposite reason. When the trust game is followed by a network formation game there is no significant increase in the level of trust compared to the simple trust game. Only one subject did not offer (while everyone offered in the control) and the average offer was equal to 552 (versus 579 in the control). Repeated interaction that follows has more of an impact on reciprocity: 25 out of 35 people reciprocated (as opposed to 20 out of 36) by sending back an average amount equal to 68% (rather than 50%) of the amount received. Results for treatment 2 are shown in table 5 and figure 5.

Session	Proposer	Recipient	Offered	Sent Back	Ratio
7	1	5	300	150	0.50
7	2	4	100	150	1.50
7	3	5	200	300	1.50
7	4	3	50	75	1.50
7	5	4	100	0	0.00
7	6	3	1000	600	0.60
8	1	3	1000	0	0.00
8	2	1	1000	0	0.00
8	3	1	100	0	0.00
8	4	5	1000	0	0.00
8	5	6	500	0	0.00
8	6	1	800	0	0.00
9	1	2	1000	1500	1.50
9	2	3	15	20	1.33
9	3	4	500	300	0.60
9	4	5	1000	3000	3.00
9	5	6	600	20	0.03
9	6	1	500	300	0.60
10	1	5	500	0	0.00
10	2	3	0		
10	3	1	1000	500	0.50
10	4	3	500	0	0.00
10	5	4	500	0	0.00
10	6	3	150	100	0.67
11	1	2	1000	1000	1.00
11	2	5	1000	20	0.02
11	3	6	200	300	1.50
11	4	1	1000	500	0.50
11	5	3	1000	1500	1.50
11	6	1	1000	1500	1.50
12	1	2	2	3	1.50
12	2	3	1000	1	0.00
12	3	4	200	100	0.50
12	4	5	300	300	1.00
12	5	1	150	2	0.01
12	6	1	600	600	1.00
AVG			551.86	366.89	0.68

Table 5: Trust game, treatment 2.

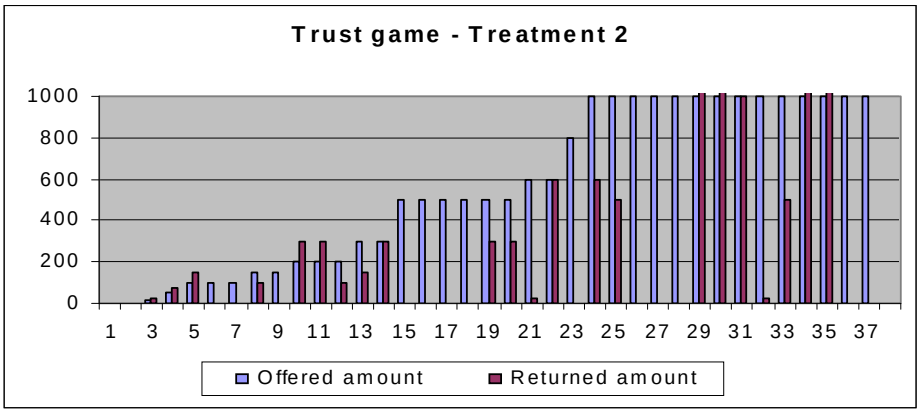

Figure 5: Trust game, treatment 2.

3.3 Networks and trust

In order to understand the impact of network formation on trust we run several OLS regressions to explain the amount offered and the amount sent back as a function of subjects' behaviour in the network formation game. We also added demographic data and trust indicators made available through a questionnaire run at the end of each session.

For the amount offered we propose that it is a function of: total number of direct links of the sender in the network formation phase; total number of direct links of the receiver; number of times that the sender proposed to the receiver; number of times that the sender failed to have his/her proposal to the receiver matched; profit of the sender in the network game; whether the session was a high or low cost one for link formation. Results for treatment 1 and 2 are in tables 6a and 6b respectively.

Dependent Variable: amount that i sends to j			
	Coefficient	**Std. Error**	**P-Value**
links of *i* in session (cum)	-5.57	6.55	0.405
links of *j* in session (cum)	-9.44	3.66	**0.017**
i proposed to *j* in session (cum)	37.86	17.75	**0.044**
i failed with *j* in session (cum)	-35.58	16.60	**0.043**
i's profit in network game	-0.01	0.03	0.771
high cost session	56.91	113.30	0.620
Constant	354.73	163.98	**0.042**
Number of observations: 29			
R^2 0.4331	Robust standard errors		

Table 6a: Amount offered, OLS regression, treatment 1.

Dependent Variable: amount that i sends to j			
	Coefficient	**Std. Error**	**P-Value**
links of *i* in session (cum)	13.39	8.06	0.108
links of *j* in session (cum)	3.22	8.01	0.691
i proposed to *j* in session (cum)	1.93	20.35	0.925
i failed with *j* in session (cum)	5.72	30.08	0.850
i's profit in network game	0.11	0.09	0.229
high cost session	120.89	267.04	0.654
Constant	-113.90	400.91	0.778
Number of observations: 35			
R^2 0.1842	Robust standard errors		

Table 6b: Amount offered, OLS regression, treatment 2.

As expected, the results are very different across treatments. In treatment 2, where the network formation game only occurs after the trust game has already been played, none of the network variables is significant in explaining the amount offered. We take this to confirm that any significance detected in treatment 1 depends exclusively on the sequentiality between the two phases and it is not to be attributed to other variables that jointly determine both the level of trust and subjects' behaviour in the network game.

In treatment 1 we find that donors make larger offers to those with whom they have succeeded in establishing frequent relationships: the amount offered is increasing in the number of times that the donor has proposed to the recipient, but decreasing in the number of times that the recipient has failed to reciprocate such proposals. Moreover offers tend to be larger when recipients do not have many links in place. It would seem that trust is established through frequent but exclusive relationships: subjects donate to those that they have been linked to and that have been linked with not too many others.

We test for significance of demographic factors and trust indicators. We do this in a OLS regression over both treatments, to find that none matters[8].

As for the amount sent back, we find that in both treatments it mostly depends on the amount received (with a coefficient of approximately 0.5). When the trust game is played after the network formation game, the recipient sends back a smaller amount when his/her profit in the network formation game has been smaller and in those sessions where the network formation involved higher costs, which again will have impacted negatively on recipients' profits. Having established reliable links in the network formation phase has no significance in explaining reciprocity and trustworthiness. Results for treatments 1 and 2 are shown in tables 7a and 7b respectively.

[8] See table in the appendix.

Dependent Variable: amount that *j* returns to *i*			
	Coefficient	**Std. Error**	**P-Value**
amount offered by *i*	0.51	0.13	**0.001**
links of *i* in session (cum)	0.73	6.94	0.917
links of *j* in session (cum)	1.93	2.01	0.346
j proposed to *i* in session (cum)	-12.02	12.87	0.361
j failed with *i* in session (cum)	5.03	14.35	0.729
j's profit in network game	-0.06	0.03	**0.065**
high cost session	-223.90	63.06	**0.002**
Constant	285.87	136.23	**0.048**
Number of observations: 29			
R^2 0.5284	Robust standard errors		

Table 7a: Amount sent back, OLS regression, treatment 1.

Dependent Variable: amount that *j* returns to *i*			
	Coefficient	**Std. Error**	**P-Value**
amount offered by *i*	0.43	0.16	**0.012**
links of *i* in session (cum)	-4.20	2.56	0.113
links of *j* in session (cum)	0.94	2.83	0.741
j proposed to *i* in session (cum)	-8.58	10.99	0.442
j failed with *i* in session (cum)	-1.04	13.88	0.941
j's profit in network game	-0.003	0.05	0.944
high cost session	-141.70	158.94	0.381
Constant	248.62	180.12	0.179
Number of observations: 35			
R^2 0.5027	Robust standard errors		

Table 7b: Amount sent back, OLS regression, treatment 2.

Again, in our regressions for reciprocity demographics and trust indicators do not matter. However agents are less trustworthy if they have been unsatisfied by the amount of money that they have earned in the experiment[9].

[9] See table in the appendix.

4 Concluding Remarks

By comparing the results obtained in the different treatments for the trust game, we find that history of play in the network formation game matters in determining the direction of trust. In choosing whom to trust, subjects select those with whom they have established stable links over time, by offering them relatively more than they do to the others. However the overall level of trust is lower when participants have known each other through the network formation game than when they play the trust game with complete strangers.

Going back to the field experiments results that observe more trust among friends, our analysis seems to suggest that neither reinforced reciprocity, nor signalling, are sufficient to explain the observed higher level of trust. It would seem in fact that a history of social interaction where both retaliation (treatment 2) and signalling (treatment 1) are possible, does not necessarily imply that participants trust each other more. In our setting past interaction has been profitable for some, but less so for others: those who were often isolated or failed to establish preferential links with others tend to trust less.

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APPENDIX

SESSION	1	2	3	4	5	6	7	8	9	10	11	12
What is your sex? (% female)	83.33	16.67	66.67	0	16.67	33.33	0	0	33.33	0	16.67	50
Have you a brother or a sister? (% yes)	83.33	16.67	83.33	66.67	66.67	66.67	50	50	66.67	66.67	66.67	100
Where are you from? (% north, % center, % south)	0	0	0	16.67	0	0	0	0	0	0	33.33	0
	100	50	66.67	66.67	66.67	33.33	66.67	66.67	50	66.67	16.67	50
	0	50	33.33	16.67	33.33	66.67	33.33	33.33	50	33.33	50	50
Are you satisfied with the amount you earned during the experiment? (% no)	50	16.67	50	66.67	50	83.33	83.33	33.33	33.33	66.67	33.33	16.67
Were the instructions and the experiment clear? (% no)	50	0	66.67	0	50	50	16.67	16.67	0	33.33	50	50
Do you think that you would have earned more if you had more experience with this game? (% yes)	16.67	33.33	33.33	0	16.67	16.67	0	0	0	0	50	33.33
Do you like to share things with your friends? (% no)	16.67	33.33	16.67	33.33	16.67	33.33	33.33	0	0	33.33	16.67	33.33
You have forgotten your watch in the university lavatories. Do you expect that you will find it there when you go back? (% no)	16.67	16.67	16.67	83.33	83.33	83.33	83.33	100	100	50	83.33	83.33
You have lost your wallet on a bus. Do you expect it will be given back to you? (% no)	66.67	50	50	83.33	50	50	16.67	83.33	100	100	50	66.67
You are sharing a lottery ticket with some friends, but the ticket is with them. In case you win, do you expect that your friends will share the prize? (% no)	33.33	33.33	16.67	16.67	0	0	33.33	0	0	16.67	0	0

Dependent Variable: amount that *i* sends to *j*			
	Coefficient	**Std. Error**	**P-Value**
links of *i* in session (cum)	1.20	3.04	0.694
links of *j* in session (cum)	-3.68	4.71	0.438
i proposed to *j* in session (cum)	25.66	12.97	**0.054**
i failed with *j* in session (cum)	-1.29	19.76	0.948
i's profit in network game	-0.017	0.026	0.515
high cost session	138.57	91.77	0.138
Female	-84.71	87.70	0.339
Has brother or sister	-5.59	76.89	0.942
North	83.69	126.58	0.512
South	-66.79	56.28	0.241
Not happy to share	-136.86	97.42	0.167
Does not expect to find watch	90.67	87.98	0.308
Does not expect to have back wallet	18.51	71.29	0.796
Does not expect to share lottery prize	-100.57	62.48	0.114
Unsatisfied	60.92	73.28	0.410
Experience	-95.72	102.15	0.354
Constant	89.77	172.24	0.605
Number of observations: 63			
R^2 0.3797	Robust standard errors		

Amount offered, OLS regression with demographics and trust indicators, treatments 1 and 2.

Dependent Variable: amount that *j* returns to *i*			
	Coefficient	**Std. Error**	**P-Value**
amount offered by *i*	0.40	0.11	**0.001**
links of *i* in session (cum)	-4.85	1.75	**0.008**
links of *j* in session (cum)	0.78	1.62	0.632
j proposed to *i* in session (cum)	-7.08	4.93	0.158
j failed with *i* in session (cum)	-7.19	9.68	0.461
j's profit in network game	-0.03	0.02	0.126
high cost session	-187.99	54.69	**0.001**
Female	-73.60	43.94	0.101
Has brother or sister	21.92	72.59	0.764
North	30.79	86.27	0.723
South	-29.81	43.84	0.500
Not happy to share	-19.64	52.90	0.712
Does not expect to find watch	18.55	41.03	0.653
Does not expect to have back wallet	38.04	41.43	0.363
Does not expect to share lottery prize	34.03	56.06	0.547
Unsatisfied	-68.92	40.58	**0.096**
Experience	53.60	50.10	0.290
Constant	376.59	111.74	**0.002**
Number of observations: 63			
R^2 0.5151	Robust standard errors		

Amount sent back, OLS regression with demographics and trust indicators, treatments 1 and 2.

INSTRUCTIONS (ENGLISH TRANSLATION)

Welcome.

This experiment comprises two phases: you will play in sequence the network game and the gifts game. You may be asked to play either the network game first and the gifts game second, or the gifts game first and the network game second. At the beginning of the experiment, your computer will tell you which of the two games you are asked to play first.

If you read carefully these simple instructions you will be able to earn a good amount of money that will be paid to you in cash immediately at the end of the experiment.

THE NETWORK GAME

The network game is an experiment on the formation of links among different subjects.

You are one of the 6 participants in this experiment; at the beginning of the experiment the computer will assign you an initial endowment of 500 experimental units and will randomly assign to you an icon (floppy, pen, radio, hand-lens, hourglass, or cube). The icon that identifies you is highlighted in red on your screen.

The experiment will last a random number of rounds: there will be at least 15 rounds and, after the 15th, a lottery will be administered by the computer in order to determine if the experiment will finish at that round or continue.

Each participant to the experiment represents a node. At the beginning of the experiment all nodes are isolated. In each round you will be asked by the computer if you want to connect to the other participants and to whom. You have the possibility to initiate one, two or more links The computer will receive all participants' proposals and will activate only the links that are mutually agreed. The graph of established connections will appear on your screen.

The window on the low right side of your screen will show you the proposals your received in previous rounds but which you did not match.

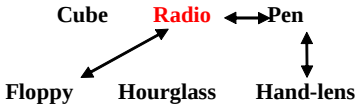
Each active link has a cost (equal for all participants) which is shown in the top window on your screen. In each round the computer will refuse your links' proposals if the expenditure required for the links that your propose, when activated, is greater than the budget that you have available to spend for that round.

In each round the compute will calculate your revenues as the product between the unitary revenue (equal for all nodes and shown in the top window on your screen) and the number of nodes that you will be able to reach both through your own and other participants' connections, as represented in the following example.

Computing costs and revenues

Example

Revenue per node: 100
Cost per link: 90



Radio's profit is equal to:

total revenue – total cost
total revenue = reached nodes x revenue per node = 3 x 100 = 300
total cost = direct links x cost per link = 2 x 90 = 180
profit = 120

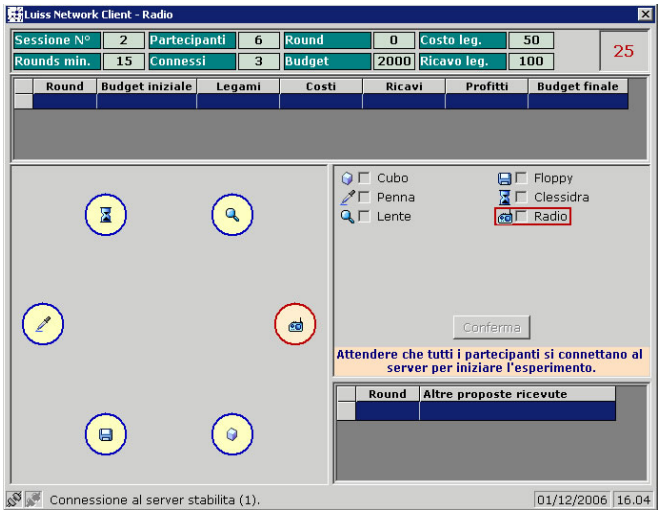
In each round the computer will calculate your profit and will display it on your screen. The overall profit from the network game is given by the sum of your profits in all rounds.

Your profit will be converted in euros on the basis of 100 experimental units = 1 euro.

More in detail

At the beginning of the experiment please wait for instructions from the experimenters.

You will find the following screen:



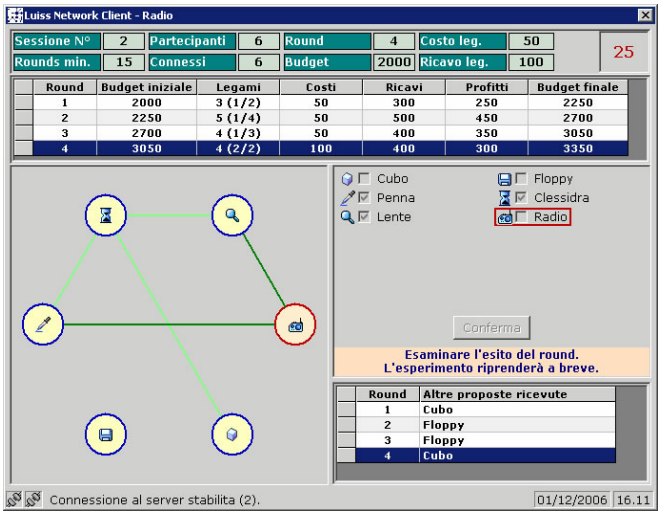
The green bar at the top of this screen gives you all the relevant information to the round you are about to play. In particular, it shows your initial endowment, the cost per link and the revenue per node.

In each round you will be able to choose to whom to propose a link by clicking on the relevant boxes corresponding to each of the other participants, in the window on the right hand side of your screen.

Be careful: every round will last at most the number of seconds indicated in red in the box at the top right of your screen. If you fail to make a choice before the given time, the computer will move you automatically to the next round.

At the end of each round the graph on the left hand side of your screen will show you the links that you (deep green) and the other participants (light green) have activated.

The table on the top is automatically updated and it shows you the results you scored in each round. The current round is highlighted in blue. You can click on the lines corresponding to the previous rounds to visualise again what the network and your profits, costs and revenues were then. The window at the bottom right of your screen provides you with additional information on proposals that you have received in previous rounds and that you have not matched.



At the end of each round, the computer will initiate a new round and you will be able to choose again to whom to link. This will occur in sequence for the first 15 rounds; after the 15th round, your screen will show two flashing lights. If they stop on green, you will have the chance to play another round; it they stop on red the network game is over.

THE GIFTS GAME

At the beginning of the gifts game you will be assigned a bonus of 100 experimental units.

You will have the chance to offer part of this amount to one and only one of the other players of your choice. The beneficiary will receive the amount you

offer multiplied by three. For example: if the player **Pen** decides to offer 300 units to the player **Cube**, the latter will receive 900 units.

The beneficiary - player **Cube** in our example - will in turn have the chance to give back to his donor some of the 900 units received (or even the whole amount, but not more). If the beneficiary does not want to give back anything, he has to enter 0 in the relevant box.

Be careful: both you and your beneficiary will have one and only one opportunity to offer and to give back.

To make your offer you will have to enter the desired amount in the box corresponding to your chosen beneficiary among the other participants to the experiment. If you do not want to offer anything to anyone, enter zero in each of the boxes. Remember that you will be able to make a positive offer to only one of the other participants. Hence the computer will reject your offer if you enter a positive amount in more than one box.

The profit you obtain in the gifts game is given by the difference between the initial bonus and the amount that you may have offered to one of the other participants, plus three times the amount that you may have been offered by one (or more) of the others net of what you may have decided to give back to them.

Your profit will be converted in euros with a ratio of 100 experimental units = 1 euro.

OVERALL PROFITS FOR THE EXPERIMENT

Your overall profits for the experiment are given by the sum of your profits in the network game and in the gifts game.

It is very important that you make choices independently and that you do not communicate with other participants during the experimental session.

For any problem, please contact the experimenters.
We hope you will find it fruitful.

Daniela Di Cagno
Emanuela Sciubba
April 2007.