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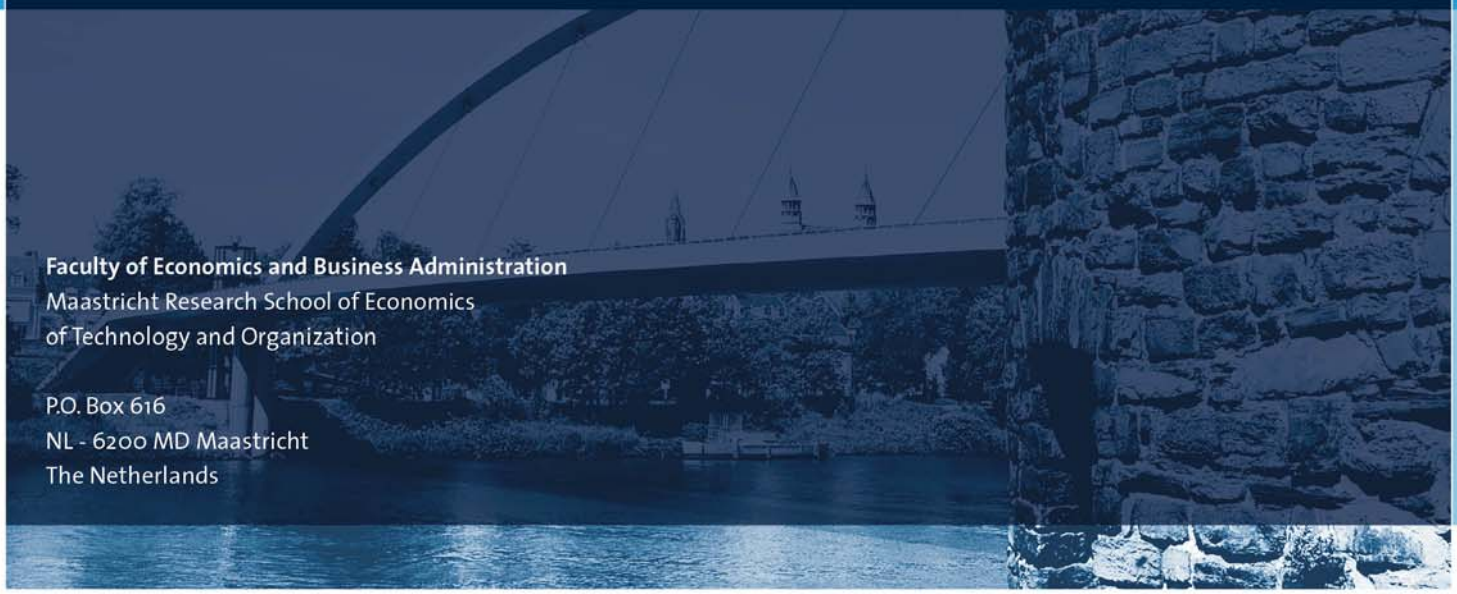

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Immaterial rewards and sanctions in a voluntary contribution experiment*

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Abstract

In this paper, we compare the cause and effect of immaterial rewards and sanctions on cooperation in a voluntary contributions experiment. We find that both rewards and sanctions increase contributions only when subjects interact repeatedly, though rewards seem to be more effective than sanctions. Moreover, in contrast to sanctions, rewards do have an impact on future contributions. Although the direct effect is negative, there is a positive indirect effect that applies to subjects who contribute above (below) the group average in a partner (stranger) matching. From this we conclude that sanctions and rewards are mainly used as a communication channel to coordinate on a more efficient outcome. Nevertheless, subjects also seem to experience additional utility from receiving approval, whereas they are insensitive to disapprovals.

JEL Classification Codes: C92; H41

Keywords: Public goods; Feedback; Communication; Experiment

1 Introduction

In many social contexts, agents face the tension between self-interest and group-interest when strategic (free-riding) behavior affects group welfare adversely. Economic examples include the private provision of a public good, the utilization of a common good, and defection from cartels. The free-rider problem is a central problem in the theory of incentives and mechanism design (Green and Laffont, 1979). While zero cooperation is often the only rationalizable strategy in a standard one-shot interaction, in repeated interaction or in presence of punishment or communication possibilities, cooperation is possible among self-interested expected utility maximizing individuals.[1]

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[1]Gächter and Herrmann (forthcoming) provides an up-to-date literature overview on factors that influence cooperation.

Experimentalists and theorists have extensively studied the free-rider problem in public goods games in various institutional settings. Fehr and Gächter (2000) introduces a similar informal sanctioning mechanism as the one used by Ostrom et al. (1992) in a common pool resource game, and finds that the opportunity to costly sanction heavily curtails free-riding behavior. This stimulating effect of costly sanctions on cooperativeness has been repeatedly mirrored in later studies, among which: Masclet et al. (2003), Page et al. (2005), Bochet et al. (2006), and Sefton et al. (2007). The explanation is that cooperators will sanction free-riders on basis of the very strong negative emotions they feel towards free-riding. In anticipation of this emotion-based sanctioning, potential free-riders increase their level of cooperation.

Masclet et al. (2003) focusses on the importance of the sanctions being material, and considers a treatment with nonmonetary sanctions in which agents (anonymously) communicate their level of disapproval. In societies, nonmonetary sanctions are often conveyed by means of (verbal) expressions such as disapproval, humiliation, chastisement, banishment, or ostracism. Initially nonmonetary sanctions are found to be as effective as monetary sanctions, but high levels of cooperation are better sustained when sanctions have material consequences. These findings have been replicated by Noussair and Tucker (2005), who in addition show that a combination monetary and nonmonetary sanctions is more effective than either system alone.

Lee and Wagner (2002) show that people express more emotions in positive social contexts than in negative social contexts in face-to-face communications. This inclination towards positive emotional response is confirmed for the use of emoticons in computer-mediated communication by Derks (2007).[2] A natural question is, therefore, whether nonmonetary rewards are more effective than nonmonetary sanctions in achieving and sustaining high levels of cooperation.

The comparison of the effectiveness between sanctions and rewards has been made in Sefton et al. (2007) for the case when these sanctions and rewards are costly for the imposer and material for the imposed. They find that the opportunity to reward or to sanction increases the level of cooperation initially. Moreover, for rewards the level of cooperation decreases to a level below that observed in the absence of opportunities to reward, whereas for sanctions it remains above the level that is observed in the absence of opportunities to sanction. Therefore, sanctioning appears to be a more effective mechanism for sustaining high levels of cooperation.[3]

[2]Emoticons are (typo)graphic depictions of facial behavior suggested to convey social emotion. Vladimir Nabokov revealed already in April 1969 the need for emoticons, by writing "I often think there should exist a special typographical sign for a smile". However, it took until 19 September 1982 for Scott Fahlman to write "I propose ... the following character sequence for joke markers: :–) Read it sideways".

[3]Notice that, in their design, sanctions reduce efficiency, whereas rewards are a pure redistribution of earnings and hence do not affect efficiency. Moreover, the absence of stranger matching treatments disallows disentangling the impact of pure feedback from the impact of pre-play communication.

In this paper, we compare the effectiveness of rewards and sanctions to achieve and (if so) to sustain high levels of cooperation, when they are costless for the imposer and immaterial for the imposed. Thereto, our design counts three main treatments conditions: the control treatment, the rewards treatment, and the sanctions treatment. In each treatment, the standard setting is the voluntary contributions mechanism as used in Fehr and Gächter (2000). In the rewards treatment, subjects are given the possibility to anonymously show approval to the other subjects' individual contributions by means of sending a smiley (☺). For the sanctions treatment, disapproval can be signaled by sending a frowny (☹).

Besides the treatment comparison between positive (smiley) and negative (frowny) feedback, we investigate the functioning of the feedback mechanism as such. In particular, we are interested whether eventual differences in contribution levels is driven purely by feedback or whether the communication channel that is provided by it plays a role. Thereto we ran for each main treatment condition sessions with a partner matching and with a stranger matching.

We find that, in a partner matching, the opportunity to provide feedback via emoticons seems to promote contributions, where positive feedback via smilies seems to be more effective than negative feedback via frownies. Due to a large variation in the treatments with feedback, both results are not found to be significant at conventional significance levels. In a stranger matching, if anything, contributions are lower in presence of a feedback mechanism. This indicates that for the partner matching it is mainly the communication channel provided by the feedback that drives the higher contributions.

Notwithstanding the neutral phrasing in the instructions, the emoticons are adopted in a normal way throughout our experimental sessions (that is, smilies/frownies are used to signal approval/disapproval about the other group members contribution), both in a partner matching and in a stranger matching. Regarding the impact of the receipt of smilies and frownies on future contributions, we find that frownies have no significant effect at all. Hence, the enhanced contribution level for some groups under the partner matching procedure seems to be triggered by the communication channel the negative feedback mechanism provides. On the other hand, smilies tend to have a negative direct effect (which is only significant in the partner matching) and positive indirect effects on the next round's contribution. In particular, subjects who contribute more (less) than the group average in the current round, tend to increase their contribution in the next round in the partner (stranger) matching whenever they receive a smiley. One possible explanation of the indirect effects is that smilies provide an encouragement to contribute more (partner matching) or subjects like to be approved by the other group members (stranger matching).

The remainder of the paper is organized as follows. In the next section, the experimental

design and procedures are detailed. Next, in Section 3, the results are reported. Finally, an extensive discussion of the results follows in Section 4.

2 Experimental design and procedures

In this study, there are three main treatment conditions: *control*, *smiley*, and *frowny*. For each of the three treatments, we ran sessions using a *partner* and a *stranger* matching. In total, 132 subjects participated in one of the 8 sessions with partner matching (11 independent groups of 4 subjects for each of the three treatments) and 144 subjects took part in one of the stranger matching sessions (three sessions per treatment with 16 subjects each).

An experimental session consists of 15 periods. In all partner matching sessions, subjects are randomly and anonymously assigned into groups of 4 in the beginning of the experiment. The participants know that the group assignment does not change during the experiment and that the exact matching is never revealed to them. In stranger matching sessions, groups are randomly and anonymously determined every round anew. Again, no feedback on the exact matchings is ever given and subjects are fully aware of the whole matching procedure.

The control treatment is equal to the *voluntary contribution mechanism* (VCM) of Fehr and Gächter (2000). Each period, a subject is endowed with 20 ECU (experimental currency units) and decides how many of these to invest into a public project (in integer amounts). Every ECU that is not invested into the creation of the public project accrues directly to the subject's private account and is saved. In addition to the saved money, each subject receives 0.4 times the aggregate group investment. After each group member has made his/her contribution decision, feedback on all individual contributions within the group and the individual earning is provided. In order to preserve anonymity, the individual contribution levels of the other group members are every period presented in a random order.

The smiley treatment extends the control treatment by the possibility to provide feedback on each other's contribution levels. More precisely, after observing the actual contributions of the other group members (contributions are again jointly presented in a random order), every subject decides for each contribution level of a group member whether or not to send a smiley of the form :) to the respective contributor. Thus, each subject sends every period between 0 and 3 smilies. The smiley is costless for both the sender and the recipient. Finally, all subjects get to know the number of smilies they received (but not on the identity of the senders) and their individual payoff. The frowny treatment differs from the smiley treatment only because the emoticon subjects can send is of the form :(instead.

The experiments were conducted in the experimental laboratory of the faculty of economics and business administration at Maastricht University in November 2007 (partner matching)

and June 2008 (stranger matching). The experiment was announced via email and subjects could register online using their matriculation number. This ensured that students could participate only once. Once the students arrived at the laboratory, they were randomly assigned to a computer terminal. All interactions took place via these terminals that were situated in such a way that subjects could neither see the screens of others nor make eye contact. The experiment was programmed and conducted with the software z-Tree (Fischbacher, 2007). Before the start of a session, subjects read the instructions and were allowed to privately ask questions that were then privately answered.[4] After reading the instructions, subjects had to answer control questions which tested their understanding of the instructions. One of the experimenters checked the answers, and the experiment only started after all subjects answered each question correctly. Subjects earned ECU during the experiment that were converted into Euro at a known exchange rate (one ECU equals three Eurocents) at the end of the experiment. In addition, subjects received a show-up fee of 3 Euro. Payment took place privately, and subjects had to leave the laboratory immediately once paid. On average, a session lasted slightly less than 60 minutes. The average payoff in the control treatment with partner matching was 13.67 Euro. The average payoff in the respective smiley (frowny) treatment was 14.58 (14.17) Euro. Finally, under the stranger matching protocol, average payoffs equaled 13.23 Euro in the control treatment, 13.05 Euro in the smiley treatment, and 12.96 Euro in the frowny treatment.

3 Results and analysis

Using the data retrieved throughout the experimental sessions, we concentrate on the following questions: (1) does the presence of a feedback mechanism enhance cooperation (and if so why)?, (2) are smilies/frownies used to show approval/disapproval about individual contribution levels?, and (3) how does the reception of a smiley/frowny shape individual behavior in the following period? Each of the following subsections is centered around one of these three questions.

3.1 Average contributions

This subsection compares the average per-period contributions between the baseline, smiley and frowny treatment under both matching protocols. Central element of study is the *Indirect Punishment Hypothesis* of Masclet et al. (2003) according to which the opportunity for individuals to express their disapproval about the other group members' contributions increases the overall contribution level. One underlying possibility for this hypothesis to hold

[4]The instructions of the smiley treatment under the partner matching protocol can be found in Appendix B.

true is that the sender (imposer) may use negative feedback as a threat that she/he is going to reduce future contributions in case the recipient of the punishment (imposed) does not increase her/his contribution. An alternative reason is that individuals do not like to be disapproved. The first reason hints at feedback being used as a pre-play communication device; the second at the fact that the receipt of negative feedback affects utility negatively.[5] The *Indirect Reward Hypothesis* for positive feedback can be defined accordingly.[6] The joint formulation of the two hypotheses is as follows.

Hypothesis 1. *The presence of a feedback mechanism using emoticons generates higher contributions.*

First, we focus on the treatments with partner matching. The left panel of Figure 1 presents the time series of the average individual contributions per period in percentages of the endowment. The share of the endowment that is allocated to the group account in the initial period lies in all treatments on average between 50 % and 60 %. From there, average contributions gradually decline in order to end with an average between 5 % and 15 % of the endowment allocated to the group account in the last period. Despite these similarities in the time trend, the figure indicates a clear ranking between the three treatments. The average contribution in the smiley treatment is larger than in the frowny treatment (except from period 5) which, in turn, shows a larger average contribution than the control treatment (except from period 2). The average of all per period contributions is 5.97 in the control treatment, 9.40 in the smiley treatment, and 7.86 in the frowny treatment.

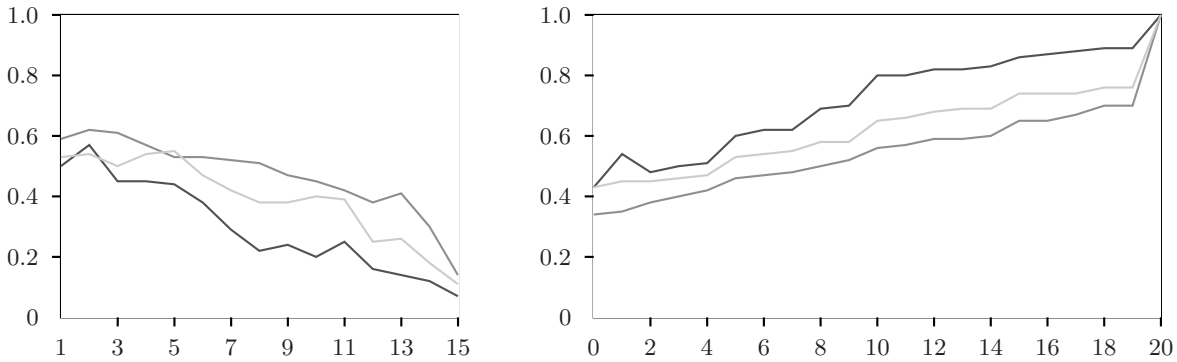

Figure 1: Average per period contributions in percentages (left panel) and cumulative distributions of contributions (right panel) for the control (dark-grey), smiley (grey), and frowny (light-grey) treatment under partner matching.

[5] See Masclet et al. (2003) page 367-368.

[6] One reason to consider approvals as well is because of the ongoing discussion on whether punishments or rewards are more helpful to establish normative behavior. As long as punishments and rewards have monetary effects for the receiver, it renders impossible to shed light on this question, simply because the effects cannot be separated from efficiency considerations (punishments necessarily reduce overall efficiency which is typically not the case for rewards).

The right panel of Figure 1, which depicts the cumulative distribution functions of individual contributions over the whole session, indicates precisely the same ranking between treatments. The cumulative distribution function associated with the smiley treatment first order stochastically dominates the cumulative distribution function corresponding to the frowny treatment that first order stochastically dominates the cumulative distribution function of the control treatment. Consequently, Figure 1 suggests that the opportunity to assign smilies or frownies to other group members increases contributions even if the emoticons have no monetary consequences at all. Moreover, the opportunity to send a smiley generates larger contributions than the opportunity to send a frowny.

Although Figure 1 indicates a clear ranking, Mann-Whitney U tests show that average group contributions do not differ significantly across treatments. The one-sided p-value is 0.2153 when comparing the smiley with the control treatment and 0.3714 when comparing the frowny with either the smiley or the control treatment. The median independent observation (the median of all average per period contributions calculated at the group level) equals 5.22 in the control treatment, 7.00 in the smiley treatment, and 6.19 in the frowny treatment.

A closer look at the disaggregated data in Appendix A reveals why the statistical tests are not successful. While most groups display initial average contributions close to 10 and present a downward sloping time trend in the control treatment (see Figure 5), different patterns can be identified for both the smiley and the frowny treatment. Figures 6 and 7 reveal that several groups are able to maintain very high levels of contributions until the very last periods (groups 3, 5, 7, and 8 in the smiley treatment and groups 1 and 9 in the frowny treatment), whereas contributions are very low from the first period on for other groups (groups 1, 2, and 9 in the smiley treatment and groups 2, 4, 7, and 11 in the frowny treatment). This indicates that behavior among the different groups in a treatment is more distinct in the presence of a feedback mechanism. And it is exactly in these treatments that some groups succeeded to achieve and sustain a high level of contribution.

To test this argument more formally, we analyze the variances of the average group contributions. We find that standard deviations are equal to 2.33 in the control treatment, 6.81 in the smiley treatment, and 5.59 in the frowny treatment. Since the one-sided p-value of the Siegel-Tukey test that compares the variance in the control treatment with the one of the smiley (frowny) treatment is 0.0381 (0.0330), these differences turn out to be significant. There is, however, no significant difference between the variance in the smiley and the frowny treatment ($p = 0.3468$, one-sided). We summarize our findings as follows.

Result 1a. *Feedback via emoticons seems to enhance contribution levels under a partner matching. Moreover, smilies seem to have a larger impact than frownies. However, the difference in the average group contribution across treatments is not significant. Though, the*

variance of the average group contribution in the smiley/frowny treatment is significantly larger than in the control treatment.

Next, we focus on the treatments with stranger matching. The left panel of Figure 2 presents the time series of the average individual contributions per period in percentages of the endowment. The share of the endowment that is allocated to the group account in the initial period is substantially lower than in the partner matching for the smiley and frowny treatments, but not so in the control treatment. Like for the partner matching, average contributions gradually decline towards an average contribution between 5 % and 15 % of the endowment in the last period. In each treatment and in every period, the average contribution also turns out to be smaller than in the corresponding treatment with a partner matching.[7]

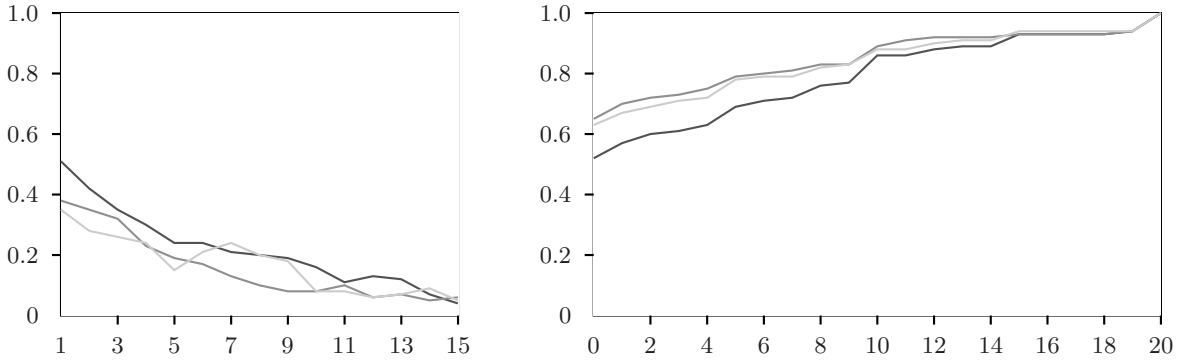

Figure 2: Average per period contributions in percentages (left panel) and cumulative distributions of contributions (right panel) for the control (dark-grey), smiley (grey), and frowny (light-grey) treatment under the stranger matching protocol.

A notable difference in comparison with the partner matching treatments is that, if anything, the average per period contributions are now larger in the control treatment than in either of the other two treatments. The only exceptions are periods 7, 14, and 15 for the comparison with the frowny and period 15 for the comparison with the smiley treatment. Also there is no obvious ranking between the smiley and frowny treatment any more. Based on our data, the average per period contribution is now 4.38 in the control treatment, 3.17 in the smiley treatment, and 3.39 in the frowny treatment.[8] According to the right panel of Figure 2, the cumulative distribution function of contributions associated with the control treatment also first order stochastically dominates the cumulative distribution function of either of the other two treatments. No dominance relation is found between the smiley and

[7]Different studies have reported different rankings between contributions in partner and stranger treatments in public goods experiments. Croson (1996), Sonnemans et al. (1999), and Keser and van Winden (2000) also find that partners contribute more than strangers, but Andreoni (1988) and Palfrey and Prisbrey (1996) find exactly the opposite to hold true. Weimann (1994) finds no difference. See Andreoni and Croson (2002) for a survey on this issue.

[8]The average per period contribution for every session can be found in Figure 8 in Appendix A.

the frowny treatment. The findings with respect to the stranger matching are summarized in the following result.

Result 1b. *Under the stranger matching, average contributions are highest in the control treatment. The cumulative distribution function associated with the control treatment first order stochastically dominates the cumulative distribution function of either of the other two treatments.*

To summarize: even though there is a clear empirical ranking between treatments under partner matching, neither the Indirect Punishment Hypothesis nor the Indirect Reward Hypothesis finds statistical support. However, we do find that variances are significantly larger in the presence of a feedback mechanism in a partner matching. Following Masclet et al. (2003), there are two leading non-exclusive explanations why feedback could possibly enhance the overall level of contributions. The first explanation is utility based and argues that if subjects believe that smilies (frownies) are sent in order to signal approval (disapproval) about contributions, then they may be willing to increase their contribution in case they experience a positive (negative) utility from receiving such a message; even if it goes along with lower monetary payoffs. The second explanation is signaling based and assumes that emoticons are mainly used as a communication device that allows subjects to coordinate on a particular kind of (cooperative) behavior. Result 1b provides some initial evidence against the first explanations, for an identical ranking between treatments should have been found under both matching protocols in order to support it.

3.2 The use of the feedback mechanisms

The findings in the former subsection provide evidence against the hypothesis that individuals like to be approved and/or have an aversion to be disapproved. However, since assigning an emoticon has neither a cost for the sender nor for the recipient, any assignment of emoticons can be sustained in equilibrium. For example, subjects may well invert their natural meaning or allocate them in a random fashion.[9] Consequently, the different ordering of treatments under the partner and stranger matching may simply be caused by a different use of the feedback mechanisms. To exclude this possibility, we investigate now the conditions under which individuals assign emoticons to other group members.

[9] Here, an important distinction with Masclet et al. (2003) has to be made. In their experiment, an informal or non-monetary sanctioning system is induced by suggesting to subjects how points should be used (more points should be assigned if there is a higher degree of disapproval). Afterwards, they check in a consistency analysis that the induced system is actually applied by subjects in the way proposed. As it can be seen from the instructions in Appendix B, we are completely silent on how to apply emoticons.

Hypothesis 2. *Smilies/Frownies are used to signal approval/disapproval about the other group members' contributions.*

The solid curves in the left panel of Figure 3 show that for the partner matching, the probability that a smiley is sent in response to a contribution of zero is 8 %, while a contribution of the whole endowment is responded with a smiley in 99 % of the cases. In general, the probability to get a smiley is increasing in the receiving subject's contribution.[10] The opposite pattern can be observed for the frowny treatment. There, no contribution is responded with a frowny in 83 % of the cases, while full contribution is responded with a frowny with 4 % probability. The overall probability that a contribution has been responded with a smiley or a frowny is 51 % and 53 % respectively.

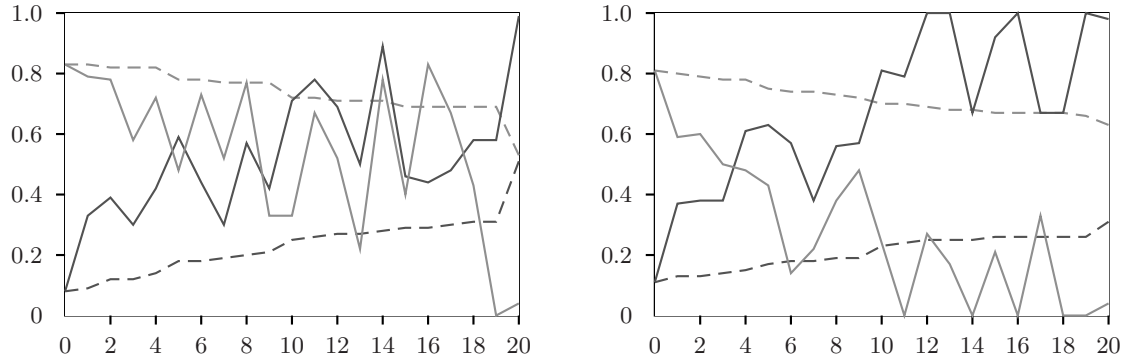

Figure 3: Probability of a smiley/frowny being sent in response to contributions for the smiley (grey) and frowny (light-grey) treatment with partner matching (left panel) and stranger matching (right panel). The dashed lines indicate the probability of smilies or frownies being sent in response to cumulations of contributions.

In the right panel of Figure 3, the relevant curves for the stranger matching are presented. A smiley is always given to a subject who contributes everything, while the probability is only 11 % if the subject does not contribute anything at all. The corresponding probabilities for the frowny treatment are 81 % (4 %) if nothing (everything) is contributed to the public project. Contributions in the range between 10 and 18 are more (less) likely to be awarded with a smiley (frowny) than in the partner matching. Still, the overall probabilities that a contribution has been responded with a smiley or a frowny is now 31 % and 63 %, respectively. This lower (higher) probability to be faced with a positive (negative) expression of emotion may be driven by the in general lower contributions in the stranger matching.

Finally, the dashed curves in the two panels show the probability to receive an emoticon

[10]The only exception from this trend can perhaps be identified for contributions in the range between 15 and 18. This drop is easily explained. In total, there are only 12 instances where an individual contributed between 15 and 18 ECU. If the other group members contributed the maximum in these periods, this slightly lower contribution is not considered worth a smiley. This interpretation is sustained by the Probit Maximum Likelihood estimation that follows.

for cumulations of contributions. These curves indicate that when contributions increase (decrease), the probability of being faced with a smiley gradually increases (decreases), while the probability of being faced with a frowny gradually decreases (increases).[11]

Result 2a. *Regardless of the matching protocol, the probability to receive a smiley (frowny) is increasing (decreasing) in the receiving subject's contribution. This finding is more pronounced for the stranger matching.*

Result 2a provides some evidence for the hypothesis that subjects use emoticons to signal approval or disapproval about the contribution of the other group members in a natural way. To strengthen this argument, we show next that sending a smiley (frowny) depends positively (negatively) on how this contribution relates to the average group contribution.

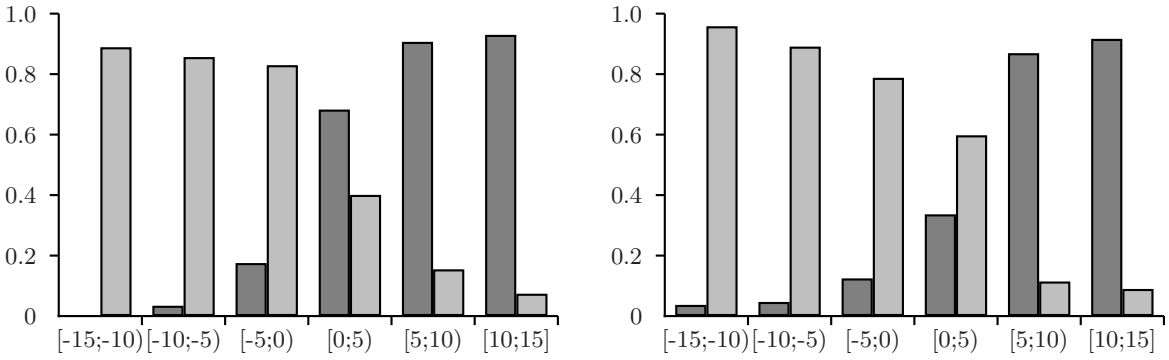

Figure 4: Probability of a smiley/frowny being sent depending on the deviation from the average group contribution for the smiley (grey) and frowny (light-grey) treatment with partner matching (left panel) and stranger matching (right panel).

Figure 4 plots the probability that an emoticon is sent to another group member as a function of how much the recipient's contribution differs from the average group contribution. It can be observed that independently of the matching procedure, subjects are more likely to send a smiley (frowny) the more the recipient's contribution deviates positively (negatively) from the average group contribution. For example, if a subject's contribution is more than 10 ECU lower than the average group contribution in a partner matching, then the probability by which each group member will send a smiley (frowny) is 0.00 % (88.89 %). If a subject's contribution is at least 10 ECU higher than the average group contribution, each group member will send a smiley (frowny) with 92.98 % (7.40 %) probability. The corresponding probabilities for the stranger matching treatments are as follows: if there is a negative

[11] The jumps that can be identified for a contribution level of 20 are caused by a number effect. As it can be seen from the cumulative distribution functions in Figures 1 and 2, in the smiley (frowny) treatment the whole endowment was contributed in 30 % (14 %) of the cases for the partner matching and with 6 % (6 %) probability for the stranger matching. The corresponding percentages for the control treatment are 11 % for the partner and 6 % for the stranger matching.

deviation from the average group contribution of more than 10 ECU, smilies (frownies) are sent in 3.70 % (95.83 %) of the cases; if there is a positive deviation of at least 10 ECU, a smiley (frowny) is sent in 91.66 % (8.97 %) of the cases.

To provide a more formal argument for these dependencies, we consider an econometric model. The dependent variable Y_{ij}^t is a dummy variable that takes the value 1 if subject i sends an emoticon to subject j in period t. Otherwise, $Y_{ij}^t = 0$. As regressors we use the average group contribution in a given period as well as negative and positive deviations of subject j's contribution from the group average.[12] Formally, we denote by $\bar{c}^t$ the average group contribution in period t and by c_j^t the contribution of subject j in period t. Letting ε_{ij}^t be the error term for the feedback from individual i to individual j in period t (which is assumed to be distributed normally and independently with mean zero), the model is completely specified as follows:

$$Y_{ij}^t \;=\; \beta_0 \;+\; \beta_1\,\bar{c}^t \;+\; \beta_2\,\max\{\bar{c}^t - c_j^t; 0\} \;+\; \beta_3\,\max\{c_j^t - \bar{c}^t; 0\} \;+\; \varepsilon_{ij}^t. \tag{1}$$

Table 1 shows the results of the Probit Maximum Likelihood estimations of Equation (1).

	Partner Matching		Stranger Matching	
	Smiley	Frowny	Smiley	Frowny
Constant (β_0)	-0.7553^{***}	0.7493^{***}	-0.8631^{***}	0.6079^{***}
	(0.0672)	(0.0600)	(0.0456)	(0.0423)
Average group contribution (β_1)	0.1057^{***}	-0.0911^{***}	0.1595^{***}	-0.0869^{***}
	(0.0043)	(0.0044)	(0.0146)	(0.0122)
Negative deviation from group average (β_2)	-0.3977^{***}	0.1715^{***}	-0.3104^{***}	0.1848^{***}
	(0.0520)	(0.0158)	(0.0293)	(0.0201)
Positive deviation from group average (β_3)	0.1835^{***}	-0.1507^{***}	0.1485^{***}	-0.1704^{***}
	(0.0225)	(0.0138)	(0.0215)	(0.0198)
Likelihood ratio index	0.4757	0.3264	0.3345	0.2323
Observations	1980	1980	2160	2160

Table 1: Probit Maximum Likelihood Estimations on the determinants of sanctioning and rewarding behavior. Standard errors are in parentheses. Errors are robust to heteroskedasticity. *** indicates significance at the 1-percent level. Controlling for time and matching groups, by introducing period dummies and dummies for matching groups (*i.e.*, session dummies in stranger treatments and dummies for each independent group in partner treatments), does not affect the qualitative results of the estimations.

There is a positive relationship between the probability of getting a smiley and the contribution relative to the group average. Vice versa, the probability of receiving a frowny is negatively related to the contribution relative to the group average. The latter relation is a replication of the findings in Masclet et al. (2003). The two results are valid for both the

[12] We do not include deviations from individual i's contribution, $\max\{c_i^t - c_j^t; 0\}$ and $\max\{c_j^t - c_i^t; 0\}$, as additional regressors because these two variables show high correlation with the deviation from the average group contribution.

partner and the stranger matching. Moreover, a subject is more (less) likely to send a smiley (frowny) at higher levels of the average group contributions.

Result 2b. *Independently of the matching protocol, the probability to send a smiley/frowny is increasing/decreasing (decreasing/increasing) in the positive/negative (negative/positive) difference of the receiving subject's contribution from the average group contribution.*

Results 2a and 2b both support the hypothesis that the feedback mechanism is used in the obvious way: smilies are applied to signal approval and frownies to express disapproval about the other group members' contributions. Therefore, we can exclude the possibility that the different ordering of treatments found under partner and stranger matching is driven by an abnormal use of the feedback mechanisms. Still, at this point it is not possible to fully reject the hypothesis that approvals (disapprovals) enter directly into the individuals' utility functions. This is because subjects may, for example, hold inaccurate beliefs about the other group members contributions so that the actual assignment of emoticons differs from the expected one. Next, we investigate how subjects react to the reception of an emoticon in order to gain insights on whether emoticons have a direct effect on utility.

3.3 The effects of the feedback mechanisms

In this subsection, we turn to the dynamics of individual contributions across rounds. In particular, we investigate how individual decisions are influenced by the feedback mechanisms (that is, emoticons received). The important question to be answered is whether subjects perceive the approval (disapproval) of other group members as a non-monetary reward (sanction) to which they are responsive in the sense that there is a positive effect on future contributions. Results in this directions can be taken as evidence in favor of the hypothesis that receiving an emoticon affects utility directly. On the other hand, if receiving an emoticon has no significant effect on future contributions, the ordering of treatments in the partner matching is likely to be caused by the communication channel the feedback mechanisms provide.

Hypothesis 3. *Smilies/Frownies received in one round have a positive impact on contributions in the next round.*

Hypothesis 3 is tested with the help of a two-step estimation procedure. In the first step, the difference in the individual contributions between two consecutive rounds, $c_i^{t+1} - c_i^t$, is regressed on a series of control variables, afterwards we regress the residuals of the first estimation on the variables we are actually interested in. The control variables of the multivariate Tobit regressions applied in the first step of the estimation procedure are the period t, the average group contribution in a given period $\bar{c}^t$, and matching groups dummies (*i.e.*, session

dummies in stranger treatments and dummies for each independent group in partner treatments). Denote by $\hat{\varepsilon}_i^{t+1,t}$ the residual of the initial estimation for individual i when taking the difference in the contribution between periods $t+1$ and t. The explanatory variables in the second estimation are the number of emoticons received in period t, $\sum_j Y_{ji}^t$, the positive/negative deviation of i's contribution from the average group deviation in period t, and the interactions between these two variables. Letting $\epsilon_i^{t+1,t}$ be the corresponding error term (which is assumed to be distributed normally and independently with mean zero), the second estimation is formally given as follows:

$$\begin{aligned}\hat{\varepsilon}_i^{t+1,t} &= \beta_0 + \beta_1 \textstyle\sum_j Y_{ji}^t + \beta_2 \max\{c_i^t - \bar{c}^t; 0\} + \beta_3 \max\{c_i^t - \bar{c}^t; 0\} \times \sum_j Y_{ji}^t \\ &\quad + \beta_4 \max\{\bar{c}^t - c_i^t; 0\} + \beta_5 \max\{\bar{c}^t - c_i^t; 0\} \times \textstyle\sum_j Y_{ji}^t + \epsilon_i^{t+1,t}.\end{aligned} \tag{2}$$

Table 2 displays the estimation results for treatments with partner matching.[13]

	Partner Matching		
	Control	Smiley	Frowny
Constant (β_0)	0.8256^{***}	1.2739^{***}	1.0718^{***}
	(0.2753)	(0.2903)	(0.3912)
Number of emoticons received (β_1)		-0.3049^{***}	-0.0325
		(0.1488)	(0.1947)
Positive deviation from group average (β_2)	-0.7723^{***}	-1.2422^{***}	-0.8603^{***}
	(0.0861)	(0.3224)	(0.1124)
—— × Number of emoticons received (β_3)		0.1421	-0.1513
		(0.1317)	(0.1045)
Negative deviation from group average (β_4)	0.3455^{***}	0.2096^{***}	0.3792^{***}
	(0.0800)	(0.0796)	(0.0967)
—— × Number of emoticons received (β_5)		0.3639^{*}	
		(0.1952)	
R^2	0.2786	0.2906	0.3115
Observations	616	616	616

Table 2: OLS estimation results on the effect of emoticons on next round's contribution under partner matching (dependent variable: $\hat{\varepsilon}_i^{t+1,t}$). Standard errors are in parentheses. Errors are robust to heteroskedasticity. * Significant at the 10-percent level. ** Significant at the 5-percent level. *** Significant at the 1-percent level.

The numbers in the table indicate that independently of the treatment, subjects who contribute more than the group average tend to decrease their contribution. Furthermore, those subjects who contribute less than the group average tend to increase their contribution. Strikingly, smilies have a negative direct effect on contributions. However, there is a positive indirect effect when the subject who receives the smiley contributed less than the group average. Finally, receiving a frowny does not have a significant direct effect on next

[13]Since the original data is censored, a Tobit regression is used for regressing the difference on the controls. The residuals of that estimation are, however, normally distributed. Therefore, an OLS regression is used for this second estimation.

period's contribution. It is also remarkable that those subjects who receive negative feedback in response to a contribution above the group average tend to decrease their contribution. This effect, however, is not significant at any conventional significance level.[14]

Result 3a. *For the partner matching, receiving a smiley has a negative direct and a positive indirect effect (for those subjects who contributed less than the group average) on future contributions. Receiving a frowny does not affect future contributions significantly.*

Next, we turn our attention to the stranger matching treatments, where due to rematching emoticons are not likely to be adopted as a signaling device. The relevant results are displayed in Table 3.

	Stranger Matching		
	Control	Smiley	Frowny
Constant (β_0)	1.3967^{***}	0.2156	0.1178
	(0.1566)	(0.1720)	(0.5421)
Number of emoticons received (β_1)		-0.0256	0.2022
		(0.1338)	(0.2134)
Positive deviation from group average (β_2)	-0.6850^{***}	-1.0382^{***}	-0.6070^{***}
	(0.0356)	(0.1825)	(0.1277)
— × Number of emoticons received (β_3)		0.2405^{***}	-0.1940
		(0.0760)	(0.1653)
Negative deviation from group average (β_4)	-0.1021^{**}	0.3716^{***}	0.3812^{***}
	(0.0432)	(0.0660)	(0.0805)
— × Number of emoticons received (β_5)		-0.0223	
		(0.0569)	
R^2	0.2786	0.2684	0.2968
Observations	672	672	672

Table 3: OLS estimation results on the effect of emoticons on contributions in stranger matching treatments (dependent variable: $\hat{\varepsilon}_i^{t+1,t}$). Standard errors are in parentheses. Errors are robust to heteroskedasticity. * Significant at the 10-percent level. ** Significant at the 5-percent level. *** Significant at the 1-percent level.

First, it can be observed that the lower contribution level in the control treatment, in comparison to the respective treatment with partner matching, can be explained by the fact that subjects who already contributed less than the group average now reduce their contributions even further. For the smiley and frowny treatment we find, like in the respective partner matching treatments, that subjects who contribute more (less) than the group average tend to decrease (increase) their contribution. Again, though insignificant here, smilies have a negative direct effect on contributions. However, instead of the indirect positive effect of the receipt of a smiley being positive for those contributing below the group average, here, we find this effect to be positive for those contributing above the group average. Again, there is

[14] We did not estimate β_5 in frowny treatments, because the variable is highly correlated with $\max\{\bar{c}^t - c_i^t; 0\}$.

no significant effect in the frowny treatment, the only visible difference is that the sign of the direct effect is now positive.

Result 3b. *For the stranger matching, receiving an emoticon has no significant direct effect on future contributions. In the smiley treatment, there is a positive indirect effect for those subjects who contribute more than the group average.*

Results 3a and 3b indicate that receiving negative feedback does not affect future contributions and, therefore, we can reject Hypothesis 3 for both frowny treatments. Consequently, it is unlikely that frownies enter negatively into the subjects' utility functions (meaning that in this setting individuals do not seem to have an aversion to be disapproved verbally). It rather seems that the negative feedback mechanism provides a communication channel that helps some groups to establish high contributions if the partner matching protocol is applied.

Our conclusions are somewhat different for the positive feedback mechanism. We found that that smilies received in one round have a negative direct impact on contributions next round under the partner matching protocol, which in principle confirms the mirror-image of the interpretation found for the frowny treatments. However, there is also a positive effect for those contributing below the group average. One possible reading of this finding is that individuals who contribute less than the group average regard receiving a smiley as an encouragement to contribute more in the next period. Finally, under the stranger matching protocol only subjects who contribute above the group average are sensitive to the receipt of a smiley. Hence, the gap in contribution level between those subjects who initially contributed a lot and the rest of the subjects widens over time. This effect can be explained if high contributors experience an additional utility from being approved by means of a smiley.

4 Discussion

The data retrieved throughout our public goods experiment indicate that the opportunity to provide feedback via emoticons promote contributions when subjects are matched according to the partner matching protocol. Furthermore, positive feedback via smilies seems to be more effective than negative feedback via frownies. Both these results are, however, not found to be significant at conventional significance levels. Like in Bochet and Putterman (2008) who consider various pre-play communication protocols, the insignificance of the results is explained by the large variation in the treatments with feedback. In fact, the variance of the average group contribution in the treatments with feedback is significantly larger than in the control treatment. When subjects are matched according to a stranger matching protocol, if anything, contributions are lower in presence of a feedback mechanism.

For a partner matching protocol, Fehr and Gächter (2000) shows that a sanctioning mechanism positively effects contributions when sanctions have material consequences for the imposer and the imposed. Masclet et al. (2003) concludes that this effect does not disappear when the consequences of the sanctions are material for the imposer, but immaterial for the imposed. Our findings refine this result and learn that, for some groups, the positive impact of sanctioning even retains when the sanction is immaterial for both the imposer and the imposed. However, in contrast to Fehr and Gächter (2000) where sanctions promote contributions also in a stranger setting, we find that sanctions, if anything, decrease contributions when subjects are randomly rematched. One conclusion is that apparently material consequences are needed to make sanctioning mechanisms effective when subjects are not involved in a supergame.

Sefton et al. (2007) compares, in a partner matching setting, contributions in a sanctioning institution against those in a rewarding institution, where in both cases the consequences are material for the imposer and the imposed. Contributions initially increase in both institution, but the effect of rewards gradually diminishes and even vanishes, whereas for sanctions the effect sustains. They conclude that sanctioning appears to be a more effective mechanism for sustaining high contribution levels. We come to the opposite conclusion when sanctions and rewards are immaterial; in our partner treatments, if anything, the rewarding institution outperforms the sanctioning institution. Like for sanctions, the impact of immaterial rewards on contributions disappears when subjects are randomly rematched.

Ellingsen and Johannesson (2008) finds that the opportunity for the recipient to provide verbal feedback to the divider substantially increases donations in a dictator game. Their preferred interpretation for anticipated feedback to shape behavior is that feelings of shame and pride in connection to norm compliance are accentuated by emotional communication. The use of emoticons in our setting allows for expressing sufficient emotion to trigger feelings of shame (frowny) or pride (smiley). Following their interpretation, contributions are expected to increase in anticipation of negative or positive feedback; in particular, in a stranger matching. Since we do not observe such an increase in the stranger matching, the explanation of Ellingsen and Johannesson (2008) seems not to apply to our setting. One noticeable difference is that their setting involves two asymmetric players, opposed to our setting with four symmetric players. Another difference is that in their setting, subjects could sent whatever (text) message they preferred, we restricted subjects to use simple emoticons.

Feelings of shame (guilt) and pride (self-respect) play also an important role in the experiments conducted by Rege and Telle (2004) and Andreoni and Petrie (2004). Both papers show that when choices and identities are publicly revealed, voluntary contributions significantly increase; thereby providing empirical support for people having preferences for (indirect) social

approval and against (indirect) social disapproval. From our experiments one could conclude that the elimination of confidentiality is more effective in achieving cooperation than the provision of an explicit (double blind) feedback mechanism.

The dominant explanation for the difference in the performance of the feedback mechanisms between the partner matching and the stranger matching seems to be that, opposed to the stranger matching, in the partner matching the smilies and frownies facilitate a (pre-play) communication device across periods. That is, smilies and frownies may be sent to convince group members to increase their contributions in the subsequent round. Isaac and Walker (1988) finds that in particular free-form face-to-face (pre-play) communication drives experimental subjects to contribute considerably more to a public good. In a review on social dilemma experiments in the era 1958–1992, Sally (1995) concludes that face-to-face communication is the single most effective treatment variable to promote cooperation. Brosig et al. (2003) suggests to attribute the effectiveness of face-to-face communication to cues from facial expression, tone of voice, body language, and the loss of anonymity. Next, while preserving anonymity, Bochet et al. (2006) finds that when vocal and visual expressions are excluded communication is almost as effective, but that the effect is destroyed once verbal communication is excluded. If our results are indeed caused by communication, our experiments learn that communication is sometimes effective in achieving high contribution levels when messages are non-verbal and contain some form of facial expression while preserving anonymity.

Notwithstanding the neutral phrasing in the instructions, the emoticons are adopted in a normal way throughout our experimental sessions. First, the probability to receive a smiley (frowny) increases (decreasing) in the receiving subject's contribution. Moreover, the probability to send a smiley/frowny increases/decreases (decreases/increases) in the positive/negative (negative/positive) difference of the receiving subject's contribution from the average group contribution. Thereby, the behavior towards the allocation of frownies is consistent with the behavior towards the allocation of disapproval points in Masclet et al. (2003). The only inconsistency with Sefton et al. (2007) is our finding that the likeliness to receive a frowny is larger the more one contributes below the group average. Like Falk et al. (2000), we find similar feedback patterns for a partner and a stranger matching, which hints at the purpose of the feedback mechanism to be nonstrategic.

Regarding the impact of the receipt of smilies and frownies on future contributions, we find the following results. First, frownies have no significant effect at all. Second, smilies have a negative direct effect on contributions under the partner matching, but there is also a positive indirect effect for those who contributed below the group average. One explanation of these results is that emoticons are indeed perceived as a signal to coordinate on larger

contributions. Under a stranger matching, smilies have an insignificant negative direct effect on contributions and, opposed to the partner matching, a positive indirect effect for those contributing above the group average. Since the receipt of an emoticon does not trigger those contributing below the group average to increase contributions, emoticons seem to work more as a feedback mechanism than as a signaling device in a stranger matching. In particular, the indirect effect of smilies can be explained if subjects like to be approved by others. Regarding the impact of feedback on future contributions, apart from one difference, our results are consistent with those in Masclet et al. (2003) and Seften et al. (2007) as far as comparable effects are mutual significant. Where Sefton et al. (2007) reports a positive impact of rewards on future contributions, we find the overall impact to be negative and only positive for those that contributed below the group average.

Our design possesses various attractive features that deserve mentioning. Since sanctions and rewards are immaterial for imposer and imposed, our setting is extreme and hence a perfect benchmark for related studies. Moreover, it allows for a fair comparison between sanctions and rewards as it excludes efficiency considerations and the possibility to restore unfair payoff distributions. Emoticons are interpreted naturally and hence the use of them does not need to be induced by the instructions. In fact, in our instructions for the smiley (frowny) treatments we were able to avoid words like 'approval' ('disapproval'). At last, our implementation of the feedback mechanism design is easily extended for studying the effect of feedback mechanisms in online trading platforms. This can be done, for instance, via a (stranger) treatment where the number of emoticons received in the preceding stage are publicly observable.

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A Figures

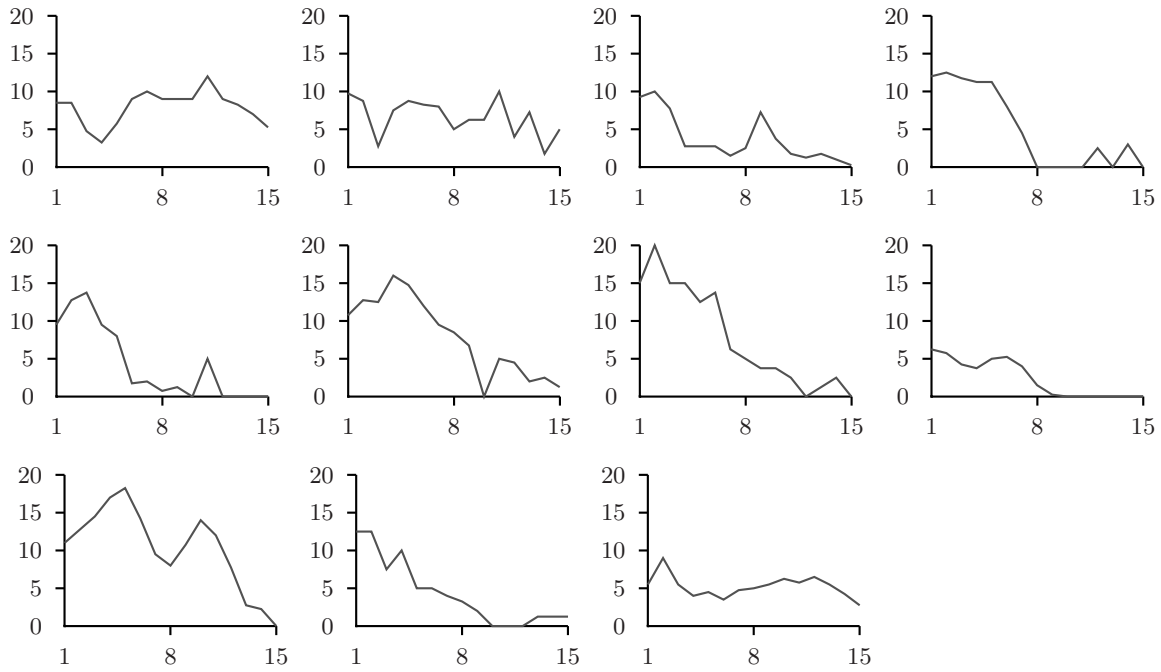

Figure 5: Average per period contributions for groups in the control treatment with partner matching.

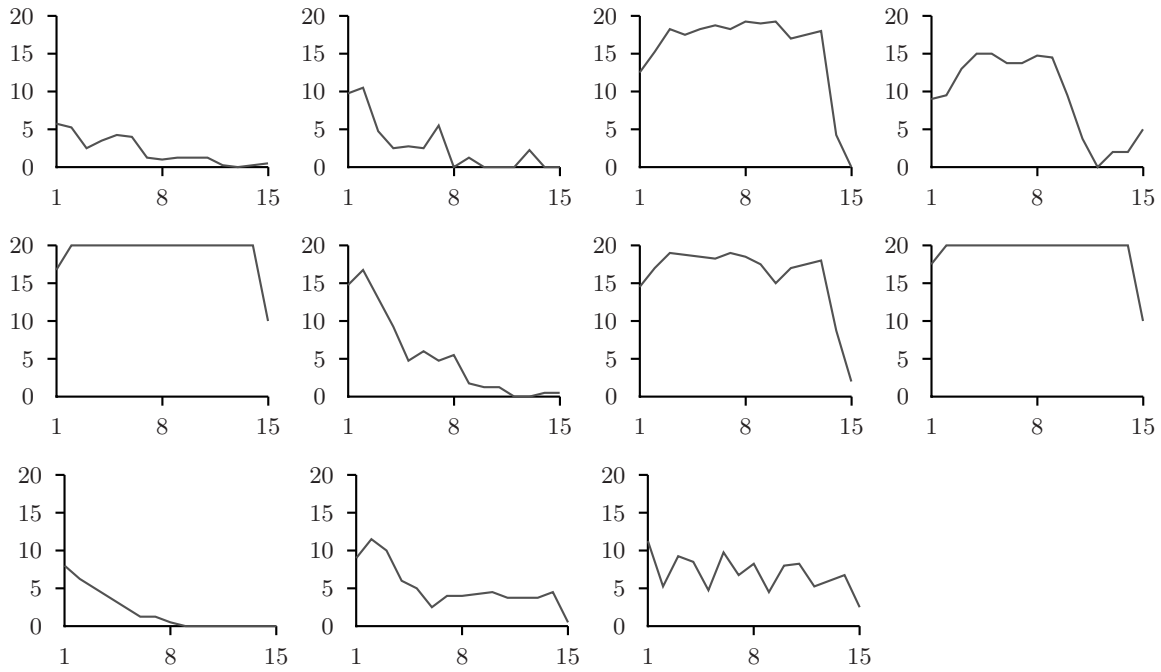

Figure 6: Average per period contributions for groups in the smiley treatment with partner matching.

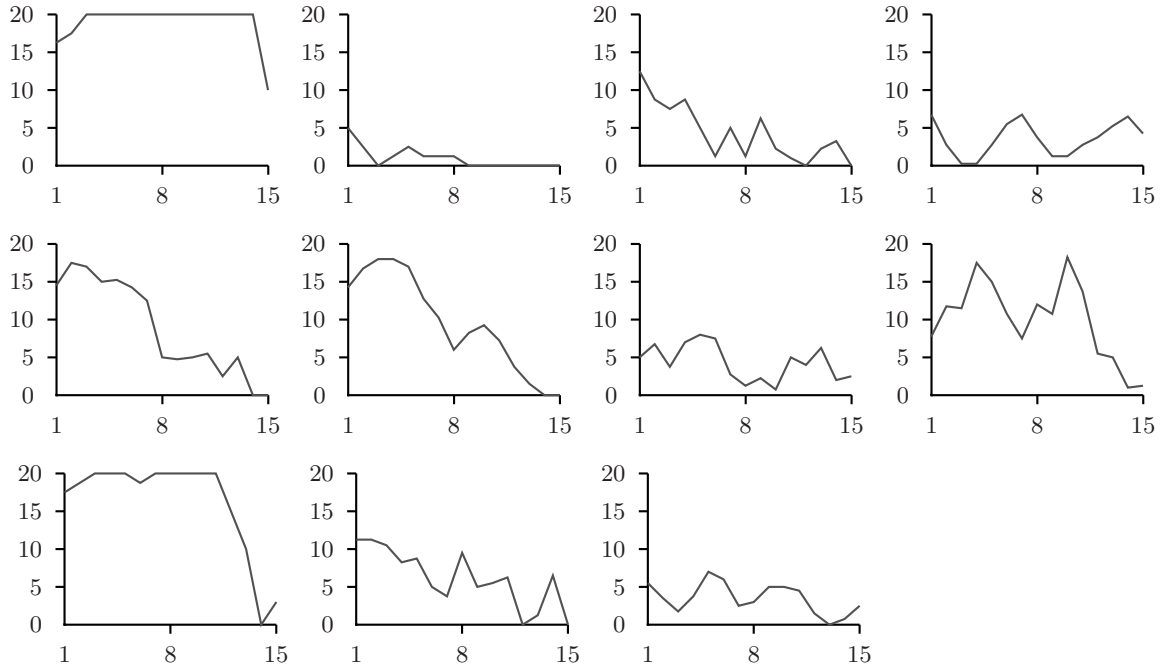

Figure 7: Average per period contributions for groups in the frowny treatment with partner matching.

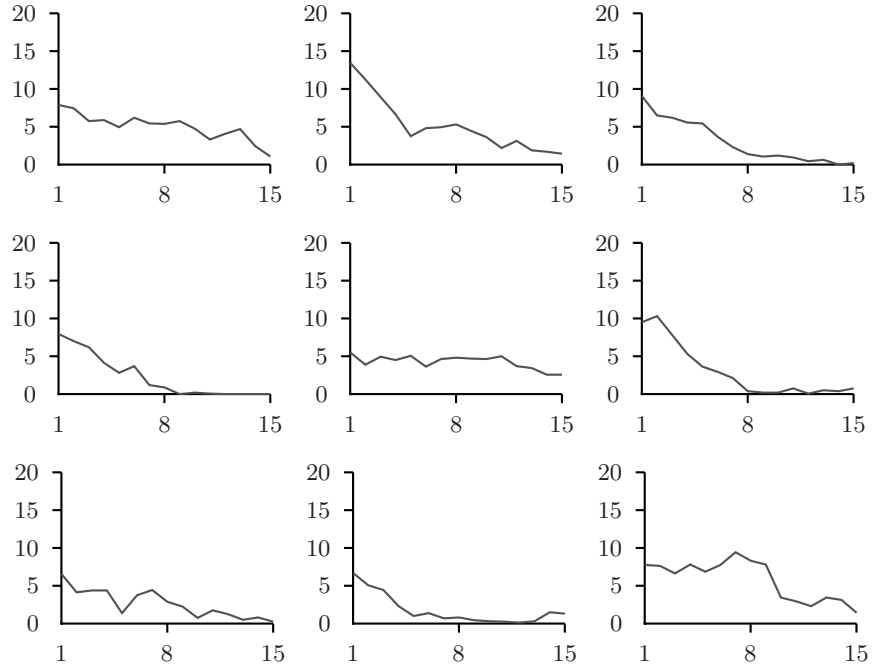

Figure 8: Average per period contributions for the nine stranger matching sessions. The first row corresponds to the control treatment, the second row to the smiley treatment, and the third row to the frowny treatment.

B Instructions

This appendix contains the instructions of the Smiley treatment with partner matching protocol. The instructions of the other treatments were phrased in a similar manner.

Welcome

Dear participant, thank you for taking part in this experiment. It will last about 60 minutes. If you read the following instructions carefully, you can—depending on your decisions—earn some more money in addition to the 3 Euro show-up fee, which you can keep in any case. The entire of money which you earn with your decisions will be added up and paid to you in cash at the end of the experiment. These instructions are solely for your private information.

We will not speak of Euros during the experiment, but rather of ECU (Experimental Currency Units). Your whole income will first be calculated in ECU. At the end of the experiment, the total amount you have earned will be converted to Euro at the following rate:

1 ECU = 3 Eurocents.

In order to ensure that the experiment takes place in an optimal setting, we would like to ask you to abide to the following rules during the whole experiment:

- do not communicate with your fellow students!
- do not forget to switch off your mobile phone!
- read the instructions carefully. If something is not well explained or you have any question now or at any time during the experiment, then ask one of the experimenters. Do, however, not ask out loud, raise your hand instead. We will clarify questions privately.
- you may take notes on this instruction sheet if you wish.
- after the experiment, remain seated till we paid you off.
- if you do not obey the rules, the data becomes useless for us. Therefore, we will have to exclude you from this (and future) experiment(s) and you will not receive any compensation.

Environment

You will learn how the experiment will be conducted later. We first introduce you to the basic decision situation. You will find control questions at the end of the description of the

decision situation that help you to understand the environment.

You will be a member of a group consisting of 4 people. Each group member has to decide on the allocation of 20 ECU. You can put these 20 ECU into your private account or you can invest them fully or partially into a project. Each ECU you do not invest into the project, will automatically remain in your private account.

Private Account

You will earn one ECU for each ECU you put in your private account. For example, if you put 20 ECU into your private account (and therefore do not invest into the project) your income will amount to exactly 20 ECU out of your private account. If you put 6 ECU into your private account, your income from this account will be 6 ECU. No one except you earns something from your private account.

The Project

Each group member will profit equally from the amount you invest into the project. On the other hand, you will also get a payoff from the other group members' investments. The income for each group member will be determined as follows:

Income from the project = 0.4 × sum of all contributions

If, for example, the sum of all contributions to the project is 60 ECU, then you and the other members of your group earn each 0.4 × 60 ECU = 24 ECU out of the project. If four members of the group contribute a total of 10 ECU to the project, you and the other members of your group earn each 0.4 × 10 ECU = 4 ECU.

Total Income

Your income is the sum of your income from your private account and that from the project.

Total Income =
Income from your private account (20 − contribution to the project)
+ Income from the project (0.4 × sum of all contributions to the project)

Control Questions

Please answer the following control questions. They will help you to gain an understanding of the calculation of your income, which varies with your decision about how to distribute your 20 ECU. Please answer all the questions and write down your calculations.

1. Each group member has 20 ECU. Assume none of the four group members (including you) contributes anything to the project.

(a) What will your total income be? _____

(b) What will be the total income of the other group members? _____

2. Each group member has 20 ECU. You invest 20 ECU in the project. Each of the other three members of the group also contributes 20 ECU to the project.

   (a) What will your total income be? _____

   (b) What will be the total income of each of the other group members? _____

3. Each group member has 20 ECU. The other 3 members contribute a total of 30 ECU to the project.

   (a) What will your total income be, if you—in addition to the 30 ECU—invest 0 ECU into the project? _____

   (b) What will your total income be, if you—in addition to the 30 ECU—invest 8 ECU into the project? _____

   (c) What will your total income be, if you—in addition to the 30 ECU—invest 15 ECU into the project? _____

4. Each group member has 20 ECU at her/his disposal. Assume that you invest 8 ECU into the project.

   (a) What will your total income be, if the other group members—in addition to your 8 ECU—together contribute another 7 ECU to the project? _____

   (b) What will your total income be, if the other group members—in addition to your 8 ECU—together contribute another 12 ECU to the project? _____

   (c) What will your total income be, if the other group members—in addition to your 8 ECU—together contribute another 22 ECU to the project? _____

The Experiment

This experimental session consists of 15 rounds. Before the first round, the computer randomly divides the participants into groups of 4. This division will last for the entire session. Participants within each group will play only among themselves. The assignment process is random and anonymous, so you will not know who else is in your group. Also, apart from us—the experimenters—nobody else knows the group composition.

Every round, you have 20 ECU at your disposal. The only decision to be taken is how many ECU you want to contribute to the realization of the public project. The corresponding computer screen is as follows:

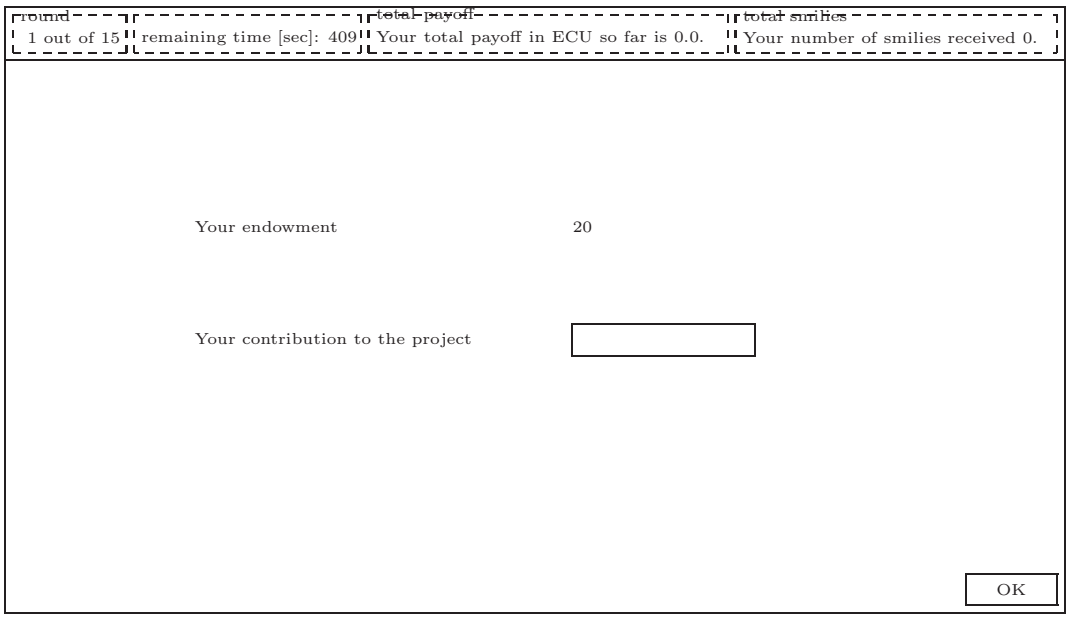

Figure 9: Screenshot 1

In the next step, you have the possibility to send Smilies of the form :) to the other group members. To do so, you are given the individual contributions of all other group members and asked whether or not you are willing to send a Smiley to the participant standing behind each particular contribution. *Observe that the individual contributions of the other group members are presented to you every round in a new random order.*

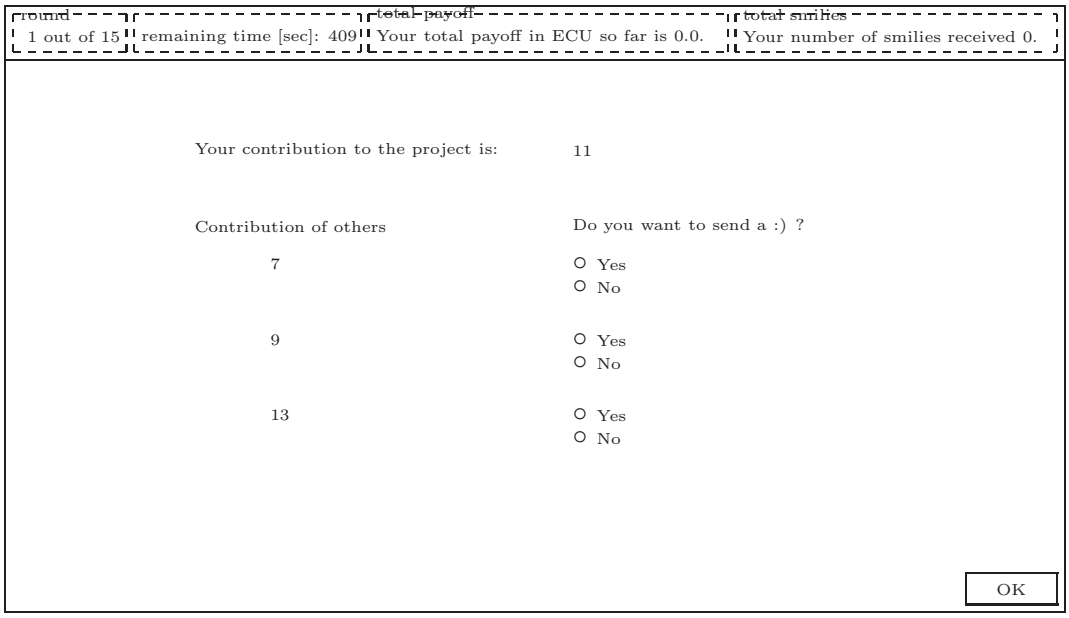

Figure 10: Screenshot 2

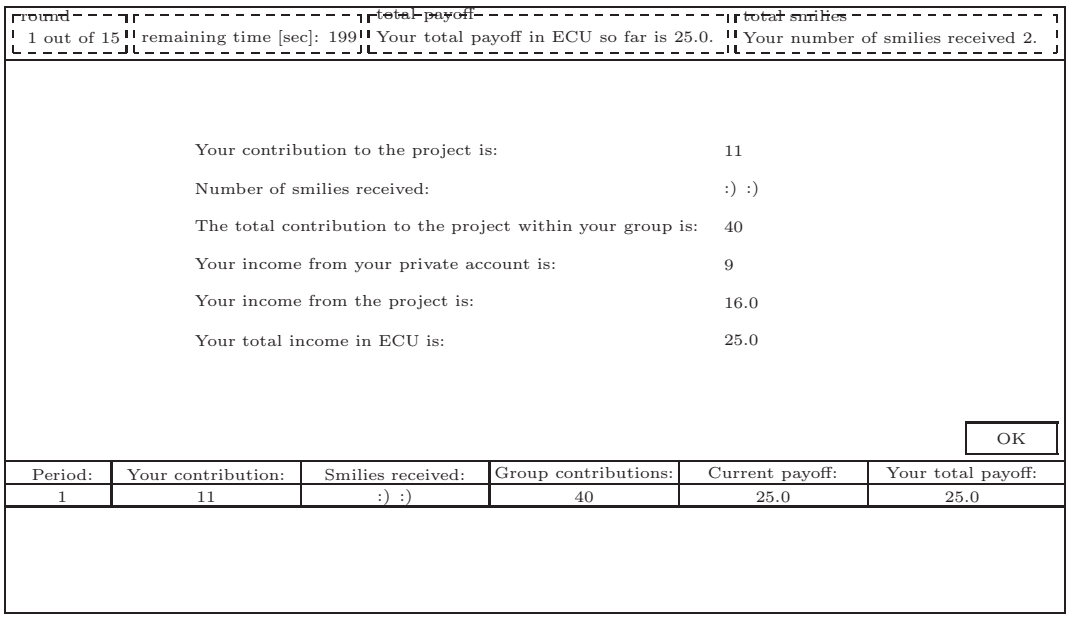

Figure 11: Screenshot 3

At the end of every round, you receive feedback on the overall contribution to the project within your group, the Smilies you received, and your resulting income (in ECU). In our example, since you contributed 11 ECU to the project and the total contribution within your group is 40 ECU, your income from the period is equal to 25 ECU. You also received two Smilies. Observe that your final payment (in Euro) is determined on the basis of the sum of all per-round payoffs (in ECU).