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Binding Contracts, Non-Binding Promises and Social Feedback in the Intertemporal Common-Pool Resource Game

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Abstract: In the intertemporal common-pool resource game, non-cooperative behavior produces externalities reducing subjects' payoffs in both the present and the future. In this paper, we investigate through two experiments whether binding contracts, non-binding promises and social feedback help to promote sustainable behavior. We find that cooperation is higher in groups where a contract can be signed or where subjects made a promise to cooperate throughout the experiment. However, not all groups sign the contract unanimously and subjects who made a promise adjust their cooperation downwards over time. We find no difference between the control condition without any regulation and the treatment condition in which subjects receive feedback on their past behavior in private. However, if received feedback can be learned by all group members, cooperation is significantly higher. Our findings show that non-binding promises and social feedback increase cooperation, but the former only in the short-run and the latter only if made public.

Keywords: cooperation; common-pool resource; non-binding promise; social feedback; laboratory experiment

1. Introduction

A common-pool resource (CPR) is a limited resource from the appropriation of which nobody can be trivially excluded. Appropriators of a CPR face a social dilemma if the consequences of their individually rational decisions considerably reduce the outcomes that initially motivated them. Even if this is common knowledge, none of the parties involved ever has a real incentive to change their behavior, whereas everyone's abstinence would be to the benefit of all. A rather extreme example of a CPR dilemma arises in a burning movie theater at a sold-out performance [1]. In such an incidence, it is in every person's self-interest to save his or her own life. The costs of not following this strategy are tremendous. Hence, everyone heads towards the exit, thus making escape increasingly improbable. In a burning movie theater, the externalities of individually rational behavior are produced at once. However, the detrimental effects of individually rational appropriation decisions in a CPR dilemma can also evolve more slowly over time. The appropriation of natural resources is the prime example. In fishery, for instance, for many centuries nobody's decision to catch a certain amount noticeably affected the yields of anybody else. However, in the second half of the last century, unrestricted fishing reduced the stocks to such an extent that fishing became increasingly unprofitable [2]. Meanwhile, it is a well-established fact that short-sighted, unsustainable behavior by humans lies at the core of the environmental problems we face. However, despite our understanding of the structure of a CPR dilemma and the fact that, for instance, today's carbon dioxide emissions will mean a higher burden for future generations than they do for our own, annual conferences on climate change repeatedly demonstrate that we are not committed to doing much about it. So, how can we overcome this lack of commitment to sustainability?

This question is difficult to answer in the field and all the more so when politicians and statesmen are involved and making decisions on behalf of the many interest groups in their countries. However, there is a considerable amount of evidence for self-governance of CPRs in the field on a lower scale than the country level [3]. Still, such environments are relatively complex and one can never be certain whether the determinants of the involved parties' decisions are all observed and measured. In the last three decades, laboratory experiments have become increasingly important in the study of human behavior in CPR dilemmas [4,5]. In laboratory experiments, unobserved and potentially confounding factors are neutralized and the effects of the variables of interest are isolated. Hence, laboratory experiments complement field studies of real-word CPR dilemmas, while also providing a higher degree of internal validity. Strong and consistent experimental evidence for the cooperation-enhancing effect of face-to-face communication and monetary sanctions has been found [6]. Although some evidence indicates that it is the possibility of commitment and approving or disapproving social feedback that makes communication effective in enhancing cooperation, these conjectures have not been tested systematically in laboratory experiments.

The present study investigates how binding contracts, non-binding promises, and social feedback affect subjects' behavior in a CPR dilemma game, set up in an experimental laboratory. The experimental setup ensures the anonymity of subjects' decisions, and therefore allows us to study the effect of non-binding promises and social feedback in isolation, unaffected by other signals and cues present in face-to-face or verbal communication. The structure of the paper following this introduction is as follows: Section 2 gives a review of findings from previous research. In Section 3, we present the game theoretical model of the intertemporal CPR dilemma and state our Hypotheses. Sections 4 and 5 present the design, the procedure and the results of our two experiments. In Section 6, we discuss our findings and conclusions, and outline our future research.

2. Previous Findings

The CPR setting has been implemented in the laboratory in many different ways in order to address various research questions. Part of the early studies investigated how far subjects' behavior in the laboratory is in line with predictions derived from game-theoretic models. Walker, Gardner, and Ostrom [7], for instance, give one of the earlier accounts of a CPR laboratory experiment. In their setup, subjects in groups of eight could decide individually whether to invest all or part of their endowment in Market 1 or Market 2. While investments in Market 1 yielded a constant rate of return, returns to investment in Market 2 depended on the total amount invested by all group members. The production function in Market 2 was parameterized such that a Pareto optimal group investment level existed, but which could be undercut or exceeded by under- or over-investment, respectively. What is more, at the Pareto optimal level of group investment, the net return from investing another unit in Market 2 was positive at the individual level. Therefore, the Nash prediction was that subjects would over-invest in Market 2, with the result being suboptimal returns to investment. Their findings corroborate these predictions.

Another laboratory experiment conducted by Herr, Gardner and Walker [8] compared subjects' behavior in a repeated CPR appropriation game with time-independent and time-dependent externalities. That is, subjects in one treatment condition faced appropriation costs that only depended on the amount depleted by each subject at the same time. Appropriation costs for subjects in the other treatment group additionally increased over time as a result of subjects' previous depletion decisions. The authors find that, in both conditions, participants' behavior corresponds with non-cooperative rather than with cooperative game solution concepts, and outcomes are significantly lower if externalities can accumulate over time. They attribute the latter finding to subjects' myopic decision-making and argue, moreover, that subjects' beliefs about the myopic behavior of others may even increase the detrimental competition for a scarce resource (for earlier experimental studies with CPR games see [9–11]).

Milinski et al. [12] suggested a "collective-risk social dilemma" to study subject's behavior concerning climate change. Actors had the option either to invest in climate protection or to keep their endowment. The game was played in groups of six over ten rounds. If the resources in the collective climate protection pool were below a certain threshold, all private resources were at risk of becoming void. The risk levels were 90, 50, or 10 percent. Only in the high-risk treatment did most groups succeed in reaching the threshold. The game structure matches the features of social or natural systems with the risk of an 'all or nothing' outcome. In contrast, the typical CPR dilemma has the property that negative externalities lead to a more gradual deterioration of collective resources.

Most laboratory experiments with CPR games were inspired by real-world cases and aimed at complementing research conducted earlier in the field [5]. These real-world cases, rather than being examples of CPR appropriation problems, illustrated how CPR could be successfully managed or under what conditions their management could fail. Among the incentives and constraints imposed by formal and informal institutions, communication and the enforcement of appropriation norms through a sanctioning system were soon identified as the main determinants of successful CPR management. Not surprisingly, these two factors were the first to be investigated in the lab. In an experiment with repeated CPR games, Ostrom et al. [6] show that communication, sanctioning, or both increase the level of cooperation and yields. Furthermore, their results show that subjects are willing to incur costs to fine free-riding group members. A sanctioning opportunity without communication, however, reduces yields when sanctioning costs are subtracted, suggesting that communication makes a sanctioning institution more efficient. Finally, subjects experiencing low yields in the first part of the experiment opt for a sanctioning institution in the second part. These groups reach higher levels of cooperation and higher yields than groups who chose not to implement a sanctioning institution (see also [13]). From these results, the authors conclude that, even without a central authority, agents are able to achieve cooperation through self-organized social institutions.

The idea that an informal sanctioning system could further the evolution of social cooperation is not new and has long been discussed in sociology [14] and political science [15]. The empirical finding, however, that subjects are willing to incur costs to fine free-riders, inspired a research strand that has attracted a lot of attention across several disciplines in the last three decades (see, e.g., [16]). Monetary punishment both communicates disapproval and punishes deviant behavior but can result in inefficient outcomes as it uses up resources [6]. Janssen et al. [17] provide further experimental evidence that a sanctioning system becomes more effective if it is combined with communication. The authors conjecture that punishment alone can be ineffective because subjects are afraid of retaliation, whereas communication allows subjects to justify their decisions and to cooperate more quickly on drawing up a set of rules (see also [18]). On the other hand, it has been argued that mere communication of normative expectations, if not backed by the threat of monetary punishment, would lose its effectiveness over time and therefore could not sustain cooperation in the long run. Noussair and Tucker [19] hypothesize that the freedom to give disapproving feedback combined with a real threat of monetary punishment should sustain cooperation and increase the efficiency of a sanctioning system compared to a system with either sanctioning mechanism alone. In their experiment with a repeated public good game, subjects had either the possibility to reduce the other group members' payoffs at a cost to themselves, had the possibility to express their disapproval with a rating on a ten point scale, or could do both. The results show significantly higher levels of cooperation if monetary punishment is possible compared with the treatment condition with nonmonetary punishment only. Moreover, they give evidence for the fact that a combination of the two sanctioning mechanisms does indeed increase efficiency (see also [20]).

It is a well-established empirical fact that in repeated game settings, contributions to public goods decrease over time if not backed by a sanctioning system. That is because otherwise cooperative subjects cease to cooperate if they experience others free-riding on their contributions. Moreover, even in one-time interactions, experimental evidence shows that subjects condition their decisions on their beliefs about other subjects' contribution levels [21]. Thus, rational and self-regarding subjects expecting other participants to be conditionally cooperative should cooperate themselves. Therefore, it is not clear how far monetary punishment is necessary to enhance cooperation in a CPR game if the adverse consequences of mutual defection are known to all participants. However, how can the parties to a CPR credibly commit themselves to cooperation? Communication as such does not affect subjects' raw incentives and, therefore, does not change Nash predictions. However, communication is more than a mere exchange of information. One obvious way communication can affect subjects' incentives is through emotional costs arising from broken promises or disapproving social feedback. The former induces guilt and the latter shame.

It has been suggested, for instance, that guilt aversion motivates cooperation in a binary trust game [22,23], as a trustee would feel guilty if he or she abused a truster's trust and, even more, if he or she had promised to do otherwise. Given that guilt aversion shapes subjects' incentives in social interactions, a promise not to let someone down is a hostage entailing emotional costs in the event of trust being abused. Starting from this assumption, Charness and Dufwenberg [24] conducted a laboratory experiment with one-shot trust games and written communication. Their results confirm that a promise to honor placed trust increases a truster's inclination to place trust and a trustee's inclination to honor that trust. In a laboratory experiment with the repeated CPR dilemma game, Mosler and Gutscher [25] allow subjects in one treatment condition to form interest groups. Subjects forming interest groups voluntarily commit themselves not to overharvest the resource and accept an authority to sanction them in case they deviate from their commitment. Their results show that subjects forming interest groups were more committed to sustainable harvesting decisions. From their experiment, it remains unclear, however, to what extent commitment and to what extent sanctioning threats induced subjects' cooperative behavior. To answer precisely this question, Vieth [26] investigates how trustees' non-binding promises and trusters' sanctioning threats or reward promises affect both parties' decisions in the one-shot trust game. Her findings consistently show that trustees' promises to honor placed trust are correlated with higher trustworthiness. Moreover, trustees are more trustworthy if promised a reward, but not if threatened with punishment (also [27]).

Guilt and shame are related concepts. Whereas guilt constitutes a psychological effect as it is created by introspection, shame constitutes a socio-psychological effect as it is induced by the disapproving reactions of others. Thus, shame aversion is an emotion that prevents one from doing things that could negatively affect one's reputation or provoke ostracism. Two studies that investigate the effect of social approval and disapproval on cooperation in the public goods game were conducted by Gächter and Fehr [28] and Rege and Telle [29]. In both experiments, subjects' decisions in the treatment condition are publicly revealed to the other group members at the end of the experiment. In the control condition, subjects only learn the aggregate group outcome. Both studies find a positive treatment effect, although the results in Gächter and Fehr's study show that cooperation decreases over time [28]. These findings, however, do not examine how far subjects actually expected the other subjects to approve or disapprove of their decisions. Other studies have implemented the possibility to approve or disapprove of other persons' decisions more explicitly. Ellingsen and Johannesson [30] and Xiao and Houser [31] conducted experiments with the one-shot dictator game, in which they varied the receivers' possibility to give written feedback to the sender. Their results consistently show that, if senders anticipate the receiver's feedback, they abstain from making unfair divisions significantly more often. The authors conjecture that sharing fairly is a norm driven by social sanctions such as shown esteem or disapproval. López-Pérez and Vorsatz [32] conduct an experiment with the one-shot prisoner's dilemma game to test hypotheses derived from a model incorporating disapproval aversion. They show that, even if subjects are brought to think about the possible reactions of their interaction partners, their propensity to cooperate increases. In a second treatment condition in which subjects could actually receive positive, negative or neutral feedback, the cooperation rate was even higher. Dugar [33] experimentally varied subjects' possibility to approve or disapprove of other subjects' decisions on a six point scale in a minimum effort game. He shows that subjects are better able to coordinate on the efficient outcome over time if they can express disapproval rather than approval. Schulz et al. [34] show that approving or disapproving feedback is more effective in communicating desirable behavior. In a field experiment, subjects' energy consumption was measured repeatedly. After the first measurement, one group received information about their own and the average energy consumption in their neighborhood. The other group received the same information but tagged with a happy face or a sad face if their energy consumption was below or above the average, respectively. In the first group, subjects adapted their energy consumption to the average, irrespective of their previous consumption level. In the second group, subjects' energy consumption decreased if it was above and did not increase if it was below the average before. Finally, Gerber, Green and Larimer [35] give evidence that people's propensity to comply with social norms increases with the degree to which their behavior is being exposed to others. In a large-scale field experiment, they vary the degree to which registered voters' participation is made public and find a substantial positive correlation with voter turnout. This finding suggests that shame is increased by the number of potential observers–something we will call the "pillory" effect.

The aim of our study is to investigate the effects of non-binding promises and social feedback (approval and disapproval) on subjects' decisions in the intertemporal CPR game. The next section describes the game in more detail and states our Hypotheses.

3. The Intertemporal CPR Game

The CPR game has N players. Each player i is endowed with the same money amount E_i and has to decide how to split the endowment on an investment of x_i in Asset A and an investment of $E_i - x_i$ in Asset B. The rate of return on Asset A is a the rate of return on Asset B is b and $a > b > 0$. Moreover, the investments in Asset A generate a cost $C = p \sum_{j=1}^{N} x_j$, where p is the rate at which total investments in Asset A translate into costs. These costs burden every player to the same extent. Investments in Asset B do not generate costs. In other words, investments in Asset A produce negative externalities and investments in Asset B are neutral. A player i's utility from his or her investment decision is thus

$$U_i = (1+a)x_i + (1+b)(E_i - x_i) - p \sum_{j=1}^{N} x_j \tag{1}$$

The utility is a linear function of x_i with gradient $a - b - p$ and intercept $E_i(1+b) - p \sum_{j \neq i}^{N} x_j$. Hence, as long as $a - b > p$ player i's utility increases in x_i. Therefore, irrespective of what the other players do, player i maximizes his or her utility by investing the whole endowment in Asset A. Rational and self-regarding agents following this strategy will thus end up getting $U_i = (1+a)E_i - p \sum_{j}^{N} E_j$. Full cooperation, that is if $x_i = 0 \; \forall \; i$ on the other hand, yields $U_i' = (1+b)E_i$. If $U_i' > U_i$, that is, if $b > a - pN$ (recall that we assume $E_i = E \; \forall \; i$), then there is a Pareto optimum in full cooperation. Since full cooperation does not establish a Nash equilibrium in rational strategies under these conditions, the CPR game represents a social dilemma.

The intertemporal CPR game considers the fact that the impact of negative externalities is often less immediate and can accumulate over time. The impact of negative externalities on agents' outcomes at time point t can be modeled as

$$C_t = p \sum_{i=1}^{N} x_{ti} + \delta C_{t-1} + \delta^2 C_{t-2} + \ldots + \delta^{t-1} C_1 \tag{2}$$

Thus, player i's utility from his or her investment decision at time t is

$$U_{ti} = (1+a)x_{ti} + (1+b)(E_{ti} - x_{ti}) - C_t \tag{3}$$

Here, $0 \leq \delta \leq 1$. If $\delta = 0$, then Equation (3) is equivalent to Equation (1) and only the externalities produced in the current period affect players' outcomes. If $\delta = 1$, then the total of external costs that have ever been produced affects players' current outcomes. Finally, if $0 \leq \delta \leq 1$ then the impact of externalities produced at an earlier time period is discounted at rate δ in every time period.

In both our experiments, subjects play the intertemporal CPR game for ten periods ($t = 10$) in groups of five ($N = 5$). In every period, each subject is endowed with 100 monetary units ($E_{ti} = 100$ MU $\forall t,\ i$). Investments in Asset A have a rate of return of 35% ($a = 0.35$) and investments in Asset B yield 5% ($b = 0.05$). Total investments in Asset A produce external costs of 2% ($p = 0.02$) which accumulate over time ($\delta = 1$). Thus, investments in Asset A can be interpreted as, for example, depletions of a non-renewable resource or as production of atomic waste with long-term persistent radiation. Also, we chose to parameterize the game with $\delta = 1$ to keep it as simple as possible.

Experiment 1 comprises three experimental conditions. Subjects in the *contract* condition can sign a contract that enforces all their investments in Asset B if signed unanimously. Subjects in the *promise* condition can voluntarily promise to invest in Asset B and if they do, their promise remains non-binding. Subjects in the *no regulation* condition do not face any regulations or possibilities to constrain themselves.

Experiment 2 comprises four experimental conditions, two of which (*contract* and *no regulation*) are the same as in Experiment 1 (see previous paragraph). In the other two conditions, after each period, subjects can rate other subjects' investment decisions either with a positive, negative or neutral rating. In the *private feedback* condition, subjects receive the other group members' ratings in private. In the *public feedback* condition, ratings are made public within the group in form of a feedback score (i.e., number of positive minus number of negative ratings).

At the end of the experiment, subjects' total earnings in terms of monetary units were averaged and converted into CHF at a rate of 0.1. The implementation of the two experiments is described in more detail at the start of Sections 4 and 5.

Hypotheses

For rational and self-regarding subjects, who apply backward induction, the model predicts investments of the total endowments in Asset A in every period. Given the parametrization of the intertemporal CPR, this results in a total payoff of 800 MU per group member. Thus, the *no regulation* condition establishes a lower benchmark for the assessment of the effectiveness of the other conditions. The *contract* condition, on the other hand, establishes an upper benchmark for our assessment. In our experiment, subjects are made aware of the social dilemma inherent in the decision situation they are facing. That is, at the beginning of the experiment, they learn that it is individually rational to invest the whole endowment in Asset A, and if everyone follows this strategy the outcome will be worse than the outcome resulting from everyone investing the whole endowment in Asset B. Hence, rational and self-regarding subjects expecting the other group members to be rational and self-regarding will sign the contract. If the contract is signed unanimously, full investment in Asset B will be executed automatically by the computer on behalf of every subject in every period. In this case, the rate of cooperation will be maximal and result in a total payoff of 1050 MU per group member.

Hypothesis 1 (H1). *Investments in sustainable Asset B will be higher in the contract condition than in the no regulation condition.*

Non-binding promises and social feedback do not affect subjects' monetary incentives. Therefore, assuming rational and self-regarding subjects does not change the predictions as compared with the *no regulation* condition. The evidence reviewed in the previous section suggests, however, that higher cooperation levels can be expected in conditions allowing for promises and feedback. First, subjects in the *promise* condition who make a non-binding promise to invest their total endowment in Asset B will comply with their promise to avoid the emotional costs they would incur from feeling guilty. Second, in both the *private feedback* and the *public feedback* conditions, subjects expecting to receive negative ratings from other group members for their investments in Asset A will rather invest in Asset B to avoid being exposed and feeling ashamed. In addition, in the *public feedback* condition, we expect investments in Asset B to be even higher due to a "pillory" effect. That is, the more potential observers there are, the higher the emotional costs incurred through shame will be and the more subjects will be inclined to avoid them by behaving cooperatively.

Hypothesis 2 (H2). *Investments in sustainable Asset B will be higher in the promise condition than in the no regulation condition.*

Hypothesis 3 (H3). *Investments in sustainable Asset B will be higher in the private feedback condition than in the no regulation condition.*

Hypothesis 4 (H4). *Investments in sustainable Asset B will be higher in the public feedback condition than in the private feedback condition.*

We test Hypotheses H1 and H2 in our first experiment and Hypotheses H1, H3 and H4 in our second experiment.

4. Experiment 1: Binding Contracts and Non-Binding Promises

The first experiment was conducted at the Decision Science Laboratory (DeSciL) of ETH Zurich[1]. Subjects were recruited by e-mail and they could register online for one of the available sessions. The 90 participants were undergraduate students from different departments, 33% female, and 20.5 years of age on average (sd = 2.55). All participants received 10 CHF for showing up and earned 25.8 CHF on average in the experiment.

4.1. Procedure

In total, six sessions were conducted with 15 subjects each[2]. Subjects were randomly assigned to one of the three conditions. Subjects were given instructions on paper (the Appendix A presents the instructions in English, translated by the authors from German). The instructions described the decision situation and explained how their own decisions and the decisions of the other subjects in their group would affect their payoffs. Several examples illustrated different scenarios[3]. Moreover, they were told that the experiment comprised two parts with 10 rounds each, that they would stay with the same four subjects in a group throughout, that their decisions were anonymous, how their earnings would be calculated from their payoffs, that their earnings would be paid out to them in private by a person not involved in the study, and that they would receive further instructions during the experiment. Then, subjects had to proceed on the screen where they first had to solve several arithmetic problems related to the decision situation. The correct answers were shown to them on the next screen. Next, they took a quiz comprising five control questions about the instructions and received the correct answers on the screen that followed. Questions with at least one wrong answer were read aloud by the experimenter and the correct answer was explained to all subjects. On the next screen, their attention was explicitly drawn to the dilemma in the interactions they were about to face. Up to this point, all subjects had received the same instructions. The screens that followed differed contingent on the experimental group to which a subject had been assigned:

1 Both the first and the second experiment were programmed and conducted with the software z-Tree [36].
2 In fact, seven sessions were conducted. Since not enough subjects showed up in Session 1, the missing treatment condition was tested in Session 7 where ten subjects were randomized on two treatments. The analysis is based on the pooled session 1 and 7 data. However, Session 7 data not generated by subjects in the missing treatment is excluded from the analysis.
3 The set of scenarios chosen for illustration was balanced, in the sense that it did not prime subjects on a particular behavior (see instructions in the Appendix A).

1. In the ***no regulation*** condition, no further instructions were given to subjects;
2. In the ***contract*** condition, subjects had to decide whether or not they wanted to sign a contract which, if signed unanimously, would authorize the computer to invest their whole endowment in Asset B in every round. Furthermore, they were made aware of two facts. They were told that if the contract was not signed by all subjects, they would be able to choose the amount they wanted to invest in Asset A or Asset B. They were also told that their decision to sign the contract or not would be displayed next to their number on the screen and would be visible to the other subjects in their group. The latter design feature allows for a better comparison of the *contract* condition and the *promise* condition, which is described next;
3. In the ***promise*** condition, subjects had to decide whether or not they wanted to promise to invest their total endowment in Asset B in every round. Moreover, they were made aware of two facts. They were told that, irrespective of their decision, they would be able to choose the amount they wanted to invest in Asset A or Asset B. They were also told that their decision to make a promise or not would be displayed next to their number on the screen and would be visible to the other subjects in their group (see Figure A1 in the Appendix A).

Next, the experiment was conducted. Apart from the groups in the *contract* condition in which the contract came into effect, subjects decided in all ten interactions how they wanted to split their endowment between Asset A and Asset B. Throughout the ten rounds, the history of their own and the other subjects' decisions was displayed on the screen, together with the total investments in assets A and B, the accumulated externalities, and their payoffs (see Figure A1 in the Appendix A). After the first part had finished, each group was assigned to one of the other experimental conditions. The second part of the experiment started with the treatment-specific instructions and proceeded in the same way as the first part. At the end of the second part, subjects learned how much they had earned and were asked to fill out a questionnaire. Thereafter, they could leave the lab and collect their money.

All result figures and test statistics reported in the next section and Section 5.2 are based on ordinary least squares (OLS) regression model estimations. Statistical significance is set at the 5% level (i.e., $\alpha = 0.05$) for two-sided tests and we account for the repeated measures obtained on the same groups of subject by estimating cluster-robust standard errors [37]. We test the statistical significance of differences between coefficient estimates using Wald tests of linear hypotheses. Upon publication, the data and Stata do-files producing the results, tables and figures reported in this paper will be made available via a public data repository.

4.2. Results

Figure 1 shows subjects' average investments in Asset B across experimental conditions. What becomes apparent instantly is that the investments in the two benchmark conditions (*no regulation* and *contract*) differ substantially. In the *no regulation* condition, average investments in Asset B are at 26.3 MU, whereas in the *contract* condition they are more than twice as high, at 53.8 MU ($F_{1,17} = 6.03$, $p = 0.025$). This supports our first Hypothesis H1. However, out of the 60 subjects who were assigned to the *contract* condition, either in the first or second part of the experiment, 15 (25%) did not sign the contract. This minority of subjects affected a majority of groups. In eight of the 12 groups (66%) in the *contract* condition, the contract did not come into effect. In these cases, subjects' average investments in Asset B did not significantly differ from subjects' average investments in the *no regulation* condition (30.8 vs. 26.3: $F_{1,17} = 0.75$, $p = 0.398$). What is more, whether or not subjects had signed the contract did not affect their subsequent investment decisions significantly, albeit those who signed the contract showed a tendency to invest lower amounts (33.8 vs. 28.9: $F_{1,17} = 2.54$, $p = 0.129$). This was unlike in the *promise* condition, in which subjects could voluntary and non-bindingly commit themselves to invest their total endowment in Asset B. Out of the 60 subjects who were assigned to the *promise* condition, 32 (53%) made a promise. Although the average amount invested in Asset B was not significantly higher than in the *no regulation* condition (35.0 vs. 26.3: $F_{1,17} = 2.28$, $p = 0.149$), we find significantly higher investments by subjects who made a promise than by subjects who did not (44.3 vs. 24.5: $F_{1,17} = 11.44$,

$p = 0.004$). The average amount invested by subjects who did not make a promise does not differ from the average amount invested in the *no regulation* condition (24.5 vs. 26.29: $F_{1,17} = 0.13$, $p = 0.720$). These results partially support our second Hypothesis H2.

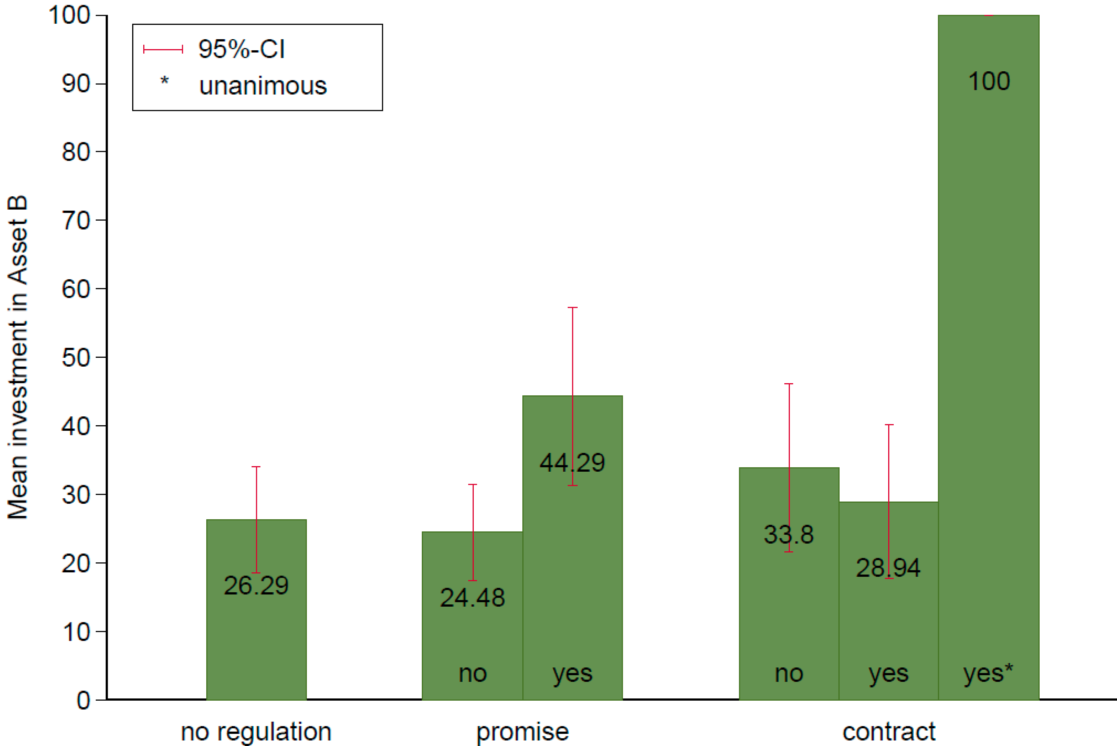

Figure 1. Mean investment in Asset B.

Figure 2 shows subjects' average investments in Asset B across experimental conditions and time[4] In all conditions, except for groups with an effectual contract in the *contract* condition, there is a clear negative trend in average investments in Asset B. Moreover, there is a clear difference between subjects who made a non-binding promise and the other subjects. Subjects who promised to invest their total endowment in Asset B start at a substantially higher investment level than subjects who did not make that promise or subjects in the other conditions. However, these subjects' investments in Asset B decrease faster and reach the same level as other groups in the last three periods. Since investment levels are decreasing from the beginning, this trend can hardly be attributed to end-round effects only.

Table 1 confirms the results presented in Figure 2. Model M1 corroborates the substantial overall downward trend in investment in Asset B ($b_{\text{period}} = -4.160$, $p < 0.001$). Model M2 shows that subjects who gave a non-binding promise invest 20 MU more on average in round 1 than subjects in the *no regulation* condition ($b_{\text{promise yes}} = 19.991$, $p = 0.023$). The model also accounts for the stronger negative trend in subjects who gave a promise by a period-promise interaction ($b_{\text{period}\times\text{promise yes}} = -3.975$, $p = 0.020$). Model M3 contains an additional term accounting for other subjects' total investments in Asset A in the previous round. If subjects are conditionally cooperative, their group members' previous investment decisions should affect their decisions in the current round. It turns out that conditional cooperation has a statistically significant but relatively weak effect on subjects' investment decisions. For every 100 MU invested in Asset A by the other four group members, a subject's investment in Asset B decreases by 8 MU ($b_{\text{others' A (lag 1)}} = -0.080$; $p = 0.008$). However, the effect of expectations and

[4] Note that in the contract condition there is no difference between investments of subjects who had signed a contract and those who had not. Therefore, the analysis is based on the pooled data disregarding whether or not subjects had initially signed the contract.

the effect of actual behavior by others cannot be separated in our data. That is, since subjects adjust their beliefs about other group members' contributions to what they have experienced in previous periods, the coefficient estimate might only reflect the discrepancy between expectations and observed behavior. Therefore, M3 most likely underestimates the influence of conditional cooperation on subjects' investment decisions. Other group members' investments in Asset A of lag 2 and 3 had no significant effect (not reported).

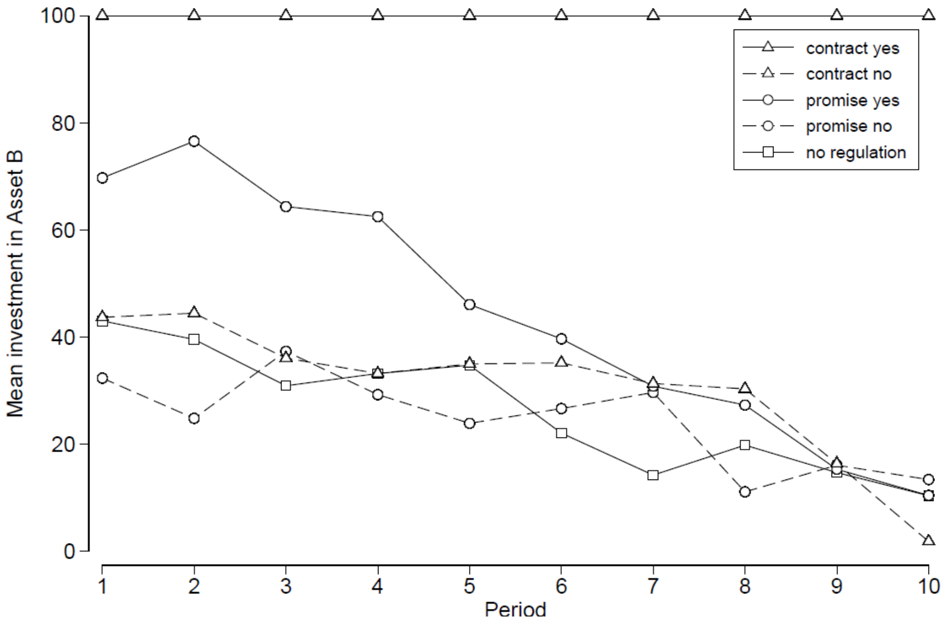

Figure 2. Mean investment in Asset B over time.

Table 1. Determinants of subjects' investment in Asset B.

	M1		*M2*		*M3*	
	Coef	**SE**	**Coef**	**SE**	**Coef**	**SE**
Main Effects						
no regulation (ref.)	28.370 ***	3.836	28.085 ***	3.918	33.872 ***	4.056
promise no	−1.808	4.966	−2.516	5.289	−5.777	4.473
promise yes	18.004 *	7.633	19.991 *	7.970	18.440 *	6.489
contract no	4.475	5.159	4.519	5.343	3.741	4.127
period	−4.160 ***	0.588	−3.591 ***	0.819	−2.378 **	0.680
Interactions with Period						
promise no			1.416	1.127	1.620	1.191
promise yes			−3.975 *	1.552	−4.260 **	1.351
contract no			−0.088	0.812	−0.749	0.829
Conditional Cooperation others' A (lag 1)					−0.080 **	0.027
N_1 (decisions)	1600		1600		1440	
N_2 (groups)	18		18		18	
adj. R^2	0.12		0.14		0.16	

Notes: OLS models with amount invested in Asset B as the dependent variable. The table lists coefficient estimates and cluster-robust standard errors (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, for two-sided tests). The variables *period* and *others'* total investments in Asset *A* are centered at 5 and 200 respectively. Subjects of groups in which a contract came into effect are excluded from the analysis (see Figure 2). N_1 and N_2 denote the number of individual decisions and groups of five, respectively.

4.3. Discussion

Despite the fact that a binding contract would have established the most efficient solution, 25% of subjects did not sign it. This minority of subjects affected the majority of groups (66%) in which a contract did not come into effect. In the second experiment, which is described in the next section in more detail, we replicated the *contract* condition. That is, subjects in this experimental condition had the possibility to sign a contract which, if unanimously signed, would authorize the computer to invest their total endowments in Asset B. Since, at the beginning of the experiment, subjects had been made aware of the inherent social dilemma in the decision situation, we were wondering why they did and, in particular, why they did not sign the contract. From the 30 subjects who participated in this condition in Experiment 2, we received 25 short statements. The subjects who had signed the contract gave more than one reason for their decision on average. They stated that they expected their earnings to be higher (10), that the contract would bring about a fair solution and increase social efficiency (7), that they would receive a sure payoff (6), that they had a bad experience in the first part of the experiment (5), that they had nothing to lose by signing it (2), or that they were curious about what would happen (1). The five subjects who decided not to sign the contract gave four reasons. One trusted the others to be fair, one expected to earn more, one regretted the decision, and two subjects said that they did not sign it because otherwise the experiment would have been boring.

5. Experiment 2: Private and Public Social Feedback

The second experiment was also conducted at DeSciL. Subjects were recruited by e-mail and could register online for one of the available sessions. Subjects were undergraduate students from different departments at ETH Zurich, 58% female, and 24.4 years of age on average (sd = 4.29). All participants received 10 CHF for showing up and earned 25.0 CHF on average in the experiment.

5.1. Procedure

Like Experiment 1, Experiment 2 comprised two parts, in both of which groups of five subjects interacted with each other in the intertemporal CPR over 10 rounds. In total, six sessions were conducted with 15 subjects each. Subjects were randomly spread on three of the four experimental conditions in the first part. Up to the point where subjects received treatment-specific instructions, the procedure of the second experiment was the same as in the first experiment (see Section 4). The instructions that followed differed contingent on the experimental condition to which a subject had been assigned:

1. In the ***no regulation*** condition, no further instructions were given to subjects;
2. In the ***contract*** condition, subjects were given the same instructions as in the *contract* condition in the first experiment;
3. In the ***private feedback*** condition, subjects were informed that after each round they would have the possibility to rate the other four subjects' investment decisions. They were told that the ratings could be positive, negative or neutral and would express approval, disapproval or indifference (see Figure A2 in the Appendix A). Moreover, they were made aware that they would neither know which of the other subjects submitted a rating nor would the other subjects learn how they had been rated;
4. In the ***public feedback*** condition, subjects received the same instructions as in the *private feedback* condition, but with one exception. Subjects were made aware of the fact that their score (i.e., number of positive minus number of negative ratings) would be displayed next to their number on the screen and would be visible to the other subjects in their group (see Figure A3 in the Appendix A).

Next, the experiment was conducted. Unlike in the first experiment, each group went through the *no regulation* condition either in the first or in the second part. In other words, all 90 subjects in

Experiment 2 went through the *no regulation* condition, either in the first or the second part, and one of the other three conditions. Whether subjects started with the *no regulation* condition in the first part or went through it only in the second part was systematically varied across sessions. At the end of the second part, subjects learned how much they had earned and were asked to fill in a questionnaire. Thereafter, they could leave the lab and collect their money.

5.2. Results

Figure 3 shows subjects' average investments in Asset B across experimental conditions. The graph confirms the results from the first experiment with respect to the *no regulation* and *contract* conditions. While average investments in Asset B are at 28.2 MU in the *no regulation* condition, they are more than twice as high in the *contract* condition, at 62.0 MU ($F_{1,17} = 4.36$, $p = 0.052$). These results once more support H1. Again, out of 30 subjects who were assigned to the *contract* condition, either in the first or second part of the experiment, seven (23.3%) did not sign the contract. Thus, the contract did not come into effect in three of the six groups (50%). As in the first experiment, in these groups, those who signed the contract showed a tendency to invest lower amounts than those who did not (28.8 vs. 19.9: $F_{1,17} = 1.31$, $p = 0.269$). With respect to social feedback, we obtain a clear result. We do not find support for our third Hypothesis H3. Feedback obtained from group members in private (in the *private feedback* condition) does not affect subjects' investments as compared to the *no regulation* condition (28.2 vs. 26.6: $F_{1,17} = 0.06$, $p = 0.802$). However, if the score (i.e., the total number of positive minus total number of negative ratings) is made public within the group (in the *public feedback* condition), investments in Asset B are significantly higher than in the *no regulation* condition (28.2 vs. 44.8: $F_{1,17} = 50.05$, $p < 0.001$) and higher than in the *private feedback* condition (26.6 vs. 44.8: $F_{1,17} = 7.64$, $p = 0.013$). These results support our last Hypothesis H4. The question is, however, how stable the effect of public feedback is over time.

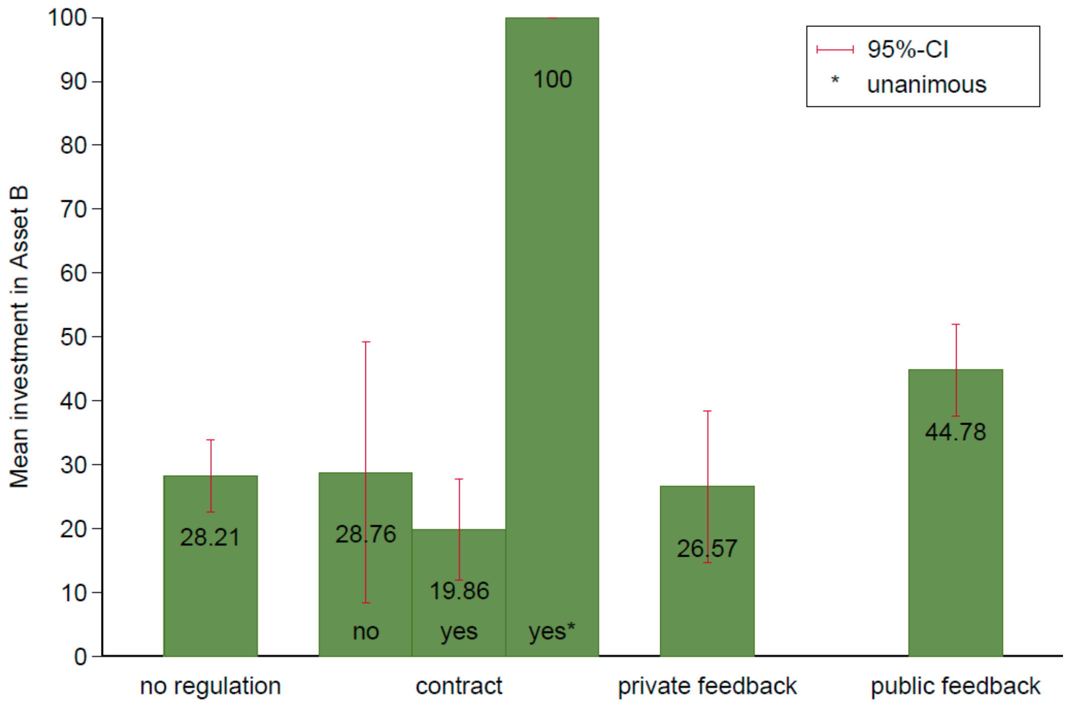

Figure 3. Mean investment in Asset B.

Figure 4 shows subjects' average investments in Asset B across experimental conditions and time. In comparison to the first experiment, subjects' investments in all conditions are rather constant or even increase in the first six periods and start decreasing from period 7. Subjects' investments in the *public feedback* condition are clearly above subjects' investments in the other conditions. Compared to promises in the first experiment, public feedback has a more stable effect on subjects' behavior, only wearing off in the last three periods.

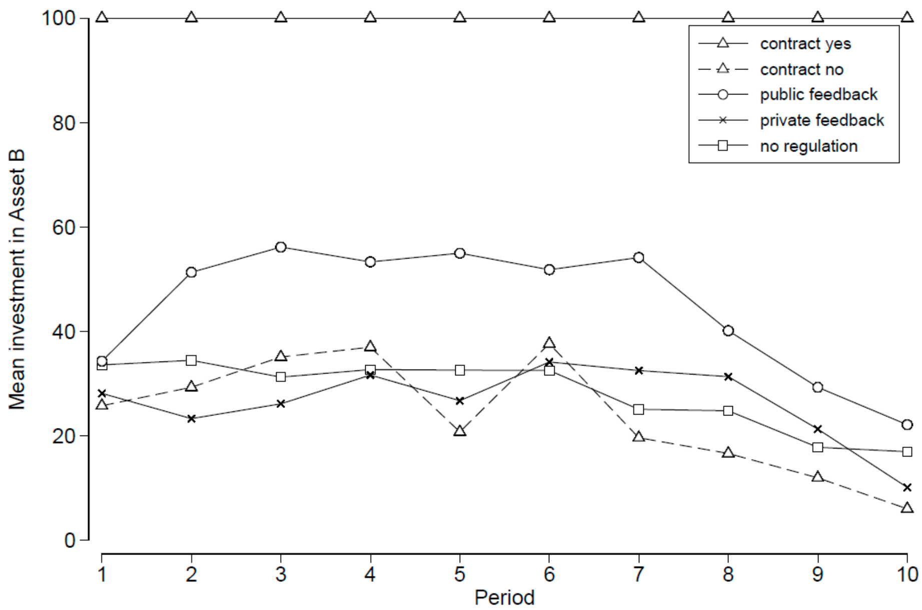

Figure 4. Mean investment in Asset B over time.

Table 2 corroborates the results presented in Figure 4. All three models contain a linear and quadratic period term accounting for the inversely u-shaped trend of subjects' investments over time. Model M1 estimates the effects of the main treatment variables only. Additional interaction terms in models M2 and M3 account for the sharper trend in the *public feedback* condition. Finally, Model M3 also accounts for subjects' investments being conditional on the other group members' total investments in the previous round. All three models confirm a statistically significant and substantial difference in subjects' investments in the *public feedback* condition as compared with the *no regulation* condition. On average, if feedback is made public, subjects' investments are 17 to 24 MUs higher than in the *no regulation* condition (M1: $b_{\text{publ. feedback}} = 16.578$, $p < 0.001$; M2: $b_{\text{publ. feedback}} = 23.771$, $p < 0.001$; M3: $b_{\text{publ. feedback}} = 17.427$, $p < 0.001$). Although conditional cooperation seems to play a role, its effect is again relatively weak. For every 100 MU invested in Asset A by the other four group members, a subjects' investment in Asset B decreases by 6 MU ($b_{\text{others' A (lag 1)}} = -0.061$; $p = 0.016$). Recall, however, that with our data, subjects' reactions to the other group members' investment decisions in the previous period cannot be disentangled from their expectations about the other group members' decisions in the future periods. Therefore, the coefficient estimate devised in Model M3 in Table 2 will underestimate the effect of conditional cooperation.

Whether feedback is provided in private only or made public within the group does not only have an effect on subjects' investments, but also on the quality and quantity of feedback provision. Figure 5 shows the average number of positive, negative and neutral feedback subjects received during the ten periods. In the *public feedback* condition, the number of positive and negative ratings is virtually the same (16.3 vs. 16.8: $F_{1,11} = 0.05$, $p = 0.821$), whereas the number of negative ratings provided in the *private feedback* condition is significantly higher than the number of positive ratings (20.9 vs. 11.3: $F_{1,11} = 8.09$, $p = 0.016$). In all likelihood, this is due to the fact that investments in sustainable Asset B are higher in the *public feedback* than in the *private feedback* condition. The number of neutral ratings is lowest and does not differ across conditions (7.8 vs. 6.9: $F_{1,11} = 0.44$, $p = 0.521$).

Table 2. Determinants of subjects' investment in Asset B.

	M1		*M2*		*M3*	
	Coef	**SE**	**Coef**	**SE**	**Coef**	**SE**
Main Effects						
no regulation (ref.)	33.843 ***	3.430	32.535 ***	3.424	36.689 ***	2.923
contract no	−4.192	6.789	−4.192	6.793	−2.947	5.744
priv. feedback	−1.639	6.448	−1.639	6.452	−0.956	5.131
publ. feedback	16.578 ***	2.344	23.771 ***	3.024	17.427 ***	2.811
period (lin.)	−1.240	0.731	−1.343	0.722	−0.953	0.746
period (quad.)	−0.590 **	0.168	−0.430 *	0.173	−0.404 *	0.173
Interaction with Publ. Feedback						
period (lin.)			0.567	1.409	−1.129	1.474
period (quad.)			−0.880 **	0.271	−0.304	0.266
Conditional Cooperation						
others' A (lag 1)					−0.061 *	0.023
N_1(decisions)	1650		1650		1485	
N_2(groups)	18		18		18	
adj. R^2	0.06		0.06		0.09	

Notes: OLS models with amount invested in Asset B as the dependent variable. The table lists coefficient estimates and cluster-robust standard errors (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, for two-sided tests). The variables *period* and *others'* total investments in Asset A are centered at 5 and 200 respectively. Subjects of groups in which a contract came into effect are excluded from the analysis (see Figure 3). N_1 and N_2 denote the number of individual decisions and groups of five, respectively.

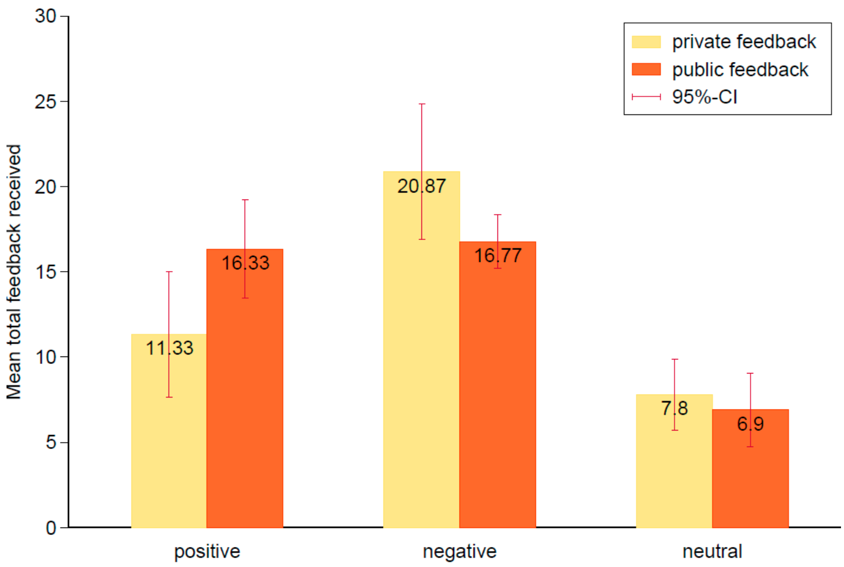

Figure 5. Mean feedback across conditions.

Figure 6 shows the average number of positive and negative ratings provided in each period in the two feedback conditions. The graph shows that the quality and quantity of feedback provision also differs over time. In the *private feedback* condition, the number of negative ratings stays above the number of positive ratings throughout the ten periods. In the *public feedback* condition, however, the number of negative ratings is below or close to the number of positive ratings in the first eight rounds, but higher in the last two rounds. This switch from mostly positive to mostly negative ratings is, in all likelihood, due to the decline in investments in Asset B in the last three rounds of the *public feedback* condition (see Figure 4).

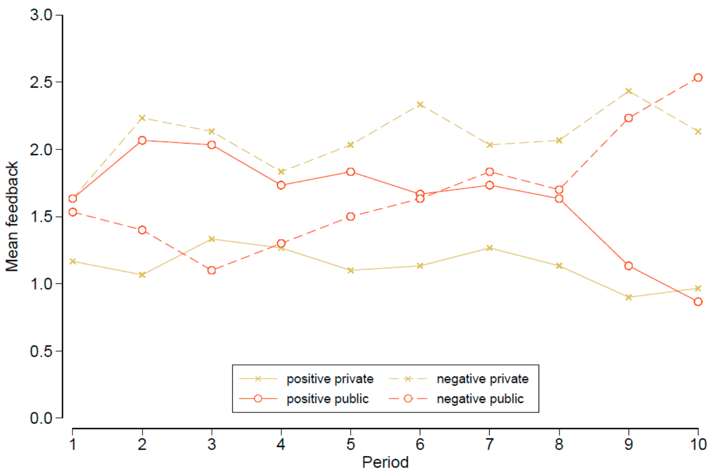

Figure 6. Mean feedback across conditions over time.

6. General Discussion and Conclusions

Our study investigates the extent to which binding contracts, non-binding promises and social feedback can help to promote sustainable appropriation in a CPR setting. It has been shown that informal sanctioning systems and communication promote cooperation in public goods and CPR settings [6,13,16,17]. However, informal sanctioning institutions are difficult to implement and monetary punishment, as it uses up resources, can lead to inefficient outcomes [16]. Communication helps subjects to coordinate on cooperative behavior and increases efficiency if combined with a sanctioning mechanism [17].

We research the extent to which non-binding promises and approving or disapproving social feedback are important elements in subjects' communication of intentions and expectations in collective decision-making. Based on evidence from behavioral game theory, we hypothesize that guilt and shame aversion are two traits that make subjects keep their promises and avoid disapproving reactions from other persons, respectively [24,30,31]. Our two experiments were designed to test these predictions. In the *promise* condition in our first experiment, subjects at the beginning of the experiment could voluntarily commit themselves to make only sustainable investments throughout the game. In two feedback conditions in our second experiment, subjects could rate group members' investment decisions after every period. In the *private feedback* condition, subjects received their ratings in private and in the *public feedback* condition ratings were made public. These conditions were tested against a lower benchmark condition without any regulations (*no regulation* condition) and an upper benchmark condition where subjects could sign a contract that enforced sustainable investments if signed unanimously (*contract* condition). The experimental setup ensured the anonymity of subjects' decisions and therefore allowed us to study the effect of voluntary, non-binding promises and social feedback in isolation, unaffected by the other signals and cues present in face-to-face or verbal communication.

We find that, without regulations, subjects' sustainable investments are relatively low and decreasing over time. Not surprisingly, groups that are given the option of signing a contract exhibit the highest level of sustainable investment. However, not all groups having this possibility sign the contract unanimously. In terms of sustainable investment, these groups do not differ from the groups in the control condition without regulation. Moreover, we find that promises have a substantial effect. That is, subjects who made a non-binding promise to make only sustainable investments throughout the experiment are reluctant to deviate from their promise. These subjects, however, adjust their investments downwards as they experience others free-riding on their cooperation [21]. Apparently, unlike subjects who made a promise, subjects who signed a contract that did not come into effect eventually are not committed to their initial declaration of intent. Recall that whether a subject signed a contract or made a promise was displayed next to their number on the decision and information feedback screens and thus made visible for all other members in their group throughout the experiment. To the contrary, we observe that subjects who signed the contract elicit a lower degree of cooperation than subjects who refused the signature. We did not hypothesize this difference, but we would like to note that this pattern emerges in both experiments (see Figures 1 and 3). A possible explanation might be that subjects willing to sign are less cooperative out of frustration that the contract failed or are just more rational than those who did not sign the contract.

Somewhat surprisingly, we do not find higher levels of sustainable investments if subjects receive the approving or disapproving feedback from other group members in private. This is in contrast to previous studies' findings (e.g., [30,31]). However, if received ratings are made public within the group, sustainable investments are significantly higher and relatively constant over time. There are at least two explanations for this difference. First, as we hypothesized, the "pillory" effect of public feedback may increase subjects' aversion to being exposed and feeling ashamed. Second, as public feedback was presented as a score (number of positive ratings minus number of negative ratings) which accumulated over time, subjects may have had status incentives to behave cooperatively. Other studies underline the plausibility of this explanation [38,39]. There are thus several avenues for future research.

Future research should investigate the relative importance of status considerations and shame for sustainable behavior. In the *public feedback* condition in our second experiment, status considerations played a minor role as there were no real benefits from acquiring a positive feedback score. An alternative design could combine the *public feedback* condition with a subsequent trust game in which the feedback score of the trustee is or is not presented to the trustor [40,41]. If status considerations play a role, investments in Asset B should be higher in the *public feedback* condition that is followed by a trust game with the feedback score of the trustee displayed. Recent research shows that sustainable behavior by individuals and organizations is perceived as a signal of these individuals' and organizations' trustworthiness [42,43].

Another avenue of future research should investigate more closely the interaction between psychological mechanisms like guilt and shame with structural individual differences [44]. In most everyday social dilemmas people differ in their endowments, costs of behaving in a particular way and the benefits they gain from their behavior. This can have positive [45,46] and negative effects on collective outcomes [47,48]. It has been shown that when paired with communication, inequality in endowments can help to reach sustainability targets and avoid collective losses in a public goods game [49].

Finally, in the light of the current debate about "car shaming" and "flight shaming", the above and related findings could be tested in field experiments. Lab experiments allow for systematic variation of experimental conditions and thus identification of the causal mechanisms in question. Moreover, lab experiments facilitate cumulative research and replication [50]. To extend the validity of lab findings on the roles of binding contracts, non-binding promises and social feedback in the intertemporal CPR game, future research should devise experimental or quasi-experimental designs to test the conjectures that can be derived from ours and others findings in natural settings [51].

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Experimental Instructions

The experiment consists of two parts. In each part, you and four other people will make decisions in 10 consecutive rounds. The groups of five will be randomly formed before the first part of the experiment and remain unchanged throughout both parts. In each of the 10 rounds of each part, you and the other 4 people receive 100 monetary units (MU) each. You then decide independently from each other how much of the 100 MU you want to invest in Asset A and how much in Asset B.

An investment in Asset A has a rate of return of 35% and an investment in Asset B has a rate of return of 5%. Investments in Asset A generate costs that are incurred by all five people. That is, 2% of the sum invested in Asset A will be subtracted from each of your five accounts. Investments in Asset B do not generate any costs. Four examples:

Table A1. Four examples.

	Ex. 1: All 5 invest in A	**Ex. 2: Only you** invest in A	**Ex. 3: All 5** invest in B	**Ex. 4: Only you** invest in B
Your investment in A	100	100	0	0
Your investment in B	0	0	100	100
Total investment in A	500	100	0	400
Total investment in B	0	400	500	100
Your gain from A (+35%)	135	135	0	0
Your gain from B (+5%)	0	0	105	105
Costs from A (−2%)	−10	−2	0	−8
Your profit	125	133	105	97

In each round, the costs from A are calculated as the total investments in A × (−0.02). Your profit in each round is calculated as the gain from A + gain from B – costs from A.

Important! The costs from investments in Asset A sum up over time. In each round, the costs from the previous round are added to the costs of the current round and subtracted from your profit. On the back of this page, the four examples in Table A1 are presented over the 10 rounds in Table A2 and illustrate this fact (look at these tables from left to right, row by row).

After each part of the experiment the average of the profit you made in the 10 rounds will be calculated. Both amounts will be added and divided by 10. At the end of the experiment, you will receive this amount in CHF together with a show-up payment of 10 CHF. **Example:** Your average profits from the two parts of the experiment are 126 and 84. The amount you will be paid after the experiment in cash is (126 + 84)/10 + 10 = 31 CHF.

Further instructions follow at the start of each part of the experiment. Please read them attentively.

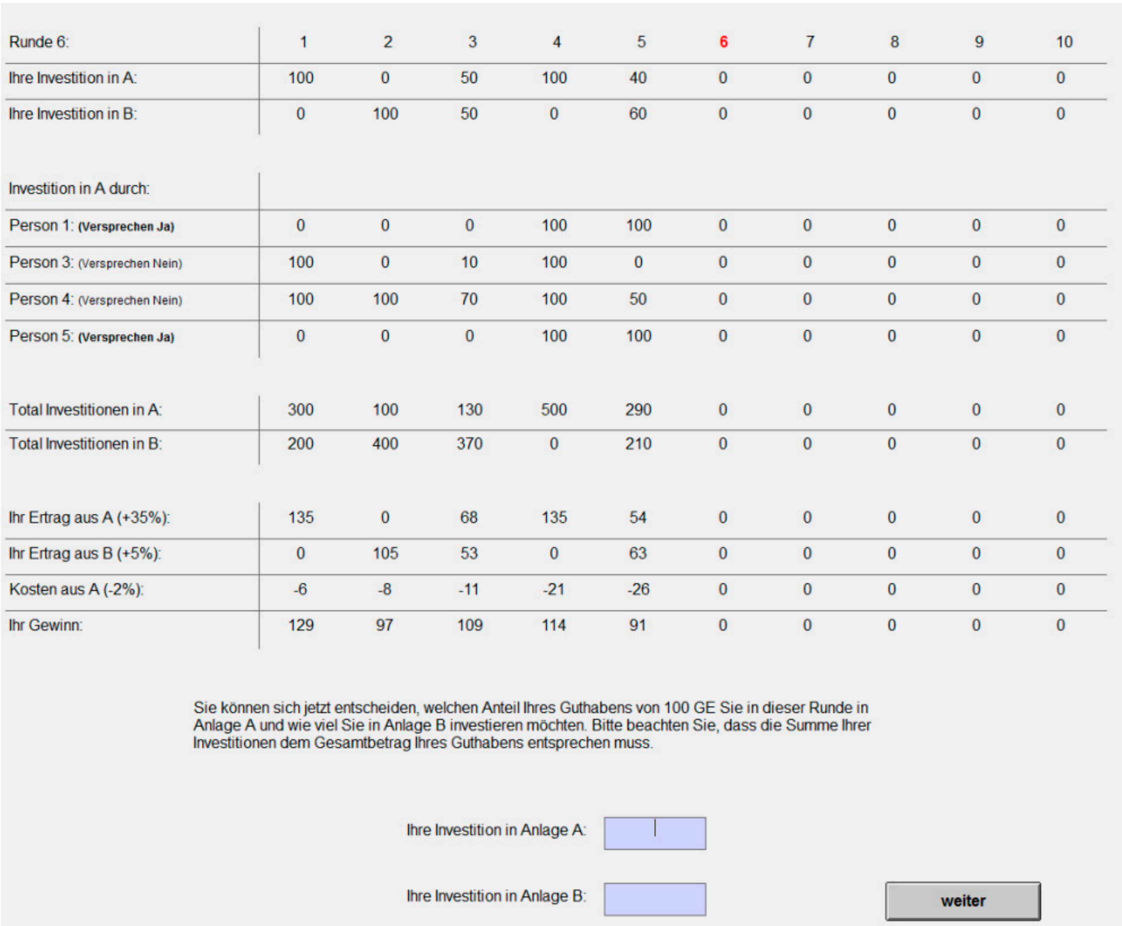
Please return this sheet after the experiment.

Table A2. Four examples over time.

Ex. 1: All 5 invest in A (your average profit = 80).										
Round	1	2	3	4	5	6	7	8	9	10
Your investment in A	100	100	100	100	100	100	100	100	100	100
Your investment in B	0	0	0	0	0	0	0	0	0	0
Total investment in A	500	500	500	500	500	500	500	500	500	500
Total investment in B	0	0	0	0	0	0	0	0	0	0
Your gain from A (+35%)	135	135	135	135	135	135	135	135	135	135
Your gain from B (+5%)	0	0	0	0	0	0	0	0	0	0
Costs from A (−2%)	−10	−20	−30	−40	−50	−60	−70	−80	−90	−100
Your profit	125	115	105	95	85	75	65	55	45	35
Ex. 2: Only you invest in A (your average profit = 124)										
Round	1	2	3	4	5	6	7	8	9	10
Your investment in A	100	100	100	100	100	100	100	100	100	100
Your investment in B	0	0	0	0	0	0	0	0	0	0
Total investment in A	100	100	100	100	100	100	100	100	100	100
Total investment in B	400	400	400	400	400	400	400	400	400	400
Your gain from A (+35%)	135	135	135	135	135	135	135	135	135	135
Your gain from B (+5%)	0	0	0	0	0	0	0	0	0	0
Costs from A (−2%)	−2	−4	−6	−8	−10	−12	−14	−16	−18	−20
Your profit	133	131	129	127	125	123	121	119	117	115

Table A2. *Cont.*

Ex. 3: All 5 invest in B (your average profit = 105)										
Round	1	2	3	4	5	6	7	8	9	10
Your investment in A	0	0	0	0	0	0	0	0	0	0
Your investment in B	100	100	100	100	100	100	100	100	100	100
Total investment in A	0	0	0	0	0	0	0	0	0	0
Total investment in B	500	500	500	500	500	500	500	500	500	500
Your gain from A (+35%)	0	0	0	0	0	0	0	0	0	0
Your gain from B (+5%)	105	105	105	105	105	105	105	105	105	105
Costs from A (−2%)	0	0	0	0	0	0	0	0	0	0
Your profit	105	105	105	105	105	105	105	105	105	105
Ex. 4: Only you invest in B (your average profit = 61)										
Round	1	2	3	4	5	6	7	8	9	10
Your investment in A	0	0	0	0	0	0	0	0	0	0
Your investment in B	100	100	100	100	100	100	100	100	100	100
Total investment in A	400	400	400	400	400	400	400	400	400	400
Total investment in B	100	100	100	100	100	100	100	100	100	100
Your gain from A (+35%)	0	0	0	0	0	0	0	0	0	0
Your gain from B (+5%)	105	105	105	105	105	105	105	105	105	105
Costs from A (−2%)	−8	−16	−24	−32	−40	−48	−56	−64	−72	−80
Your profit	97	89	81	73	65	57	49	41	33	25



Runde 6:	1	2	3	4	5	6	7	8	9	10
Ihre Investition in A:	100	0	50	100	40	0	0	0	0	0
Ihre Investition in B:	0	100	50	0	60	0	0	0	0	0
Investition in A durch:										
Person 1: **(Versprechen Ja)**	0	0	0	100	100	0	0	0	0	0
Person 3: (Versprechen Nein)	100	0	10	100	0	0	0	0	0	0
Person 4: (Versprechen Nein)	100	100	70	100	50	0	0	0	0	0
Person 5: **(Versprechen Ja)**	0	0	0	100	100	0	0	0	0	0
Total Investitionen in A:	300	100	130	500	290	0	0	0	0	0
Total Investitionen in B:	200	400	370	0	210	0	0	0	0	0
Ihr Ertrag aus A (+35%):	135	0	68	135	54	0	0	0	0	0
Ihr Ertrag aus B (+5%):	0	105	53	0	63	0	0	0	0	0
Kosten aus A (-2%):	-6	-8	-11	-21	-26	0	0	0	0	0
Ihr Gewinn:	129	97	109	114	91	0	0	0	0	0

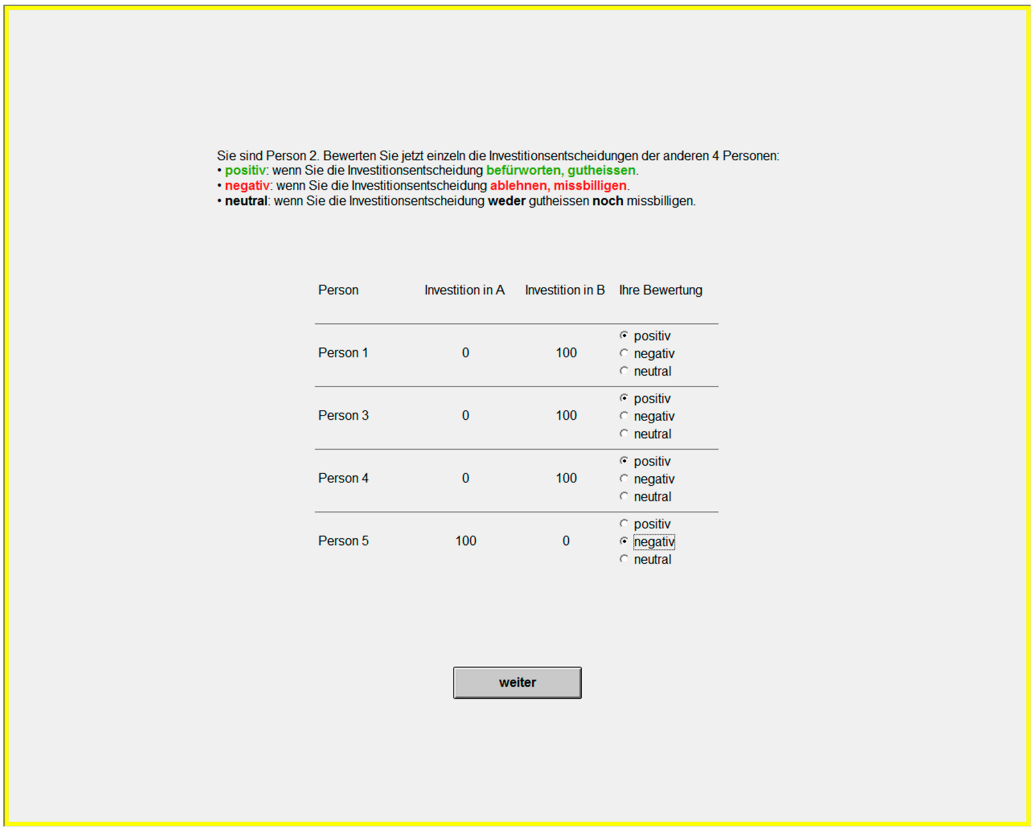
Sie können sich jetzt entscheiden, welchen Anteil Ihres Guthabens von 100 GE Sie in dieser Runde in Anlage A und wie viel Sie in Anlage B investieren möchten. Bitte beachten Sie, dass die Summe Ihrer Investitionen dem Gesamtbetrag Ihres Guthabens entsprechen muss.

Ihre Investition in Anlage A:

Ihre Investition in Anlage B:

weiter

Figure A1. Decision screen of Person 2 in period 6 in *promise* condition.

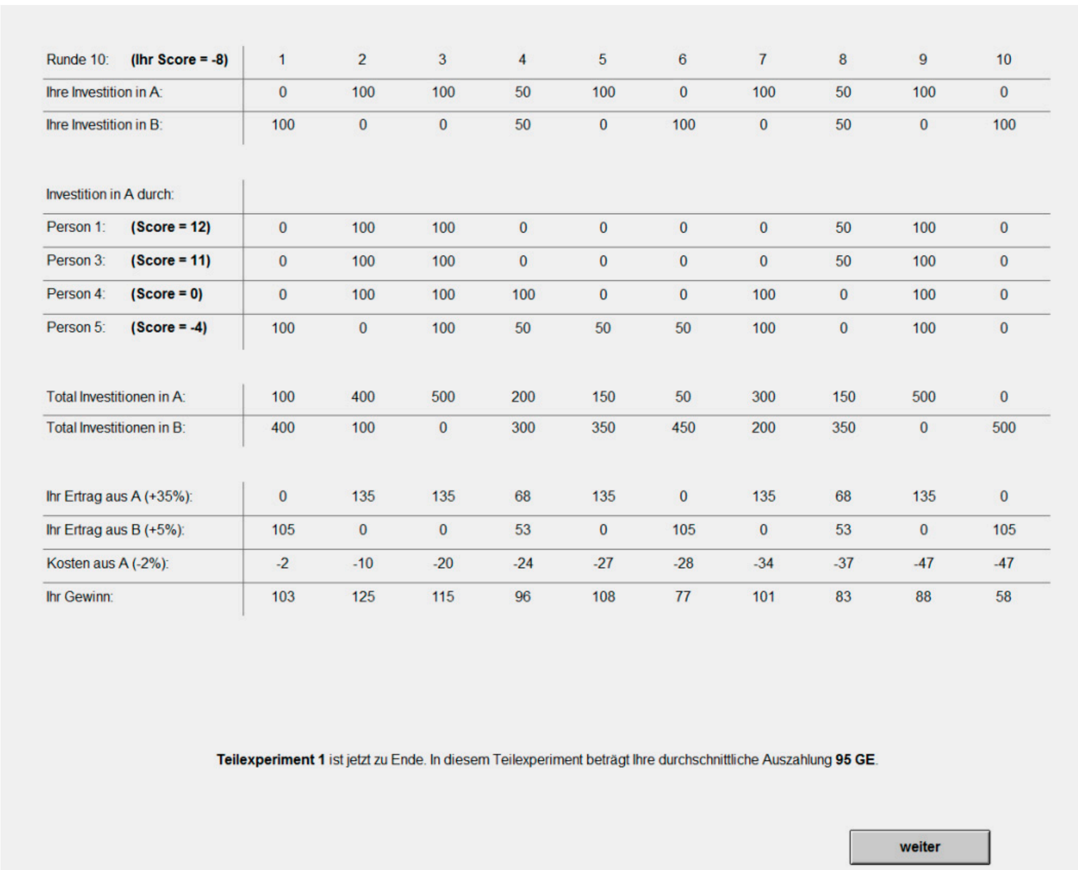


Sie sind Person 2. Bewerten Sie jetzt einzeln die Investitionsentscheidungen der anderen 4 Personen:
• **positiv**: wenn Sie die Investitionsentscheidung **befürworten, gutheissen**.
• **negativ**: wenn Sie die Investitionsentscheidung **ablehnen, missbilligen**.
• **neutral**: wenn Sie die Investitionsentscheidung **weder** gutheissen **noch** missbilligen.

Person	Investition in A	Investition in B	Ihre Bewertung
Person 1	0	100	positiv / negativ / neutral
Person 3	0	100	positiv / negativ / neutral
Person 4	0	100	positiv / negativ / neutral
Person 5	100	0	positiv / negativ / neutral

weiter

Figure A2. Rating screen of Person 2 in feedback conditions.



Runde 10: **(Ihr Score = -8)**	1	2	3	4	5	6	7	8	9	10
Ihre Investition in A:	0	100	100	50	100	0	100	50	100	0
Ihre Investition in B:	100	0	0	50	0	100	0	50	0	100
Investition in A durch:										
Person 1: **(Score = 12)**	0	100	100	0	0	0	0	50	100	0
Person 3: **(Score = 11)**	0	100	100	0	0	0	0	50	100	0
Person 4: **(Score = 0)**	0	100	100	100	0	0	100	0	100	0
Person 5: **(Score = -4)**	100	0	100	50	50	50	100	0	100	0
Total Investitionen in A:	100	400	500	200	150	50	300	150	500	0
Total Investitionen in B:	400	100	0	300	350	450	200	350	0	500
Ihr Ertrag aus A (+35%):	0	135	135	68	135	0	135	68	135	0
Ihr Ertrag aus B (+5%):	105	0	0	53	0	105	0	53	0	105
Kosten aus A (-2%):	-2	-10	-20	-24	-27	-28	-34	-37	-47	-47
Ihr Gewinn:	103	125	115	96	108	77	101	83	88	58

Teilexperiment 1 ist jetzt zu Ende. In diesem Teilexperiment beträgt Ihre durchschnittliche Auszahlung **95 GE**.

weiter

Figure A3. Final screen of Person 2 in *public feedback* condition.

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