Experimental comparison of direct, general, and indirect reciprocity

Kaisa Herne\textsuperscript{a}, Olli Lappalainen\textsuperscript{b}, Elina Kestilä-Kekkonen\textsuperscript{c}

\textsuperscript{a}University of Turku, Department of Political Science, kaisa.herne@utu.fi

\textsuperscript{b}Turku School of Economics, Department of Economics, olli.lappalainen@tse.fi,

\textsuperscript{c}National Institute for Health and Welfare, elina.kestila-kekkonen@thl.fi
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Abstract

We examine three forms of reciprocity – direct, indirect and generalized – using a sequential dictator game where the first round recipient becomes the second round dictator. In the case of direct reciprocity, the second round dictator rewards/punishes the second round recipient of her/his behaviour in the first round. In indirect reciprocity, the second round dictator is aware of the first round play but has not taken part in the first round play. S/he is yet able to punish/reward the first round dictator based on her/his behaviour in the first round. In generalized reciprocity, the second round dictator has taken part to the first round but is able to reward/punish someone else than the first round dictator. We investigate motivation behind reciprocal behaviour, and study whether reciprocity could be explained by social influence. We find that direct and generalized reciprocity are equally frequent. Intentions do not seem to play a role in our setting, and no evidence for social influence is found.

JEL classification D03

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1. Introduction

Reciprocity is an essential part of human cooperation and it entails punishing non-cooperators and rewarding those who cooperate. However, in the literature there is not an agreed understanding of what reciprocity means and the term is used in various meanings. A rough distinction can be made according to whether reciprocity is seen as action that provides mutual benefits for the reciprocators or whether such benefits are not expected. In this paper, we follow Seinen and Schram (2004) who define reciprocity as “conditional behaviour where kind acts are rewarded and hostile acts punished, even when this is costly and there is no direct self-interest to do so”. This is a rather loose definition which does not specify the reasons why people reciprocate. It includes reciprocity motivated by mutual benefit but does not require it. In this paper, reciprocity is studied in an experimental setting where strong reciprocity is expected. Fehr, Fischbacher and Gächter (2002; see also Gintis 2000; Bowles and Gintis 2001) emphasize that the essential feature of strong reciprocity is “a willingness to sacrifice resources even if this is costly and provides neither present nor future material rewards for the reciprocator”.

Direct reciprocity occurs between the same actors, i.e. A hurts/benefits B first and later B reciprocates A. Rapoport’s tit-for-tat strategy (Axelrod 1984) is a prime example of direct reciprocity. However, it appears that reciprocity is not restricted to its direct form, which occurs between the same actors, but that indirect and generalized reciprocity, where a third actor is involved, also play a role in developing and preserving social relationships. In indirect reciprocity, the return is expected from someone other than the actual recipient of the original action (Alexander 1987). Indirect reciprocity occurs when A hurts/benefits B first, and subsequently C who has information on A’s behaviour towards B reciprocates A. Nowak and Sigmund (1998) characterize positive indirect reciprocity by the pious advice “give, and you shall be given”. Alexander’s conception of indirect reciprocity refers to ongoing relations in large groups where interaction
occurs repeatedly and individuals build reputation and status. In generalized reciprocity, the return is directed to someone else than the original actor (see Moody 2008 for a review). Generalized reciprocity occurs when A hurts/benefits B first, and subsequently B reciprocates C. The reason might be that B is unwilling or unable to reciprocate A. The importance of indirect and generalized reciprocity is further corroborated by the fact that there seems to be an evolutionary basis for their existence (Nowak and Sigmund 1998; Nowak and Roch 2007). It can also be noted that generalized reciprocity has been observed among non-human species (Rutte and Taborsky 2007).

In this paper, we compare direct, indirect and generalized reciprocity experimentally. We distinguish players’ reactions to other players’ past action and their own experience with the aim to find out the relevance of each of these factors. We use the dictator game to get pure responses to other players’ behaviour independent of strategic motivations or motivations related to efficiency, risk attitudes or trust. We use two control treatments with randomized first round allocations to compare intention and outcome based explanations of reciprocal behaviour. Lastly, to test the social influence hypothesis, we include a treatment where the second round dictator is informed about the outcome of the first round allocation between a randomly chosen dictator-receiver pair, unrelated to her/his own receiver. We do not observe statistically different frequencies of direct, indirect and generalized reciprocity. Moreover, we do not find confirming evidence for the social influence hypothesis, whereas we find evidence for the relevance of outcome distributions in our experimental setting.

The paper is organized as follows. The next section summarizes the main results of previous studies and section three surveys different motivations offered as explanations for reciprocal behaviour. Section three also discusses the contribution of this study. Experimental procedures are described in
section four and hypotheses in section five. Results are represented in section six and discussed in section seven which also concludes the paper.

2. Reciprocity studies

Many studies on direct reciprocity indicate that it is an essential part of human behaviour (e.g. Bolton, Brandts and Ockenfels 1998; Charness 2002; Offerman 2002; Cox 2004). Indirect reciprocity is also observed frequently in repeated interaction. It seems that social status or reputation is important in giving other people hints of how to evaluate each individual and how to treat her/him (e.g. Sugden 1986, Wedekind and Milinski 2000, Ohtsuki and Iwasa 2004, Engelmann and Fischbacher 2004, Seinen and Schram 2004). Güth, Köningstein, Marchand and Nehring (2001) study what they call indirect reciprocity in a one-shot interaction. According to the terminology used in this paper their study allows for both indirect and generalized reciprocity. Güth et al. (2001; see also Dufwenberg, Gneezy, Güth and van Damme 2001; Greiner and Levati 2005) use the investment game and observe less investments and rewards in the case of indirect/generalized reciprocity than in the case of direct reciprocity. Ben-Ner, Putternan, Kong and Magan (2004) study generalized reciprocity experimentally by a two part dictator game (see below). They find lower correlation between amounts received and amounts given to the other player in the case of generalized reciprocity than in the case of direct reciprocity.¹ Cason and Mui (1998) study how social influence may affect subjects’ behaviour in a sequential dictator game framed as a market exchange. They find that subjects on the average make more self-regarding second stage allocations in the ‘Irrelevant Information’ treatment (they know the birthday of the recipient), but that receiving ‘Relevant Information’ (they know the first round dictator behaviour) does not result in a statistically significant shift towards self-regarding second stage allocation choices. Servatka (2010, 2009) explores how reputation, social influence, and identification affect subjects’ behaviour in a
non-strategic two-stage dictator game. The first round decision makers undergo a role reversal and become second round dictators yielding a setting in which one cannot distinguish between generalized reciprocity and indirect reciprocity, as defined in this paper, or their possible interaction effect. Servatka’s results indicate that reputation has a stronger impact on second stage dictator behaviour than social influence and identification. Stanca (2009) compares direct, indirect and generalized reciprocity by a two-stage gift-exchange game. He observes generalized reciprocity more often than direct or indirect.²

To summarize, various forms of reciprocity are frequently observed but their frequency seems to vary depending on the specific game structure. There is also some indication that generalized reciprocity is as important as direct and indirect reciprocity in one-shot interactions. However, none of the existing experiments distinguishes the influence of one’s own experience in past interaction from one’s observation of others’ behaviour with third players. For example, in repeated interaction where players can build reputation both one’s own experience with other players (i.e. whether other players have been kind or unkind to oneself) as well as rewarding or punishing on the basis of a third player’s reputation can be relevant in reciprocal behaviour. Furthermore, the evidence on social influence is mixed which calls for further investigation of the phenomenon. The aim of our study is to distinguish one’s own experience from responses to other’s reputation as well as to see whether social influence could account for reciprocity in experimental studies. In addition, we will investigate the role of intentions and outcomes in reciprocal behaviour. This issue is discussed in the next section.

3. Why do people reciprocate?

Let us next briefly look at the offered reasons or explanations of reciprocal behaviour. It is beyond the scope of this paper to investigate which one/ones of these reasons are correct – apart from the
outcome distribution/intention distinction defined below – but the offered reasons seem to be relevant for the understanding of our results. It is also important to bear in mind that the reasons discussed here are not mutually exclusive but may interact and provide explanations for reciprocity in different combinations.

It should first be pointed out that reciprocity is distinct from pure altruism. Positive reciprocity is conditional kindness that should be distinguished from unconditional kindness motivated by altruism (Cox 2004), unless one speaks about a special type of reciprocal altruism. Even though reciprocators are not pure altruists, they exhibit seemingly altruistic action. The reason for this can, however, be mutual benefit expected from the altruistic act. For example, sequential cooperation can bring about mutual benefits because of efficiency gains. It is also possible that mutual benefit is not something that people think consciously when they reciprocate. It might be the case that they follow (internalized) norms which in turn are based on long term benefits following from reciprocity. It has also been suggested that emotions play a central role in explaining reciprocal behaviour (Offerman 2002; Reuben and van Winden 2008). This would mean that others’ harmful action gives rise to negative emotions, whereas beneficial action gives rise to positive emotions. If one thinks of intentions and emotions as an explanation of reciprocity, it seems likely that they are related. However, it does not seem impossible either that emotional responses might arise even when intentions are absent. For example, one can feel happy when winning in a lottery and pass this feeling on to other people.

Inequality aversion has been considered to explain many observed deviations from payoff-maximizing behaviour. According to this view, people care about their own payoffs as well as about the differences between their own and others’ payoffs, i.e. they care about the distribution of outcomes. Fehr and Schmidt (1999) and Bolton and Ockenfels (2000) provide theories that model
inequality aversion. These theories explain many experimental observations of individual
behaviour, in dictator and ultimatum games, for example, and extend game theoretic predictions by
taking account of observed behaviour. Besides outcome distributions, players’ intentions seem to
have an influence on responses to their behaviour. This means that it is not only relevant whether an
outcome distribution is fair but also whether other players’ motivations are considered fair. For
example, it makes a difference to peoples’ responses whether the other player can control the
fairness of the allocation (Falk et al 2008). Rabin (1993) provides a game-theoretic model that
incorporates intention based behaviour. His model takes account of players’ beliefs about other
players’ intentions. There are a number of experimental studies on the role of outcomes and
intentions in individual decision making (e.g. Blunt 1995; Bolton, Brandts and Ockenfels 1998;
Nelson 2002; McCabe, Rigdon and Smith 2003; Charness 2004; Cox 2004; Falk, Fehr and
Fisbacher 2008; Stanca, Bruni and Corazzini 2009). While the evidence is slightly mixed, it seems
reasonable to conclude that both are relevant but that further investigation is needed to understand
in which way they influence individual behaviour. In this paper, we look at intention versus
outcome based explanations of reciprocity.

Different forms of prosocial behaviour have also been attributed to so called observer effect, that is,
in addition to their monetary payoffs, subjects care about behaving in a way they believe is socially
appropriate (c.f. Cason and Mui 1998). A standard approach is to use a double blind procedure to
control for possible unwanted social influence caused by the presence of the experimenter.
However, since a classroom experiment is an unfamiliar environment, subjects may look for cues as
to what constitutes acceptable behaviour. One way to cope with the unfamiliar situation is simply to
observe what other subjects do, provided that such information is given, and act in the same
manner. Such influence cannot be controlled directly by simply ensuring complete anonymity, but
by comparing subject behaviour in treatments in which such information is available to treatments in which it is not (cf. Servatka 2009).

4. **Experimental procedures**

The experiment covered ten sessions distributed over three weeks in November-December 2008. In each session, 24 subjects were randomly divided to different classrooms, yielding a total of 30 observations for each of the six treatment groups, and 60 observations for the unconditional first stage dictator game. With few exceptions, subjects (n=240) were local university undergraduate students, recruited by using mailing lists and by posting on campus area bulletin boards. An average session lasted for about 1.5 hours. The subjects gained an average payoff of 16.53 euros plus a participation fee of 5 euros.

The experiment is based on six treatments in a between-subject design. The baseline treatment is direct reciprocity (dir), and other treatment groups are generalized reciprocity (gen), indirect reciprocity (indir), mimicking (mim), and one respective control group for generalized and indirect reciprocity treatments (denoted here by indir-r and gen-r), in which the first round dictator decision is replaced by a random allocation.

In each session subjects engaged in the sequential dictator game: (1) In the first round, dictators made a decision of how much to share of their initial endowment of 16 euros with a randomly assigned respondent in another room. (2) In the second round, the subjects in the six treatment groups became dictators in turn. Second round dictators made their allocation decision in a strategy method sheet, where they recorded a comprehensive allocation plan, matching an integer amount of money [0, 16] they were willing to give away for every feasible donation made by a first round dictator. Strategy method sheets were completed before second round dictators received information.
of the actual first round play. The first round dictators were told that the experiment will include two parts and that they will receive instructions for the second part after finishing the first part. They were not given any other information of the second part. We were careful to avoid cheating of subjects – they were not given any false or misleading information. It is possible that some dictators anticipated the second round and this might have increased dictator game giving. However, we have no reason to believe that there was a difference between the treatments in this respect.

Upon arrival, subjects within each room were asked to sit at randomly assigned seats and were given first round instructions. When each participant had completed reading the instructions, correct understanding was controlled by a practise round. In addition to instructions, each subject was dealt two envelopes, one of which contained the initial endowment of 16 euros, while the second was an opaque padded envelope used for holding and transferring the donated money from a dictator to a recipient. In order to minimize possible observer and uncontrolled social influence effects, we followed a double blind procedure to guarantee complete experimenter-subject and between-subject anonymity. In every treatment, dictators and recipients were seated in different rooms, and in each room the dictators made their allocation one at a time in a ‘voting booth’ where the actual physical distribution of money from one envelope to another was observed neither by other subjects nor by the instructor. The envelopes with possible donations were deposited in a ballot box located inside the booth. After all subjects in a given room were ready, the instructor collected the box and delivered it to a second instructor outside the room, who then recorded the first round dictator allocations in a control sheet to ensure that second round dictators adhered to their submitted strategies. This was done by comparing the second stage dictator allocations with the recorded actual first round allocations and the respective entries in the strategy method sheet prior delivering the allocations to recipients. If a mismatch between second round allocation and the amount dictated by the strategy sheet entry was found, the envelope was returned to the instructor.
within the room, who then delivered it to the dictator in question and asked her to recheck the amount donated. The procedure was explained to the subjects in the written instructions to guarantee that they understood the double blind nature of the experiment.

All first round dictators chose an integer amount of euros [0, 16] to be sent to a recipient in another room. In the direct reciprocity treatment, the first round recipient became a dictator in the second round and sent back an amount corresponding to the entry in her/his strategy method sheet. In the generalized reciprocity treatment the second round dictator sent the allocation to a third, unrelated person instead of the first round dictator. In the indirect reciprocity treatment, the first round dictator became a second round recipient, but her/his second round allocation was decided by a third person, instead of the first round recipient. This third person was informed about the first round allocation.

The control treatments generalized-random (gen-r) and indirect-random (indir-r) are similar in design with respect to generalized and indirect reciprocity treatments, except that the first round allocation was determined by a random device, i.e. a draw from a uniform distribution [0, 16] rounded to the closest integer. In the indir-r control, after having completed the strategy method sheet, the second round dictator was informed about the first round random allocation received by the first round player, with whom the second round dictator then shares her endowment [0, 16]. In the gen-r treatment, after filling in the strategy method sheet of how to share 16 euros between her/himself and a randomly chose receiver, each second round dictator received an envelope which contained a randomly drawn allocation of money. The random control treatments enabled us to investigate whether it makes a difference that the first round allocation is made by a dictator or it by a random draw. Furthermore, in the mimicking treatment, after filling in the strategy method sheet, the second round dictator received information about a division between a randomly selected first
round dictator-recipient pair, and proceeded on dividing her endowment with a randomly selected individual. In the mimicking treatment, the second round dictator recipient pair is therefore not in any role in the first round and vice versa. The second round dictators in indir, indir-r and mim groups were informed about the relevant first round allocation by a small note, in which the monitor outside the room has copied the respective entry from the control sheet. It should be kept in mind that all second round dictators completed the strategy method sheet first and were given money or information of the first round play only after that. In all treatment, subjects completed a survey, and were paid the participation fee of 5 euros upon leaving the classroom. Experimental procedures are represented in Table 1.

5. Hypotheses

Our interest lies in comparing the strength of association between first and second round dictator allocations in direct and generalized reciprocity treatment groups, and finding out possible differences in the second round dictator behaviour in generalized and indirect reciprocity treatments with respect to the random allocation control groups. Moreover, in the social influence treatment we examine whether the second round dictators are socially influenced by decisions of others, by informing each second round dictator about an allocation decision of a randomly chosen first round dictator. In each treatment, we employ the strategy method to obtain comprehensive allocation plans instead of single data points, conditional on first round dictator behaviour, which enables us to analyze data both at the individual and aggregate levels. While there is some evidence that the use of the strategy method does not affect the decision making behaviour relative to a standard decision method (e.g. Cason and Mui 1998, Brandts and Charness 2000), this finding is contested in Güth et al. (2001). However, since the strategy method is used systematically in all six treatments, the
problem stemming from a possible difference between conditional and on-the-spot behaviour arises only if the strategy method impact is systematically different between the treatments, as pointed out in Falk et al. (2008). It should also be noted that Stanca (2009) compares decision and strategy methods and observes slightly larger correlations between amounts received and sent with the decision method than with the strategy method. He therefore concludes that it cannot be the case that the strategy method would increase the likelihood of observing reciprocity. In section seven, we discuss a possible influence of the strategy method in this experiment which seems to require further investigation.

The subgame perfect equilibrium of the two round dictator game predicts that dictators keep all of the endowment to themselves in both rounds of the game, assuming that subjects’ utility equals monetary income from the experiment. We call this the standard prediction and the corresponding hypothesis the payoff maximizing hypothesis. However, there is plenty of evidence that this prediction does not hold, in particular if there is no double blind procedure and the initial endowment is provided by the experimenter (for a review see Smith 2008). In our experiment, we use the double blind procedure, but since our main interest is in the dependence between the first and second round giving and not as much in the magnitude of the dictator game giving, we do not use earned money. There seems to be no reason to believe that this would affect our conclusions concerning the differences between the treatments and controls.

If the zero contribution assumption is rejected, it brings forth the question about the nature of the association between the first and second round allocations for each dictator-recipient pair of the two stage dictator game. Specifically, we are interested in the alternative hypothesis of strong positive reciprocity which postulates that the second round dictator behaviour is reciprocal, that is, a
generous (not so generous) first round allocation is followed by a generous (not so generous) second round allocation.

In case we cannot accept the null hypothesis of no reciprocity, the question arises whether the intensity of reciprocity differs across treatments, i.e. whether the treatment groups differ from the ones they are compared with in terms of strength of the association between first and second round allocations. Boyd and Richerson (1989) provide a model of the evolution of what they call indirect reciprocity. The general idea is that when interaction is repeated cooperative strategies, like tit-for-tat in the case of direct reciprocity, become successful. Boyd and Richerson specify upstream and downstream tit-for-tat –strategies which are parallel to generalized and indirect reciprocity as defined in this paper. Boyd and Richerson’s model predicts that direct reciprocity is more frequent than indirect and generalized and also that indirect is more frequent than generalized reciprocity. Boyd and Richerson’s model is not directly applicable to our experiment concerns cooperation in repeated interaction. It might yet suggest that similar differences in the frequencies of different types of reciprocity are observed in other interaction contexts as well. Based on Stanca’s (2009) results we might expect that generalized reciprocity is observed more often than direct or indirect. However, unlike our experiment, Stanca uses the gift exchange game and there are also other differences in the designs that can influence the results. It should also be noted that, in our design, in the direct and generalized reciprocity treatments, the second round dictators have a possibility to earn money in the first round, whereas in the indirect reciprocity treatment this was not possible. Therefore, we do not specify a hypothesis about possible differences between all the three forms of reciprocity in terms of frequency.

Let us next consider what we expect of the role of intentions in our experiment. Some writers have assumed that reciprocity is outcome based, that is, only payoff consequences matter (Fehr and
Schmidt 1999, Bolton and Ockenfels 2000). This would mean that fairness intentions play no role and therefore the association between first and second round dictator behaviour does not depend on how the first round was allocation was decided – whether it was donated by an active agent, or was an outcome of a random event. Consequently, there would be no difference between the indirect and generalized reciprocity treatments and their respective control groups. Alternatively, it can be assumed that the perceived intentions matter, and the second round dictator behaviour is more responsive to the first round allocations in generalized and indirect reciprocity treatments than in the respective control groups (Dufwenberg and Kirschsteiger 2004). Finally, if social influence or mimicking behaviour is not driving the results in an experimental setting such as our design, the choices of unrelated first round dictators should have little if any effect on the average size of the second round dictator allocations in the social influence treatment.

6. Results

The mean amount sent by the first round dictators was 4.33 (median 4.50) euros, or 27% of the endowment, and the mean conditional second round allocation (averaged over all strategy method sheets) was coincidentally also 4.33 (median 3.00). The second round mean allocation is clearly different from zero, thus leading us to reject the null of payoff maximizing behaviour (t-observed 17.02, p < 0.001). The mean amounts of second round allocations averaged over strategy method sheets in each treatment group were 5.02 in dir, 5.44 in gen, 3.17 in indir, 4.72 in gen-r, 3.54 indir-r, and 4.08 in mim (p<0.001 in each treatment group), while the medians were 4 dir, 5 in gen, 2 in indir, 4 in gen-r, 3 indir-r, and 2 in mim. Table 2 reports the means aggregated over the strategy method sheet as well as the conditional mean allocations per each feasible first round allocation, and table 3 displays the respective medians. We can justifiably reject the null hypothesis of payoff maximizing behaviour.
The association between first round and second round allocations is further illustrated in figures 1, 2 and 3, which display the groupwise strategy method means and medians for each feasible first round dictator allocation. One should note that the indir-r control treatment is depicted inversely in figure 2 and in Table 4. Thus, for example, a mean dictator response to a first round random allocation of 12 is compared to a mean dictator response to an intentional first round allocation of 4. Obviously, in both examples the second round recipient has an equal endowment after the first round is finished, and thus we are able to control whether intentions matter, or do the second round dictators only consider the fairness of the final outcome distribution.

Result 1. Strong reciprocity is observed, i.e. reciprocal behaviour is observed with a double blind procedure and without strategic incentives to behave reciprocally.

Let us next see whether there is a difference between second round allocation plans between the treatments. We test the pairwise differences in contributions across treatment groups by a Mann Whitney U-test, which is reported in table 4. The test is conducted by calculating the average contribution over individual strategy sheets and using 30 independent observations per treatment. The results indicate that there is not a statistically significant difference in contributions between direct reciprocity and generalized reciprocity treatments, nor between generalized and indirect reciprocity treatments and their respective random controls. Moreover, by comparing contributions conditional on each feasible first round action reported in table 4, we do not observe any significant differences between direct and generalized reciprocity treatments, nor between intentional
generalized and indirect treatments and their respective random controls. Thus by studying the contributions, it appears that we cannot tell difference between direct and generalized reciprocity treatment. Furthermore, the second round allocations seem to be driven by distributional considerations, in other words, intentional first round choices do not appear to evoke any stronger reciprocal response than random first round allocations.

We proceed by testing the significance of the correlation in each group. We compute individual correlation coefficients by pairs of subjects and employ the relevant one sided sign test. In addition to sign test results, the within group Spearman and Pearson correlations between second and first round allocations are reported in the first and third rows in table 5. The sign test results are statistically significant except for the mimicking treatment. Given the results reported in table 5 we reject the null hypothesis of no reciprocity between first and second round contributions in all treatment groups, except in the mimicking treatment. We continue testing differences in reciprocity between groups by employing the Kruskall-Wallis test, whose results clearly indicate that there are differences between groups (p=0.002).

In order to find out the exact pairwise differences in correlations between groups, we conduct a series of pairwise Mann-Whitney tests. Table 6a reports the results. The conducted tests do not detect any significant differences between direct and generalized reciprocity treatments. And as expected, there appears to be no significant differences between the intentional and randomized treatments (generalized and indirect treatments vs. their respective control groups). Moreover, as
reported in table 6b, the observed pairwise differences between the direct reciprocity treatment and the mimicking treatment remain significant at the conventional 0.05 level even after Bonferroni adjustment. The same holds true for the difference between the mimicking treatment and the generalized reciprocity treatments, while the difference between the mimicking and the indirect reciprocity treatments is significant at the 0.10 level after Bonferroni-adjustment. Thus we can conclude that the strength of association between first and second round allocations is significantly different (weaker) in the mimicking treatment than in other treatment groups.

Insert Tables 6a and 6b about here

In order to analyze the results at the aggregate level, we turn to regression analysis. By regressing the amount sent conditionally in the second round over the amount received in the first round, we obtain the results displayed in table 7 (column 1). We use the direct reciprocity treatment as the reference group, to which generalized reciprocity and its control are compared. Given the possibility of censored observations, we employ also tobit regression with limits [0,16] (column 2), which yields qualitatively similar results. The regression coefficient 0.38 is significant at the 0.01 level indicating a positive association between first and second round dictator allocations. Once we take into account the effect of possible censoring, the strength of association between first and second round allocations is at least the same, if not slightly stronger, as shown in the column (2). The level dummies are not significant at the conventional levels; however, in the tobit regression the interaction dummy coefficient of generalized reciprocity control is negative and suspiciously close of being significant. On one hand this would indicate that intention plays a role after all in our design, since the reciprocal response appears stronger in direct and generalized reciprocity treatments, but on the other, the evidence is not entirely convincing given the results of individual level pairwise comparison, and might be an artefact caused by the selected reference group. We also
performed similar regression analysis on pooled indirect and indirect control treatment data, but apart from first round allocation coefficient, which has a positive sign ($0.16, p < 0.01$), the coefficients remain insignificant, and thus we omit reporting them in table 7.

We can summarize our main findings as follows:

**Result 2.** We do not observe statistically significant differences between direct and generalized reciprocity.

**Result 3.** We do not observe statistically significant differences between indirect and generalized reciprocity and their random controls, indicating that in this experimental setting, outcome distributions seem to be more relevant than intentions for reciprocal behaviour.

**Result 4.** There is no indication of mimicking, meaning that the social influence hypothesis can be rejected.

The use of the strategy method allows us to detect possible interesting patterns of behaviour at the individual level. Though given the cardinality of the strategy space ($17^{17}$), any such analysis remains far from exhaustive and thus interpretation has to be made with caution. Nevertheless, our data suggests a few interesting behavioural patterns, which can be readily categorized. In particular, we can make a distinction between the extreme ends of behaviour: narrow self-interest, where the donation is zero irrespective of the first round allocation, and pure altruism, where everything is donated unconditionally. However, a more interesting pattern is probably what we call ‘perfect reciprocity’, where the second round mover chooses exactly the same amount as the first round dictator, resulting in correlation of 1.0. The distribution of the aforementioned strategies is reported
in table 8. It is interesting to note that the share of players using perfect reciprocity is significantly higher in the direct reciprocity group than in the other treatment groups, and on the other hand, the amount of players resorting to lump sum heuristics in the mimicking treatment is significantly larger than in the other treatments.

7. Discussion

The results of this experiment show that direct, indirect and generalized reciprocity can be observed with a double blind procedure and with no motivations related to strategic or efficiency concerns, i.e. the experiment gives further evidence of the existence of strong reciprocity – even when it is extended to interaction among more than two persons. Moreover, in this experiment, direct and generalized reciprocity are equally frequent. To our knowledge, this is the first time generalized reciprocity is observed in an experimental setting where the second round recipient has not acted in any role in the first round of the game. This indicated that one’s own experience in previous interactions is passed on to other people, i.e. generalized reciprocity is independent of the receiver’s reputation. In addition, indirect reciprocity is also observed when the second round dictator has no experience of the first round play. This indicates that the receiver’s reputation is also relevant on its own right. To summarize: this experiment shows that both generalized and indirect reciprocity are relevant and that they are relevant as independent patterns of behaviour.

Our experiment also sheds light to the motivations of reciprocal behaviour. First, the results indicate clearly that social influence cannot explain reciprocal action. This indicates that what we observe in laboratory experiments is indeed genuine reciprocity and not just mimicking others’ behaviour.
Second, in our experiment outcome distributions rather than intentions explain indirect and
generalized reciprocity. This finding was unexpected and requires further investigation. At the
moment, we can think of three possible reasons for the minor role of intentions in this experiment:
First, it is possible that intentions matter more in the case of punishing rather than in the case of
rewarding (Bolton et al 1998; Charness 2002; Offerman 2002; Cox 2004; see however Falk et al
2008 for a opposite result). Dohmen, Falk, Huffman and Sunde (2006) observe that in survey
responses there is no correlation between positive and negative reciprocity. They suggest that
positive and negative reciprocity are fundamentally different traits. In our experiment, subjects did
not have an opportunity to take away money from other players which might have overemphasized
distributional considerations. It should be kept in mind, though, that punishing and rewarding in
experiments depends on how the reference point is defined. As long as the initial endowment is
provided by the experimenter subjects do not really lose money – they only earn more or less.
However, there is much evidence on the importance of reference points in individual decision
making (e.g. Samuelson and Zeckhauser 1988; Kahneman, Knetsch and Tahler 1990, 1991;
Bateman, Munro, Rhodes, Starmer and Sugden 1997).

Second, it is possible that intentions and emotional responses are linked in a way that did not show
up in our experiment. For example, Charness (2002) emphasizes that feelings of gratitude and
revenge require intentional action. It has also been suggested that generalized reciprocity is due to
the fact that people feel gratitude when they receive benefits and this feeling of gratitude makes
them pass on rewards to third persons (Bartlett and DeSteno 2006; Nowak and Roch 2007). Bolton
et al. (1998) suggest that the normal form game in their experiment might explain why intentions
are not important. Similarly, in our experiment, it might be that the use of the strategy method did
not give rise to emotional responses in the same manner as would a direct response to the action of
the first stage dictator. In fact, Bolton et al (1998) suggest that a partner’s move gives rise to an emotional reaction, whereas a conditional choice gives rise to a more calculating behaviour.

Finally, motivation behind an intentional action may have an effect on perceived kindness of that action: If a choice is not motivated by strategic considerations (extrinsic motivation), reciprocal response might be stronger (Stanca et al. 2009). It is worth noting that the beliefs of the second round dictator about the first round dictator’s motives could well drive the results, but our design does not allow for both non-strategic and strategic first round choices; in order to provide the subjects with the simplest possible decision making environment, essentially every first round choice was a non-strategic one.
References


Figure 1. Median and mean second round dictator (strategy method) allocations in the direct reciprocity, in the generalized reciprocity, and in the gen-r control treatments. N=30 observations per treatment.
Figure 2. Median and mean second round dictator (strategy method) allocations in the indirect reciprocity treatment and in the control treatment. Control treatment depicted with reversed x-axis. N=30 observations per treatment.
Figure 3. Groupwise median and mean allocations: The mimicking treatment. N=30 observations per treatment.
<table>
<thead>
<tr>
<th>Dir</th>
<th>Indir</th>
<th>Gen</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. B → A</td>
<td>2. C → A</td>
<td>2. B → C</td>
</tr>
</tbody>
</table>

1. Instructions
2. Practise round
3. A decides how much of [0, 16] to allocate to B.
4. B decides how much of [0, 16] to allocate to A conditional on A’s potential first round play (in the strategy method sheet)
5. B receives [0, 16] euros from A
6. Survey
7. Payment

Table 1. Experimental procedures in the six treatments

<table>
<thead>
<tr>
<th>Indir-r</th>
<th>Gen-r</th>
<th>Mim</th>
</tr>
</thead>
</table>

1. Instructions
2. Practise round
3. Random allocation of [0, 16] to A
4. B decides how much of [0, 16] to allocate to A conditional on the random allocation (in the strategy method sheet)
5. B receives information of the random allocation
6. Survey
7. Payment

Table 1. continued
Table 2. Groupwise means of strategy method allocations by second round dictators conditional on each feasible first round allocation. Topmost row: average over strategy method sheet.
<table>
<thead>
<tr>
<th></th>
<th>Dir</th>
<th>Gen</th>
<th>Gen-r</th>
<th>Indir</th>
<th>Indir-r</th>
<th>Mim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group median</td>
<td>4.00</td>
<td>5.00</td>
<td>4.00</td>
<td>2.00</td>
<td>3.00</td>
<td>2.00</td>
</tr>
<tr>
<td>0</td>
<td>0.00</td>
<td>1.50</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
<td>1.50</td>
</tr>
<tr>
<td>1</td>
<td>1.00</td>
<td>2.00</td>
<td>1.00</td>
<td>0.00</td>
<td>0.50</td>
<td>2.00</td>
</tr>
<tr>
<td>2</td>
<td>2.00</td>
<td>2.00</td>
<td>1.50</td>
<td>1.00</td>
<td>1.00</td>
<td>2.00</td>
</tr>
<tr>
<td>3</td>
<td>3.00</td>
<td>3.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>2.50</td>
</tr>
<tr>
<td>4</td>
<td>4.00</td>
<td>4.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>3.00</td>
</tr>
<tr>
<td>5</td>
<td>5.00</td>
<td>5.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.50</td>
</tr>
<tr>
<td>6</td>
<td>6.00</td>
<td>5.00</td>
<td>3.00</td>
<td>2.50</td>
<td>2.50</td>
<td>3.00</td>
</tr>
<tr>
<td>7</td>
<td>5.50</td>
<td>6.00</td>
<td>3.00</td>
<td>2.50</td>
<td>3.00</td>
<td>2.50</td>
</tr>
<tr>
<td>8</td>
<td>7.00</td>
<td>7.00</td>
<td>4.00</td>
<td>3.00</td>
<td>3.00</td>
<td>1.50</td>
</tr>
<tr>
<td>9</td>
<td>7.50</td>
<td>6.50</td>
<td>4.00</td>
<td>3.00</td>
<td>3.00</td>
<td>3.00</td>
</tr>
<tr>
<td>10</td>
<td>6.50</td>
<td>6.50</td>
<td>5.00</td>
<td>2.50</td>
<td>3.50</td>
<td>3.00</td>
</tr>
<tr>
<td>11</td>
<td>5.00</td>
<td>6.50</td>
<td>5.00</td>
<td>3.00</td>
<td>3.50</td>
<td>3.50</td>
</tr>
<tr>
<td>12</td>
<td>7.00</td>
<td>7.00</td>
<td>6.00</td>
<td>4.00</td>
<td>4.00</td>
<td>3.00</td>
</tr>
<tr>
<td>13</td>
<td>6.00</td>
<td>7.50</td>
<td>6.00</td>
<td>3.00</td>
<td>5.00</td>
<td>2.50</td>
</tr>
<tr>
<td>14</td>
<td>8.00</td>
<td>8.00</td>
<td>6.00</td>
<td>3.50</td>
<td>5.50</td>
<td>2.00</td>
</tr>
<tr>
<td>15</td>
<td>7.00</td>
<td>8.00</td>
<td>6.50</td>
<td>4.00</td>
<td>5.50</td>
<td>2.00</td>
</tr>
<tr>
<td>16</td>
<td>8.00</td>
<td>8.00</td>
<td>6.00</td>
<td>3.00</td>
<td>6.00</td>
<td>2.00</td>
</tr>
</tbody>
</table>

Table 3. Groupwise median allocations sent by second round dictators
<table>
<thead>
<tr>
<th></th>
<th>Dir vs. Gen</th>
<th>Gen vs. Gen-r</th>
<th>Indir vs. Indir-r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-obs</td>
<td>-0.353</td>
<td>-1.015</td>
<td>-1.133</td>
</tr>
<tr>
<td>0</td>
<td>-2.089**</td>
<td>-0.510</td>
<td>-0.724</td>
</tr>
<tr>
<td>1</td>
<td>-1.739*</td>
<td>-0.241</td>
<td>-0.485</td>
</tr>
<tr>
<td>2</td>
<td>-1.279</td>
<td>-0.135</td>
<td>-0.230</td>
</tr>
<tr>
<td>3</td>
<td>-0.751</td>
<td>-0.149</td>
<td>-0.053</td>
</tr>
<tr>
<td>4</td>
<td>-1.106</td>
<td>-0.373</td>
<td>-0.106</td>
</tr>
<tr>
<td>5</td>
<td>-0.823</td>
<td>-0.633</td>
<td>-0.114</td>
</tr>
<tr>
<td>6</td>
<td>-0.188</td>
<td>-0.447</td>
<td>-0.309</td>
</tr>
<tr>
<td>7</td>
<td>-0.527</td>
<td>-0.536</td>
<td>-0.594</td>
</tr>
<tr>
<td>8</td>
<td>-0.735</td>
<td>-0.783</td>
<td>-1.047</td>
</tr>
<tr>
<td>9</td>
<td>-0.150</td>
<td>-0.899</td>
<td>-1.242</td>
</tr>
<tr>
<td>10</td>
<td>-0.285</td>
<td>-0.921</td>
<td>-1.701*</td>
</tr>
<tr>
<td>11</td>
<td>-0.522</td>
<td>-1.136</td>
<td>-1.712*</td>
</tr>
<tr>
<td>12</td>
<td>-0.045</td>
<td>-1.085</td>
<td>-1.261</td>
</tr>
<tr>
<td>13</td>
<td>-0.298</td>
<td>-1.241</td>
<td>-1.633</td>
</tr>
<tr>
<td>14</td>
<td>-0.030</td>
<td>-1.390</td>
<td>-1.849*</td>
</tr>
<tr>
<td>15</td>
<td>0.000</td>
<td>-1.040</td>
<td>-1.921*</td>
</tr>
<tr>
<td>16</td>
<td>-0.143</td>
<td>-1.067</td>
<td>-1.687*</td>
</tr>
</tbody>
</table>

Table 4. Mann Whitney U-test for differences in conditional contributions for each feasible first round allocation: Direct vs. Generalized, Generalized vs. random allocation control (Gen-r), and indirect reciprocity treatment vs. random allocation control (Indir-r).^^1

*significant at the 0.10 level; ** significant at the 0.05 level.

^1Significance levels not Bonferroni-adjusted for pairwise comparisons in the table.
Table 5. Sign test for significance of correlations based on independent individual observations within each treatment group (n=30 per group).

*significant at the 0.10 level; ** significant at the 0.05 level.
Table 6a. Mann-Whitney U-test for differences in correlations between treatment groups (p-values 2-tailed).¹

<table>
<thead>
<tr>
<th>Sent by A</th>
<th>Dir-Gen</th>
<th>Gen-Gen-r</th>
<th>Indir-Indir-r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spearman</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z-observed</td>
<td>-0.10*</td>
<td>-0.78</td>
<td>-1.56</td>
</tr>
<tr>
<td>Pearson</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z-observed</td>
<td>-0.09</td>
<td>-0.84</td>
<td>-1.38</td>
</tr>
</tbody>
</table>

*significant at the 0.10 level.

¹Observed p-values reported before Bonferroni-adjustment.
Table 6b. Mann-Whitney U-test for differences in correlations between treatment groups (p-values 2-tailed).

<table>
<thead>
<tr>
<th>Sent by A</th>
<th>Dir-Mim</th>
<th>Gen-Mim</th>
<th>Indir-Mim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spearman</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z-observed</td>
<td>-2.75**</td>
<td>-4.02***</td>
<td>-2.48**</td>
</tr>
<tr>
<td>Pearson</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z-observed</td>
<td>-2.75**</td>
<td>-4.02***</td>
<td>-2.59**</td>
</tr>
</tbody>
</table>

*significant at the 0.10 level; ** significant at the 0.05 level; *** Significant at the 0.001 level.

1Observed p-values reported before Bonferroni-adjustment.
<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amount sent by 1st round dictator (A)</td>
<td>0.38</td>
<td>0.47</td>
</tr>
<tr>
<td></td>
<td>(3.72)***</td>
<td>(3.94)***</td>
</tr>
<tr>
<td>Gen dummy</td>
<td>0.79</td>
<td>1.40</td>
</tr>
<tr>
<td></td>
<td>(0.80)</td>
<td>(1.04)</td>
</tr>
<tr>
<td>Gen dummy*A</td>
<td>-0.05</td>
<td>-0.085</td>
</tr>
<tr>
<td></td>
<td>(-0.38)</td>
<td>(-0.60)</td>
</tr>
<tr>
<td>Gen-r dummy</td>
<td>1.16</td>
<td>1.74</td>
</tr>
<tr>
<td></td>
<td>(1.18)</td>
<td>(1.29)</td>
</tr>
<tr>
<td>Gen-r dummy*A</td>
<td>-0.18</td>
<td>-0.23</td>
</tr>
<tr>
<td></td>
<td>(-1.66)</td>
<td>(-1.80)*</td>
</tr>
<tr>
<td>Constant</td>
<td>1.96</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>(2.56)**</td>
<td>(0.47)</td>
</tr>
<tr>
<td>(pseudo) R^2</td>
<td>0.13</td>
<td>0.023</td>
</tr>
<tr>
<td>left censored obs.</td>
<td>323</td>
<td></td>
</tr>
<tr>
<td>right censored obs.</td>
<td>29</td>
<td></td>
</tr>
</tbody>
</table>

Table 7. Second round allocations regressed on first round feasible contributions, robust standard errors clustered on individual. Direct reciprocity as the reference group. Column (1) OLS, and column (2) Tobit regression censored at [0, 16]. Observed t-values in parenthesis.

***Significant at 0.001 level, ** significant at 0.05 level, and * significant at 0.10 level.
<table>
<thead>
<tr>
<th>Type of strat./Treat.</th>
<th>Direct</th>
<th>Gen</th>
<th>Indir</th>
<th>Gen-r</th>
<th>Indir-r</th>
<th>Mimick</th>
<th>Total share of all, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>perfect reciprocity</td>
<td>33 %</td>
<td>10 %</td>
<td>3 %</td>
<td>0 %</td>
<td>3 %</td>
<td>3 %</td>
<td>9 %</td>
</tr>
<tr>
<td>payoff maxim.</td>
<td>20 %</td>
<td>13 %</td>
<td>23 %</td>
<td>17 %</td>
<td>3 %</td>
<td>17 %</td>
<td>16 %</td>
</tr>
<tr>
<td>lump sum</td>
<td>3 %</td>
<td>3 %</td>
<td>3 %</td>
<td>17 %</td>
<td>0 %</td>
<td>37 %</td>
<td>11 %</td>
</tr>
</tbody>
</table>

Table 8. Relative share of strategy types within treatments. The used classification covers 35 % of the employed strategies.
Appendix

Instructions for second round dictators in the direct reciprocity treatment

(Translation from Finnish)

General instructions concerning participation in the experiment as well as the practise round are omitted here.

Part I

You will now start the actual experiment where you can earn money. The experiment has two parts. The participants are randomly divided into rooms A and B. You are in the room B. In the first part, all participants in room A are given 16 euros. Participants in room B are not given money.

Those in room A can send 0 – 16 euros to a randomly selected participant in room B. Each B-room participant can receive money only from one A-room participant. The money one sends cannot be divided into smaller units than one euro. Each A-room participant can keep the money s/he does not send to a B-room participant.

Part II

In the second part of the experiment, all participants in this room will be given 16 euros. Participants in room A are not given money. You can send 0 – 16 euros to the A-room participant who sent you 0 – 16 euros in the first part of the experiment. The money one sends cannot be divided into smaller units than one euro. You can keep the money you do not send to the A-room participant.

In the table below, columns indicate the sums of money that the participant in room A could have sent to you. Mark the sum of money you will send to the participant in room A in the second row of the table. Mark in the table, how much you will send to the A-room participant, if the A-room participant has sent you 0 euros, 1 euro, 2 euros, etc. You have to fill in every cell in the second row. You have to indicate these sums of money before you will be told how much the A-room participant has sent to you. You have to send A-room participant exactly the sum of money you indicate in the table, i.e. you can not change the sum you will send after having been told how much you got yourself.

Fill in the third row of the table as well. It tells how much is left to you from the 16 euros in each case. Fill in the fourth row as well. It tells your total earning that you get when you add up how much is sent to you and how much is left to you, i.e. the first and fourth rows in the table. Do not count the five euros show up fee to your total earnings in the table.
<table>
<thead>
<tr>
<th>The sum of money sent by an A-room participant</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>The sum of money you will send to an A-room participant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The sum of money that is left to you</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Your total earning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When you have filled in the table copy it to the violet form dealt on your table. The instructor will collect this form before you will be told the sum of money sent to you. When you have filled in the table above and the table in the violet form, check that you have the same sums in both tables. Then put the violet form into the violet envelope. Do not stick the envelope. Raise up your hand. The instructor will collect the violet envelope.

The instructor will next give you a brown envelope, which includes the sum of money that the A-room participant has possibly sent you. You can open the envelope and keep the money.

After this the instructor will ask each participant in this room to go to the booth located in the room. The instructor will give you a white envelope which includes 16 euros as well as an empty brown envelope. Take these instructions with you to the booth so that you can check the sum of money you will send.

When you are in the booth put the sum of money you will send to the A-room participant in the brown envelope. Fasten the envelope with a paper clip and put it in the box inside the booth. Do this even though you will not send any money in the envelope. The money you will not send to the A-room participant is left to you. Put them back to the white envelope. You can keep the money.

Take the white envelope with you independent of the sum of money you have possibly put in it.

When each participant in this room has been in the booth in their turn the instructor will give the envelope box and the violet envelopes to a courier. The courier will check outside this room that the money sent correspond to the sums indicated in the violet envelopes. If there is a mismatch the second part of the experiment will be repeated. The courier checks the sums on the level of ID-codes, which means that he cannot match a certain sum of money to a certain person. After checking the sums the courier will take the envelopes in room A where the A-room participant will get the envelope you sent to her/him.

The instructor will next deal you a questionnaire. When you have completed the questionnaire put it upside down on the table.
After having completed the questionnaire the experiment is over and you can leave. The instructor will give you the five euro show up fee when you leave.
1 In Ben-Ner et al.’s experiment the third person has actually played the first part as well but with a different partner.

2 Stanca (2008) uses the terms social indirect reciprocity and generalized indirect reciprocity which correspond to indirect reciprocity and generalized reciprocity in this paper.

3 An English translation of the instructions to the direct reciprocity second round dictators can be found in the appendix. Other instructions are available from the authors.

4 The initial endowment to each dictator was one ten euro bill, one five euro bill, a two euro coin, and three one euro coins making it possible to give away any integer amount between 0 and 16 euros.

5 The questionnaire measured items related to trust, political attitudes and some personality traits, as well as the standard background variables. The analysis of the questionnaire is under way.