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by Stephan Schosser and Bodo Vogt

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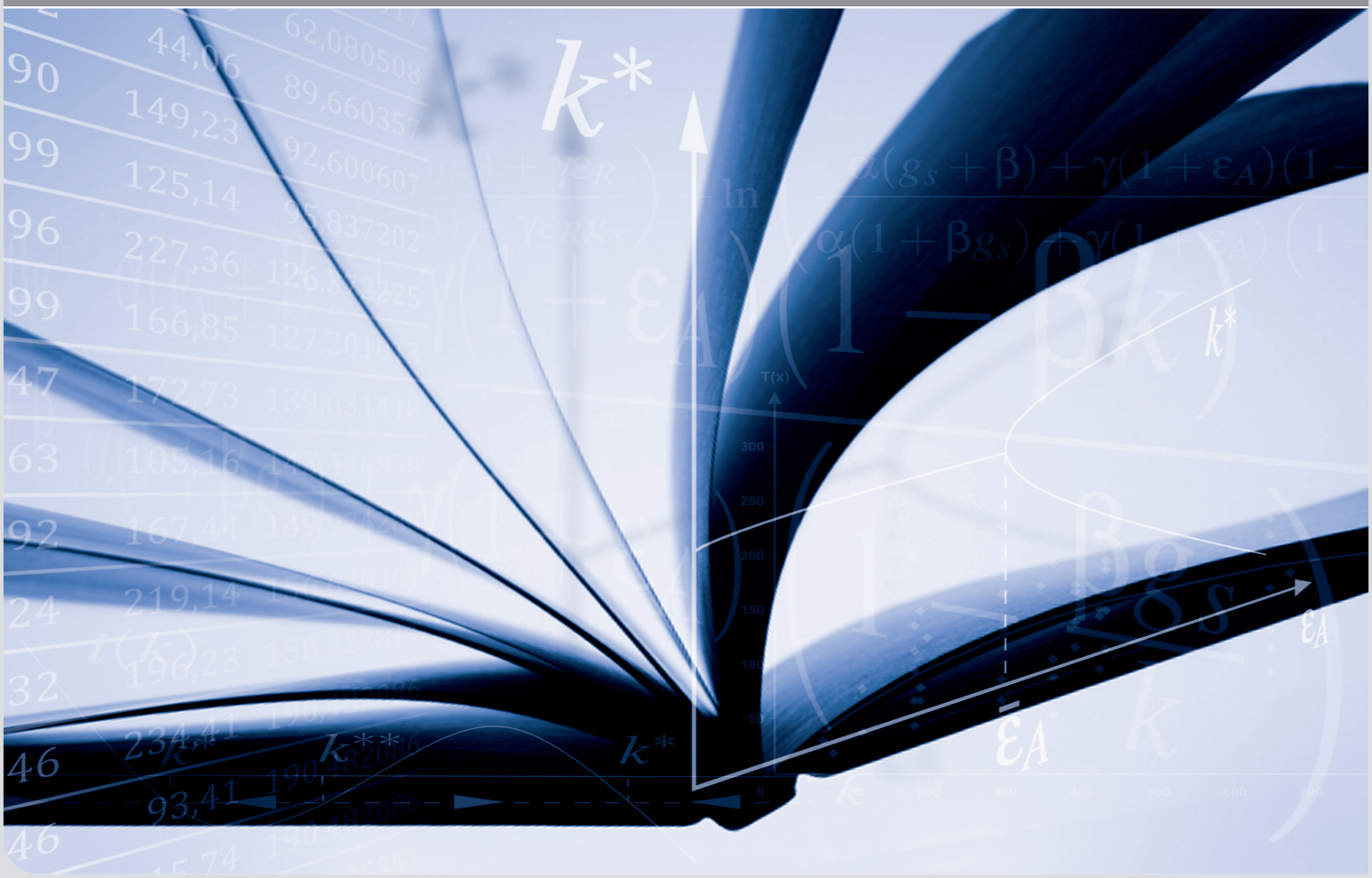

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The Public Loss Game

- An Experimental Study of Public Bads -

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Abstract

We analyze cooperative behavior of participants who faced a loss. In particular, we extend the Public Good Game by a fixed loss in the beginning of every period. We show that humans change their behavior compared to corresponding studies with gains only. First, in contrast to literature on gains, we observe significant order effects. When participants first play a treatment with punishment, they cooperate less and face higher punishment costs than when first playing a treatment without punishment. The changes are that drastic that punishment does not pay in the first case, while it does in the later. Second, for participants first playing without punishment the contributions in the very first period of play determine the contributions throughout both treatments of the game, yielding higher contributions in the punishment treatment than when playing with gains. Participants punishing first, show no comparable behavior.

Keywords: Public Good, Punishment, Losses, Experiment.

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We live in a time of crises. Several advanced economies face the severe thread of bankruptcy; whole populations in Africa and the Middle East loose the basis for their lives in their fight for democracy; and environmental threads, like Fukushima or CO_2 emissions, endanger other countries. All these crises lead to large-scale cooperation across nations. Europe offers credit to financially save their struggling partners; the US military supports the fight against dictators and the whole world almost instantly sent technical equipment and manpower to Japan after the first plant in Fukushima exploded. This result is surprising as experimental work on cooperation of the last decades confirms one central fact: Although strangers initially contribute to a high extend, voluntary support for others decreases over time [12, 29]. While varying in height across different cultures, this effect can be found worldwide [3]. Between the examples above and the experimental studies one central difference exists. In experiments participants distribute money they received as "present" from the experimenter, while voluntary contribution among the described nations is a direct response to the losses different humans faced. Therefore, one central question emerges: What are the characteristics of cooperation in the loss case?

Biologists, psychologists and economists have intensively studied cooperation under gains. Different motivations for cooperation exist [20]. Kin selection [1, 23], i.e. close relatedness between different individuals, fosters cooperation. This motive only explains cooperation among relatives. Reciprocity [21, 22], i.e. cooperation with others who cooperated before, circumvents this restriction and allows for cooperation among strangers. Finally, group selection [13], i.e. selecting interaction partners, ensures cooperation as cooperative individuals join other cooperative individuals who in consequence do not decrease their cooperation levels. Aside these justifications for cooperation, altruistic punishment ensures cooperative behavior among participants [1, 4, 14]. Here, participants use part of their earnings to reduce the payoff of other group members. Although the cultural background of participants strongly influences punishment behavior [5, 14], several basic properties do not differ across different subject pools: with the use of punishment the degree of cooperation remains stable; participants use anti-social punishment, i.e. a fraction of participants punishes others although being more cooperative then themselves; punishers accept the costs for punishment often resulting in lower overall payoffs than in experiments without punishment. Surprisingly, even informal punishment, i.e. stating disapproval with the behavior of others instead of direct monetary sanctions, ensures high degrees of cooperation [19]. Is the punishment mechanism extended by a reputation mechanism, the degree of cooperation increases even further [24]. In sum, punishment is the preferred mechanism to ensure cooperation – even among strangers. Even participants having the chance to choose between an institution with punishment and an institution without punishment prefer the punishment institution [11, 26]. In addition punishment does not crowd out voluntary cooperation: If

participants first cooperate in a scenario with punishment before acting in a scenario without, they show exactly the same behavior as when not having faced the punishment scenario before – at least when participants play under gains and punishment is perceived as fair [7].

Public Good Games are a prominent approach to analyze punishment, cooperation and reciprocity. In one popular version of the Public Good Game [3], participants interact in groups of four for ten periods. Each group member receives an endowment of 20 tokens each period. Then the participants choose how many tokens they want to contribute to a joint project and how many tokens to keep for them. For each token kept, a participant receives 1 Experimental Currency Unit (ECU), while all members of the group receive 0.4 ECU per token contributed. In groups where all participants keep all tokens for themselves, the payoff per participant is 20 ECU. If all participants contribute everything into the group project, the overall payoff per participant is 32 (= 0.4x20x4) ECU. Hence, each participant can choose to earn 20 ECU without any risk, while they can earn up to 32 ECU by risking to be exploited by the other group members.

In experiments, one typically adds punishment to the Public Good Game by displaying the contributions of all other group members after the distribution decision. Participants can than assign up to 10 deduction points to each other group member depending on their contributions. Per assigned deduction point the punishing participant pays one 1 ECU, while the punished participant looses 3 ECU.

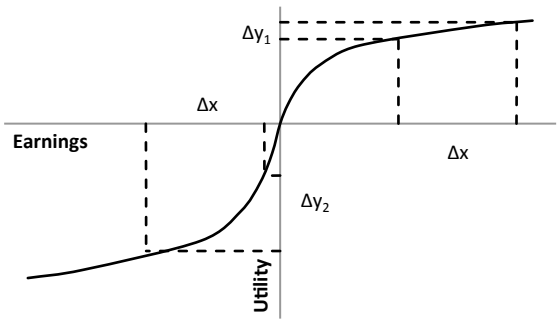


Figure 1: Impact of equivalent changes in earnings on utility under gains and losses. According to prospect theory, which is widely accepted among behavioral economists, methods transferring monetary payoffs in utility have two central properties: (1) Utility functions are s-shaped and individuals value losses higher than gains. In cooperative situations the shape of a utility function has a severe impact on the decision situation. If a certain fraction of the payoff is fixed and a variable part is added, the variable part has only minor impact on utility. This is visualized in the right part of this figure. Doubling earnings (Δx) leads to a small increase in utility (Δy_1). If individuals faced a loss before their decision, the impact of the fixed payoff is small, while the same increase in payoffs (Δx) leads to a drastic increase of utility (Δy_2)

In Public Good experiments without punishment one typically observes mediocre contributions to the public good in the first periods, which decrease over time. Almost all participants choose to play the riskless strategy in the end of the experiment. While in

treatments with punishment participants tend to resort to the risky strategy throughout the experiment.

During the last years, prospect theory [17, 18, 28, 15, 16] is often used to explain human behavior. According to this theory utility functions are s-shaped and individuals value losses higher than gains (see Figure 1). The additional utility (Δy_1) participants receive if all participants cooperate, compared to groups without any contributions are small in the gain case. Namely, if all participants can guarantee earnings of 20 ECU by egoistic behavior, their increase in utility is small if all increase their earnings to 32 ECU by contributing everything. The situation changes, if participants act under losses. E.g., if all participants receive a loss of 32 ECU in the beginning of each period, they can reach earnings of 0 ECU per period by showing full cooperation, while they receive -10 ECU when being uncooperative. The impact of the same difference in earnings (Δx) is big, when calculating the utility change (Δy_2) of a participant. Given this observation, changes in mediocre levels of contribution have a stronger impact on utility when analyzing losses, than when analyzing gains. Participants have to cooperate much more to reach the same levels of utility under losses, than they have to under gains. Therefore, effects of emotions [3] or reciprocity [20] should be much clearer to observe than in experiments with gains.

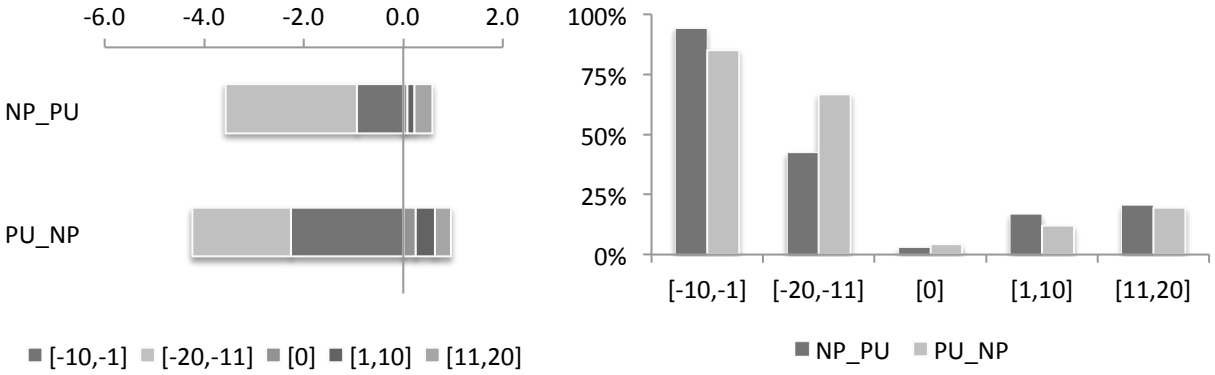
Table 1: Frequency and average height of social and anti-social punishment per group: This table gathers information concerning punishment in both session types. As Social Punishment, we summarize all situations, in which the current participant contributed more than the group member he might punish. Anti-Social Punishment stands for all other situation, i.e. when the other group member contributed more or the same amount as the current participant. The column '#' indicates the number of occurrences of corresponding situations, 'Freq.' stands for the proportion of punishments divided by the value in '#'. The column 'Avg.' finally specifies the average amount of ECU a participant invested in punishment of other group members. Notice, that in three groups (5, 8, 11) of the NP_PU sessions no participant ever deviated from full contribution. Hence, no participant of these groups could ever punish socially.

	Social Punishment						Anti-Social Punishment						All Punishment			
Grp.	NP_PU			PU_NP			NP_PU			PU_NP			NP_PU		PU_NP	
	#	Freq.	Avg.	#	Freq.	Avg.	#	Freq.	Avg.	#	Freq.	Avg.	Freq.	Avg.	Freq.	Avg.
1	12	66.7%	0.67	29	89.7%	0.90	108	15.7%	0.16	91	7.7%	0.08	20.8%	-0.34	27.5%	-1.38
2	12	91.7%	0.92	34	64.7%	0.65	108	0.0%	0.00	86	7.0%	0.07	9.2%	-0.28	23.3%	-1.06
3	15	100.0%	1.00	29	75.9%	0.76	105	0.0%	0.00	91	2.2%	0.02	12.5%	-0.54	20.0%	-0.67
4	9	88.9%	0.89	59	71.2%	0.71	111	6.3%	0.06	61	9.8%	0.10	12.5%	-0.21	40.0%	-1.25
5	0	-	-	46	76.1%	0.76	120	0.0%	0.00	74	16.2%	0.16	0.0%	0.00	39.2%	-1.98
6	6	100.0%	1.00	57	57.9%	0.58	114	0.0%	0.00	63	9.5%	0.10	5.0%	-0.15	32.5%	-1.68
7	44	15.9%	0.16	18	77.8%	0.78	76	2.6%	0.03	102	2.0%	0.02	7.5%	-0.13	13.3%	-0.28
8	0	-	-	3	66.7%	0.67	120	2.5%	0.03	117	3.4%	0.03	2.5%	-0.03	5.0%	-0.09
9	23	82.6%	0.83	12	100.0%	1.00	97	6.2%	0.06	108	2.8%	0.03	20.8%	-0.77	12.5%	-0.25
10	35	57.1%	0.57	6	66.7%	0.67	85	12.9%	0.13	114	0.0%	0.00	25.8%	-0.84	3.3%	-0.21
11	0	-	-	32	62.5%	0.63	120	0.8%	0.01	88	2.3%	0.02	0.8%	-0.01	18.3%	-0.38
12	18	83.3%	0.83	49	85.7%	0.86	102	18.6%	0.19	71	49.3%	0.49	28.3%	-0.82	64.2%	-3.78
All	174	62.6%	-1.97	374	73.3%	-2.97	1266	5.2%	-0.12	1066	8.0%	-0.42	12.2%	-0.34	24.9%	-1.08

Experimental Results We report the results of an experiment on public goods with losses. The experiment is identical to the experiment introduced by Fehr [3], except for a loss all participants received in each period at the height of the maximum earnings the participants could reach under full cooperation, namely at height 32 and the payoff mechanism. We paid all participants 14 days in advance, to ensure they used the money as it was their own [25]. We conducted our experiments at the Karlsruhe Institute of Technology and compare our results with results from a public good experiment conducted in Bonn during an intercultural study [14]. We first give an overview of the punishment behavior observed, before we analyze the contributions of the participants and their payoffs. As participants changed their behavior between both session types, we put our focus on the differences between session types.

Punishment: According to existing analyses of public good games (see e.g. [4, 3, 14]) public good experiments with and without punishment should not show any order effects. Therefore, we analyze punishment behavior in the Public Loss Game with a focus on order (see Table 1). An analysis of punishment behavior shows that participants in first playing in a treatment without punishment and in a treatment with punishment afterwards (NP_PU sessions) punish less (Mann-Whitney U, two-tailed, $p = 0.046$, $Z = -1.994$, $W = 115.5$, $U = 37.5$) and face lower punishment costs (Mann-Whitney U, two-tailed, $p = 0.026$, $Z = -2.223$, $W = 111.5$, $U = 33.5$) than participants who play the other sequence of treatments (in PU_NP sessions). When analyzing Social Punishment, i.e. punishment of less cooperative group members, and Anti Social Punishment, i.e. punishment of equally or more cooperative group members, we neither see this effect in the frequency (Social Punishment: Mann-Whitney U, two-tailed, $p = 0.393$, $Z = -0.855$, $W = 120.0$, $U = 42.0$; Anti Social Punishment: Mann-Whitney U, two-tailed, $p = 0.297$, $Z = -1.044$, $W = 132$, $U = 54$) nor the height (Social Punishment: Mann-Whitney U, two-tailed, $p = 0.594$, $Z = -0.533$, $W = 124.5$, $U = 46.5$; Anti Social Punishment: Mann-Whitney U, two-tailed, $p = 0.117$, $Z = -1.566$, $W = 123$, $U = 45$) of punishment. Therefore, we calculate the difference between own contribution and the contribution of a group member and bin punishment accordingly. Hence, we split Social Punishment into the intervals [-20,-11] and [-10,-1], while we split Anti-Social Punishment into [0], [1,10] and [11,20] (see Figure 2). Using this grouping, we find differences in the frequency and height of punishment for the interval [-20,-11] (Freq.: Mann-Whitney U, one-tailed, $p = 0.040$, $Z = -1.873$, $W = 92$, $U = 26$, Avg.: Mann-Whitney U, one-tailed, $p = 0.040$, $Z = -1.787$, $W = 92$, $U = 26$). All other intervals show no significant differences ([-10,-1] Freq.: Mann-Whitney U, two-tailed, $p = 0.879$, $Z = -0.153$, $W = 92.5$, $U = 47.5$; Avg. Mann-Whitney U, two-tailed, $p = 0.196$, $Z = -1.292$, $W = 98.5$, $U = 32.5$; [0] Freq.: Mann-Whitney U, two-tailed, $p = 0.887$, $Z = -0.189$, $W = 147$, $U = 69$; Avg.: Mann-Whitney U, two-tailed, $p = 0.950$, $Z = -0.063$, $W = 149$, $U = 71$; [1,10] Freq.: Mann-Whitney U, two-tailed, $p = 0.776$, $Z = -0.284$, $W = 91$, $U = 46$; Avg.: Mann-Whitney U, two-tailed, $p = 0.626$, $Z = -0.487$, $W = 109.5$, $U = 43.5$; [11,20] Freq.: Mann-Whitney U, two-tailed, $p = 0.542$, $Z = -0.609$, $W = 87$, $U = 42$; Mann-Whitney U, two-tailed, $p = 0.239$, $Z = -1.177$, $W = 101$, $U = 35$). To sum up, significant differences in punishment behavior between both session types exist. Namely, both frequency of punishment and average height of punishment are higher in the punishment treatment of PU_NP sessions

than in the punishment treatment of NP_PU sessions. We attribute this result to a harsher line of action against strong unsocial behavior in PU_NP sessions than in NP_PU sessions.



(a) Height of punishment costs

(b) Relative frequency of punishment

Figure 2: Height and frequency of punishment by relative contribution: This figure illustrates the height (a) and frequency (b) of punishment separated by the difference between a participants contribution and the contribution of the corresponding group member. E.g., the interval [-20,-11] indicates that the participants contribution lie between 11 and 20 tokens higher than the contribution of the group member and the interval [0] gathers all case with equal contributions.

Finally, we investigate the development of punishment over time (see Figure 3). As the figure illustrates punishment costs are relatively stable throughout the experiment, while they increase in the last period of the NP_PU session (Wilcoxon Signed Rank Test – 9x Period 10 > Period 9, 1x Period 10 < Period 9, 2x Period 10 = Period 9, $p = 0.017$, $Z = -2.397$). Punishment costs of the PU_NP sessions do not increase in the last period (Wilcoxon Signed Rank Test – 9x Period 10 > Period 9, 2x Period 10 < Period 9, 1x Period 10 = Period 9, $p = 0.141$, $Z = -1.471$).

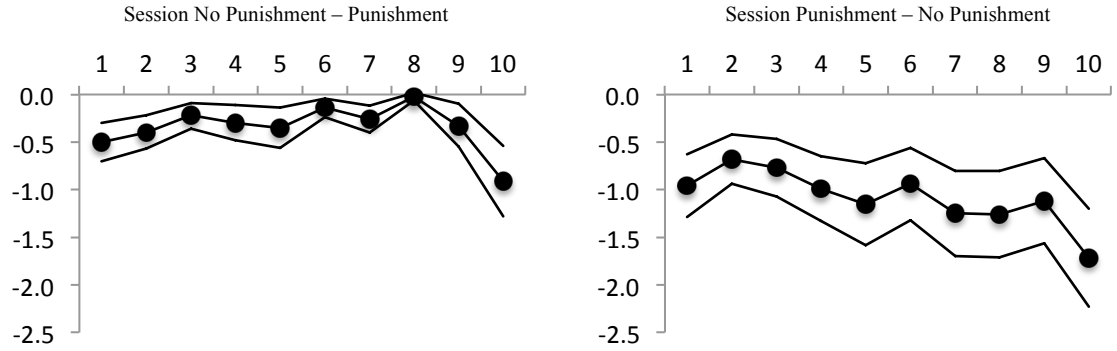


Figure 3: Development of average deduction costs per participant with 95% confidence interval: The dotted lines show the average costs for punishment per session type. The lines without dots stand for the 95% confidence intervals of the corresponding data points. While punishment costs remain stable throughout the experiment, costs increase in the last period.

Contributions: After we have shown, that punishment behavior is significantly different in NP_PU sessions and PU_NP sessions, we now investigate the contributions of the participants (see Table 2). Both treatments, i.e. Treatment No Punishment (Mann-Whitney U, one-tailed, p = 0.039, Z = -1.790, W = 119, U = 41) and Treatment Punishment (Mann-Whitney U, one-tailed, p = 0.049, Z = -1.965, W = 116, U = 38), have higher contributions in the NP_PU sessions, than in the PU_NP sessions.

When investigating the temporal development of contributions over time (see Figure 4), we only find end game behavior in the punishment treatment of the PU_NP sessions (Wilcoxon Signed Rank Test – 2x Period 10 > Period 9, 8x Period 10 < Period 9, 2x Period 10 = Period 9, p = 0.016, Z = -2.41), while we find no end game behavior in any other treatment (NP_PU, Punishment: Wilcoxon Signed Rank Test – 3x Period 10 > Period 9, 9x Period 10 < Period 9, 3x Period 10 = Period 9, p = 0.120, Z = -1.554; NP_PU, No Punishment: Wilcoxon Signed Rank Test – 4x Period 10 > Period 9, 4x Period 10 < Period 9, 4x Period 10 = Period 9, p = 0.944, Z = -0.070; PU_NP, No Punishment: Wilcoxon Signed Rank Test – 3x Period 10 > Period 9, 6x Period 10 < Period 9, 3x Period 10 = Period 9, p = 0.192, Z = -1.304). Notice in both punishment treatments participants show end game behavior. While in sessions NP_PU such end game behavior is characterized by an increase of punishment in the last period, it results in decreased contributions in sessions PU_NP. For both treatments without punishment, we do not observe such behavior.

Table 2: Average contribution and standard deviation of contributions per group: This table shows the average contribution per group and treatment and the standard deviation of the contributions. As already mentioned when describing punishment behavior, the average contribution in three groups (5, 8, 11) of Treatment Punishment in NP_PU sessions is 20. Aside this, contributions are higher in NP_PU sessions than in PU_NP sessions.

Group	Punishment				No Punishment			
	NP_PU		PU_NP		NP_PU		PU_NP	
	Avg.	S.D.	Avg.	S.D.	Avg.	S.D.	Avg.	S.D.
1	19.43	2.23	17.15	6.17	5.43	6.20	1.75	4.63
2	18.43	5.33	15.65	7.13	6.88	9.38	7.63	8.95
3	17.98	6.07	17.20	5.41	7.18	7.43	7.33	8.78
4	19.55	2.04	8.48	6.54	7.90	7.87	0.45	1.36
5	20.00	0.00	12.80	8.49	18.63	4.93	3.88	7.30
6	19.43	3.19	10.68	5.94	9.25	6.85	12.93	7.07
7	14.50	5.97	18.68	4.08	5.25	7.16	2.68	5.22
8	20.00	0.00	19.75	1.58	16.60	7.12	7.23	8.99
9	15.98	8.09	18.88	3.84	5.15	8.51	7.53	7.10
10	18.10	3.97	19.13	3.90	7.60	7.00	5.00	8.77
11	20.00	0.00	18.58	3.66	5.60	8.49	4.98	6.04
12	17.63	5.80	8.30	7.39	4.08	6.84	3.28	5.04
All	18.42	-	15.44	-	8.30	-	5.39	-

Analyzing contributions in the first period shows significant differences between NP_PU and PU_NP sessions in the treatments without punishment (Mann-Whitney U, two-tailed, p = 0.033, Z = -2.135, W = 2054, U = 878). These differences are not visible in the first period of

the punishment treatment (Mann-Whitney U, two-tailed, p = 0.189, Z = -1.315, W = 2173.5, U = 997.5). In addition, in NP_PU sessions the contribution in the first period of the No Punishment treatment determines both the average contribution in the whole No Punishment treatments (Anova, p = 0.026, F = 6.823) and the subsequent Punishment treatment (Anova, p = 0.047, F = 5.138). This is different for the PU_NP session. Here, contributions are a good predictor for the punishment treatment (Anova, p = 0.001, F = 23.220), while no correlation between contributions in the first period of the Punishment Treatment and the No Punishment Treatment exists (Anova, p = 0.876, F = 0.026).

The results concerning contributions are especially interesting, when compared to experiments with gains. The height of cooperation in experiments over gains lies bellow the lower bound of the 95% confidence interval of the height of cooperation in the Punishment Treatment in NP_PU sessions. Accordingly upper bound of the corresponding 95% confidence interval in in No Punishment Treatments in the PU_NP session lies most periods bellow the height of cooperation in the treatments without punishment over gains.

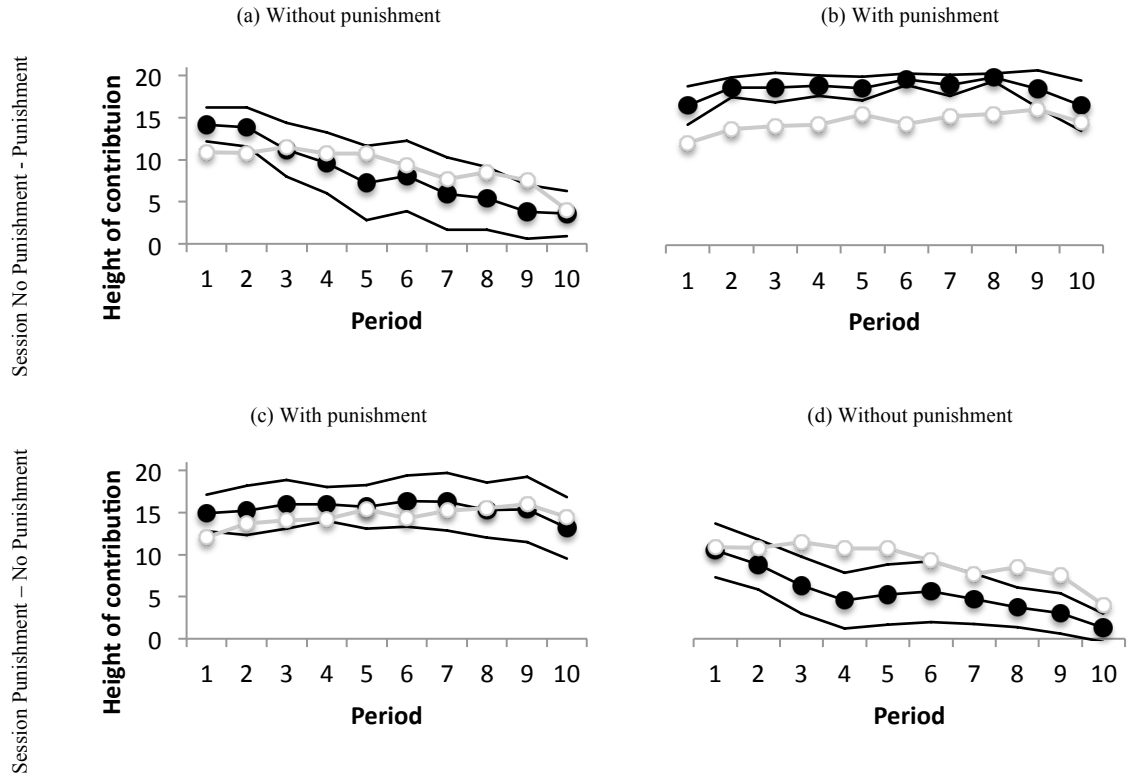


Figure 4: Development of average contributions per participant with 95% confidence interval: These figures show the development of average contributions over time (dotted lines). According to existing investigations, in treatments with punishment ((b) and (c)) contributions tend to be stable over time, while they decrease in treatments without punishment ((a) and (d)). In contrast to existing investigations, 95% confidence intervals (lines without dots) of the treatment with punishment in NP_PU sessions tends to be narrower than the corresponding 95% confidence interval of the PU_NP sessions. In addition contributions in NP_PU sessions are higher than in PU_NP sessions for both treatments.

Income: Both punishment costs are higher in PU_NP sessions than in NP_PU sessions, while at the same time contributions in PU_NP sessions are lower than in NP_PU sessions. This results in clear differences between the incomes of a participant in a PU_NP session and in a NP_PU session (see Table 3).

Table 3: Average income and standard deviation of income per group: This table shows both the average income and the standard deviation of incomes per group. While for NP_PU sessions the income on average is higher in the punishment treatment, it is not for the PU_NP sessions.

Group	Punishment				No Punishment			
	No Punishment – Punishment		Punishment – No Punishment		No Punishment – Punishment		Punishment – No Punishment	
	Avg.	S.D.	Avg.	S.D.	Avg.	S.D.	Avg.	S.D.
1	-4.45	4.15	-16.77	13.16	-8.75	5.68	-10.95	4.13
2	-4.25	6.26	-15.31	10.35	-7.88	8.62	-7.43	8.45
3	-7.23	9.39	-9.36	8.63	-7.70	6.33	-7.60	7.58
4	-2.77	3.68	-21.24	6.74	-7.26	6.67	-11.73	1.28
5	0.00	0.00	-25.90	11.72	-0.83	4.62	-9.67	6.98
6	-2.12	6.12	-23.43	10.71	-6.45	4.98	-4.24	5.85
7	-4.90	4.91	-4.19	5.17	-8.85	6.72	-10.40	4.43
8	-0.30	0.91	-1.25	2.48	-2.04	5.64	-7.67	7.73
9	-11.57	11.76	-3.68	5.20	-8.91	6.96	-7.48	5.95
10	-10.91	10.12	-2.93	6.84	-7.44	6.60	-9.00	7.57
11	-0.10	0.50	-5.26	6.35	-8.64	7.50	-9.01	5.33
12	-11.13	9.95	-39.60	10.82	-9.56	5.41	-10.04	4.47
All	-4.98	-	-14.08	-	-7.03	-	-8.77	-

The income of the participants in the No Punishment Treatment is higher in the NP_PU sessions than in the PU_NP sessions (Mann-Whitney U, one-tailed, $p = 0.039$, $Z = -1.790$, $W = 119$, $U = 41$), the same holds for the income in the Punishment Treatment (Mann-Whitney U, two-tailed, $p = 0.043$, $Z = -2.021$, $W = 115$, $U = 37$).

Next, we calculate the ratio between income in the Punishment Treatment per period and the income per period in the treatment without punishment for both session types (see Figure 5). This ratio is an important indicator for the utility of a punishment mechanism: If the ratio is higher than 1, this implies that the punishment mechanism pays, while a value smaller than 1 hints that punishing is not beneficial at all. The analysis shows that while punishment pays in almost all periods of the NP_PU sessions, it never pays in the PU_NP sessions.

In experiments with gains, punishment pays in the last few periods, while it does not pay throughout the experiment. This contrasts the results in experiments with losses. Here, depending on the sequence of treatments punishment pays or not.

Summary: An experimental comparison of the Public Loss Game clearly shows order effects when playing the Punishment before instead of after the No Punishment Treatment. Both

punishment costs are higher, while contributions and income are lower, if the participants have no chance of punishing in the second treatment. Although our experiments only last for 10 periods, in the experiments punishment pays. Contrasting comparable results concerning gains [9].

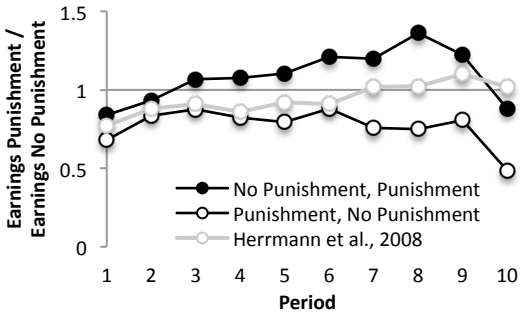


Figure 5: Comparison of incomes in both treatments separated by session types: This figure shows the ratio between income per period in the Punishment Treatment and income per period in the No Punishment Treatment. Values above 1 imply that punishment pays in the respective period, while values are below 1 if the ratio is smaller than 1. For the PU_NP sessions the ratio never exceeds 1, while it is above 1 in most periods of the NP_PU sessions (except for period 1, 2 and 10).

Discussion Our results clearly support direct and indirect reciprocity as justification for cooperative behavior. The high degrees of cooperation in the treatment without punishment lead to high degrees of cooperation in the treatment with punishment, if played in this order. The contrary holds when the sequence of treatments is changed. Aside this, the results cast serious doubt on any fairness or inequality aversion [1, 6] related justification. If such a justification was adequate the restart should have no impact on the behavior of the other participants. Punishment alone does not pay. Participants need to have experience with cooperative behavior of others. Without such experiences, and the willingness to behave reciprocally punishment only yields increased losses.

We deem the high degrees of cooperation, we currently observe across country to be reciprocal behavior for cooperation of nations currently struggling.

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Appendix

In this appendix, we present the experimental instructions and procedures used during our experiments. We focus our presentation on the sessions in which we conducted the treatment without punishment before the treatments with punishment. We adopted these instructions and procedures for the other sequence of treatments accordingly. As instructions and procedures, we adapted the corresponding documents described in the "Supporting Online Material", of the paper "Antisocial Punishment Across Societies" by Herrmann et al. (Herrmann et al. 2008). The instructions published were written in English, hence we translated them to German for our experiments, and translated them back to English for this appendix.

1. Experiment Design

Conducting experiments with losses is slightly different compared to experiments over gains. Therefore, after describing our treatments, we introduce the procedure for recruiting the participants of our sessions with a focus on differences to standard experiments over gains, before we describe the experimental procedure.

1.1. Treatments

We conducted two treatments with all participants of our experiments. In the Treatment No Punishment (NP) participants played a Public Good Game for 10 periods in groups of 4 participants. The parameterization of the experiment followed Fehr and Gächter [3] which has been used in several subsequent studies (see e.g., [14]). Namely, participants received an endowment of 20 tokens to distribute. Every token kept for oneself resulted in a payoff of 1 Experimental Currency Unit (ECU), while a token contributed to the public good yielded 0.4 ECU per group member. In contrast to Fehr and Gächter all participants received a period loss of 32 ECU (the payoff each participant earned if all group members showed full cooperation) in the beginning of each period. The Treatment Punishment (PU) was identical to the Treatment No Punishment except that we added a punishment stage after the participants made their decisions. During the punishment stage participants first saw the contributions of their group members in random order and could decide whether to punish a participant or not. Participants could punish each group member with 0 to 10 deduction points, costing themselves 1 ECU per deduction point and the punished group member 3 ECU per deduction point. In the end of the experiment, we transferred the payoff in ECU to a payoff in € by multiplying it with 0.025.

1.2. Conduction of Sessions

We recruited our participants using ORSEE [10] from various disciplines at the Karlsruhe Institute of Technology. Within the invitation, we informed the participants that they had to come to the final experiment and to an additional appointed time for receiving instructions at least two weeks before the experiment. During the additional appointment, we paid the participants their show up fee without giving any further information concerning the experiment.

We conducted all experiments at the networked laboratories of the Karlsruhe Institute of Technology. In this laboratory all participants are separated to ensure anonymity. The software used throughout the experiments was zTree (Fischbacher, 2007).

To minimize the impact of the experimenter, we conducted all sessions with the same team of two student assistants. Both student assistants did not have knowledge of the literature on public goods before the end of the last session, nor did we discuss our expectations concerning the experiment with them. To further standardize the procedure, the student assistants resorted to written guidelines when conducting the experiment.

In each out of 6 sessions, 16 participants (4 groups) took part. In sum 96 participants attended one of our sessions. To ensure that enough participants arrived at the final experiment, we recruited some additional participants. The loss in participants corresponds to the average fraction of participants we lose per experiment of this size in Karlsruhe. All participants who received their show up fee during the instructions, but did not attend the session returned the show up fee to the experimenter during the days after the session. With participants who attended the session, but could not participate in the experiment, we conducted a lottery during which they could lose part of their show up fee. This lottery will not be evaluated in the remainder of this paper.

After the experiment ended, the participants paid their lost money to the experimenter. We gave participants who had no money with them an additional date for payback, if they had not enough money with them. The slowest participant to pay his money returned it four days after the session, the majority of participants returned it the same or the following day.

2. Experimental Procedure

In the beginning of each session, we randomly assigned participants to seats in the laboratory. Afterwards, participants read the instructions and answered several control questions to ensure that they understood the experiment. After the control questions we summarized the instructions making them common knowledge among all participants. Then the participants played the first treatment. After the first treatment, we conducted a second treatment introduced by additional instructions and control questions. After the second treatment, participants answered a short questionnaire concerning their perception of the game, before we paid all participants in private.

Between the sessions, we varied the sequence of treatments. Namely, we played 3 sessions with Treatment Punishment following Treatment No Punishment (Session Type NP_PU), while we changed the order for 3 other experiments (Session Type PU_NP) (see Table 4).

Table 4: Number of sessions, groups and participants per session type

	Sessions	**Groups**	**Participants**
No Punishment, Punishment (NP_PU)	3	12	48
Punishment, No Punishment (PU_NP)	3	12	48
Sum	***6***	***24***	***96***

Two weeks before each session all participants received a show up fee of 13.00 €. This show up fee consisted of the default show up fee in Karlsruhe of 5.00 € plus additional 8.00 €. Given all participants showed full cooperation during all periods each participant would receive exactly 8.00 € for participation. In this way we ensured that all participants of one group could reach a payoff during the treatments of 0.00 € for full cooperation, while at least one participant received a loss when deviating. In addition all participants received 0.625 € (25 ECU) in the beginning of each punishment treatment. These payoff rules have another advantage: As we used the same transfer rate between ECU and € as Herrmann et al. did (Herrmann et al., 2008) in experiments in Germany, a group showing the same behavior in our experiments as in the experiments of Herrmann et al. received the same gains and losses for contributions and punishment in our experiments as in their experiments. The average payoff per participant including the show up fee was 9.53 € (NP_PU Sessions: 10.70 €; PU_NP Sessions: 7.96 €) with a minimum of -1.30 € (NP_PU Sessions: 7.70 €; PU_NP Sessions: -1.30 €) and a maximum of 13.70 € (NP_PU Sessions: 13.70 €; PU_NP Sessions: 12.70 €) respectively. On average the experiments lasted 1:23 hours (instructions + control questions: 49 minutes, treatments: 34 minutes).

The remainder of this section presents the protocol the student assistants followed when conducting the experiment.

2.1. Preparation of the experiment

- Before the experiment start up all computers in the laboratory (zLeafs) and the server (zTree)
- Distribute instructions with the back of the instructions facing up
- Prepare cards with computer numbers in the lab, so that participants can be randomly allocated to computers.

2.2. Welcoming outside the lab

- "Hello, we are glad that you participate in our experiment. You will learn in the lab what the experiment is about."
- "You are randomly assigned to seats in the lab. Please draw a number and take a seat on the corresponding place in the lab."

We conducted all experiments with 16 participants per session. Therefore, we invited and paid off additional participants to ensure that every session consisted of at least 16 participants. If more than 16 participants showed up, we let only the first 16 participants draw a number. With all remaining participants, we played another decision experiment. We chose this procedure, instead of asking participants whether they wanted to leave voluntarily as we deem it to result in more "random" subject groups.

2.3. Introduction in the lab

- "Thank you for coming. You will learn from the instructions we have distributed to your computer place what the experiment is about. Before we start the experiment, we want to point out that communication is not allowed throughout the experiment."

- "At the end of the instructions, you will find control questions. Answering these questions is no exam. The questions are meant to ensure that you understood how the earnings of the experiment are calculated. Please start reading the instructions."

2.4. After answering the control questions of the No Punishment Treatment

- "All participants have answered the control questions correctly. Before we start with the experiment, we summarize it."
- "As you know, you interact in this experiment with three other group members. The experiment lasts for 10 periods. During all periods you are in the same group. Every period, you have to decide how many of the 20 tokens you want to contribute to a project and how many you want to keep for yourself. Please be aware that you cannot transfer any tokens to the next period. In each period you start with an endowment of 20 tokens. You make your decision about the contribution to the project by entering the amount of your contribution in the input dialog."
- "When all four group members have made their decisions, a result screen will appear. The result screen lists your contribution to the project, the total sum of contributions of all four group members to the project, your earnings from retained tokens and your income from the income."
- "The income of retained tokens is the difference between 20 and your contribution to the project. Your income from the project is calculated as 0.4 times the total sum of the contributions of all four group members to the project."
- "After the result screen was shown, the so called information screen will appear. On this screen, you will find a table. In the first column your contribution to the project (absolute and in %) is listed. In the other columns the contributions of all other group members are listed in a randomly chosen order."
- "Do you have any questions?"

2.5. Conduction of the No Punishment Treatment

Participants take their decisions undisturbed and unobserved by the experimenters, who only observe the experiment by monitoring the software.

2.6. After Conduction of the No Punishment Treatment

- "The experiment is now finished. Another experiment follows that lasts 10 periods as well. After this, the entire experiment is finished. You will then have to answer a short questionnaire and will then get paid."
- "We will now distribute the instructions for the next 10 periods."

2.7. After answering the control questions of the Punishment Treatment

- "The second experiment differs from the previous experiment. We have introduced a second stage. Please see Fig. 4 of the instructions. There you find the input dialog of the second stage. This dialog is similar to the information dialog, you know from the first experiment."
- "New in this two-stage experiment is the possibility for you to assign deduction points (between 0 and -10) to the other group members. One deduction point costs you 1 ECU

and reduces the income of the group member to whom you assign the deduction point by 3 ECU."
- "If you assign deduction points, you have to put a negative sign in front of the number. This two-stage experiment will be repeated 10 times with the same people in the group."
- "Do you have any questions?"

2.8. Conduction of the Punishment Treatment

Participants take their decisions undisturbed and unobserved by the experimenters, who only observe the experiment by monitoring the software.

2.9. After Conduction of the Punishment Treatment

- "The second experiment is now finished. Please answer the questions in our questionnaire. After this, we will pay you in private."

After answering the questionnaire all participants are paid in private and the experiment ends.

3. Translated Experimental Instructions

In this section we present an English translation of the instructions used throughout our experiments. Compared to the instructions in Herrmann et al. (Herrmann et al. 2008), we made the following changes:

- The first four sections until the start of the description of the experiment were changed according to the first sections typically used in experiments conducted at the Karlsruhe Institute of Technology.
- We replaced the term "guilder" in the original by "ECU" to resemble the wording typically used at the Karlsruhe Institute of Technology.
- We corrected three typos in the original instructions. There, some examples describing the conversion of tokens to guilders, or ECU, in error specified tokens as unit of the result instead of the experimental currency.
- We changed the instructions to introduce the period loss.

Aside these changes, we stuck to the original instructions as close as possible.

3.1. No Punishment Treatment

Welcome to this experiment and thank you very much for your participation. You received € 13.00 for participation in this experiment. These earnings can increase or decrease in the following depending on your own decisions and the decisions of your fellow players. Please read these instructions – which are the same for all – carefully. To ensure that you understand the instructions, please answer the control questions after reading the instructions. These control questions are displayed at your computer terminal as soon as you confirmed reading the instructions there.

Please remain calm and switch of your mobile phones. Communication among the participants is not allowed. If you have any questions, please raise your hand. An experimenter will than come to you and answer your question in private. If you do not follow these Instructions, we have to suspend you from the experiment. You then have to return all payments for participation.

Your payoff during the experiment depends on your decisions as well as the decisions of other participants. Your earnings will be calculated in experimental currency units (ECU) during the experiment. At the end of the experiment your entire earnings will be converted to Euro. The conversion rate is:

1 experimental currency unit (ECU) = 0.025 Euro

Every period consists of one stage. In the beginning of each period, you receive a loss of -32 ECU. In addition you receive 20 tokens. In the remainder we call this your endowment. Your task is to decide how to use your endowment. You have to decide how many of the 20 tokens you contribute to a project and how many of them to keep for yourself. The consequences of your decision are explained in detail below. At the beginning of each period the following input dialog for the first stage will appear (see Fig. 1: Input Dialog).

We will account your earnings with you at the end of the experiment. You will be paid in private to ensure that no other participant learns your payoff.

Course of the Experiment

The experiment is divided into 10 separate periods. In each period the participants are divided into groups of 4. You will therefore be in a group with 3 other participants. The composition to groups of 4 will stay the same for the 10 periods of the experiment. In the following pages we describe the experiment in detail.

The period number appears in the top left corner of the input dialog. In the upper right corner you see how many more seconds remain for your decision. You will have 90 seconds in the first two periods and60 seconds in the remaining periods. Your decision must be made within the time limit.

Your endowment in each period is 20 tokens. You have to decide how many tokens you want to contribute to the project by typing a number between 0 and 20 in the input field. This field is reached by clicking it with the mouse. As soon as you have decided how many tokens to contribute, you have also decided how many tokens to keep for yourself: This is (20 – your contribution) token. After entering your contribution you must click the “OK”-Button. Once you have done this, your decision can no longer be revised.

After all members of your group have made their decisions the following screen will show you the total amount of tokens contributed by all four group members to the project (including

your contribution) (see Fig. 2: Result Screen). This screen also shows you how many ECU you have earned during the first stage.
Your income consists of three parts:

(1) The period loss, which you received in the beginning of the period.

Period Loss = -32 ECU

(2) The tokens, which you kept for yourself ("Income from retained tokens") with:

1 token = 1 ECU

(3) The "Income from the project". This income is calculated as follows:

Income from the project = 0.4 x total contributions to the project

Your income in ECU of a period is therefore:

-32
+ (20- "Ihr Beitrag zum Projekt")
+ 0.4 x sum of all contributions to the project

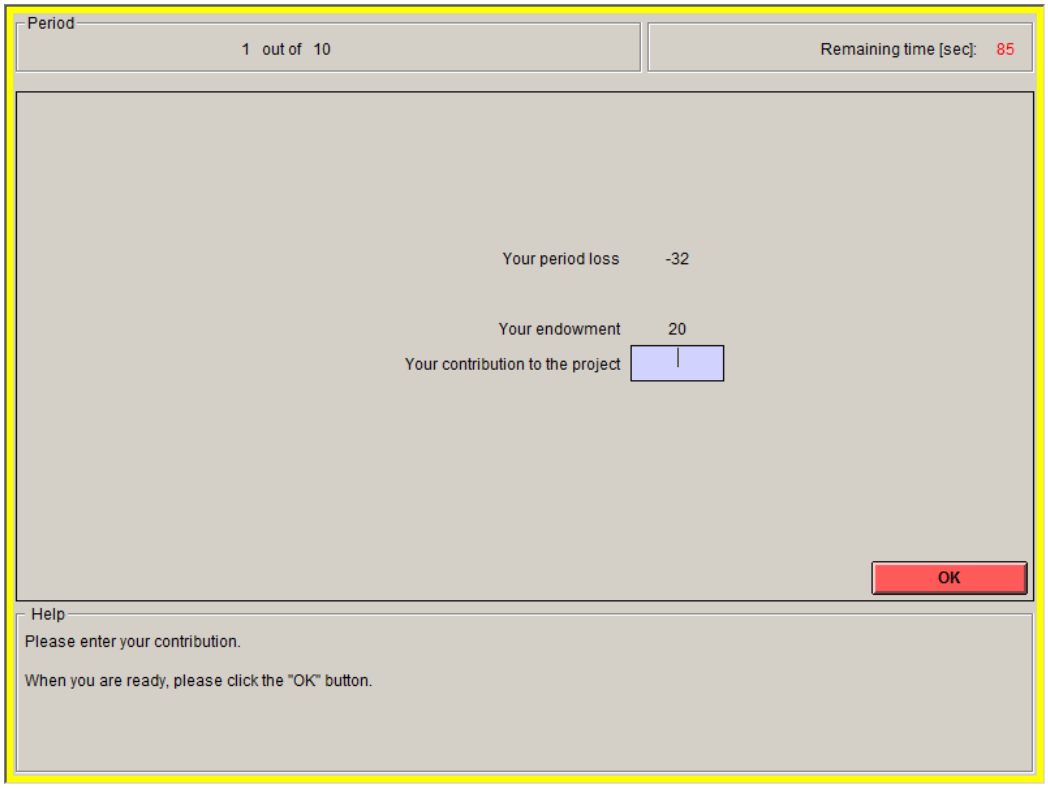

Fig. 1: Input Dialog

The income of each group member from the project is calculated in the same way, i.e. each group member receives the same income from the project. Assume, for example, that the sum of the contributions to the project 60 tokens. In this case each member of the group receives an

income from the project of: 0.4 x 60 = 24 ECU. If the total contribution to the project is 9 tokens, then you and all other members of the group receive an income of 0.4 x 9 = 3.6 ECU from the project.

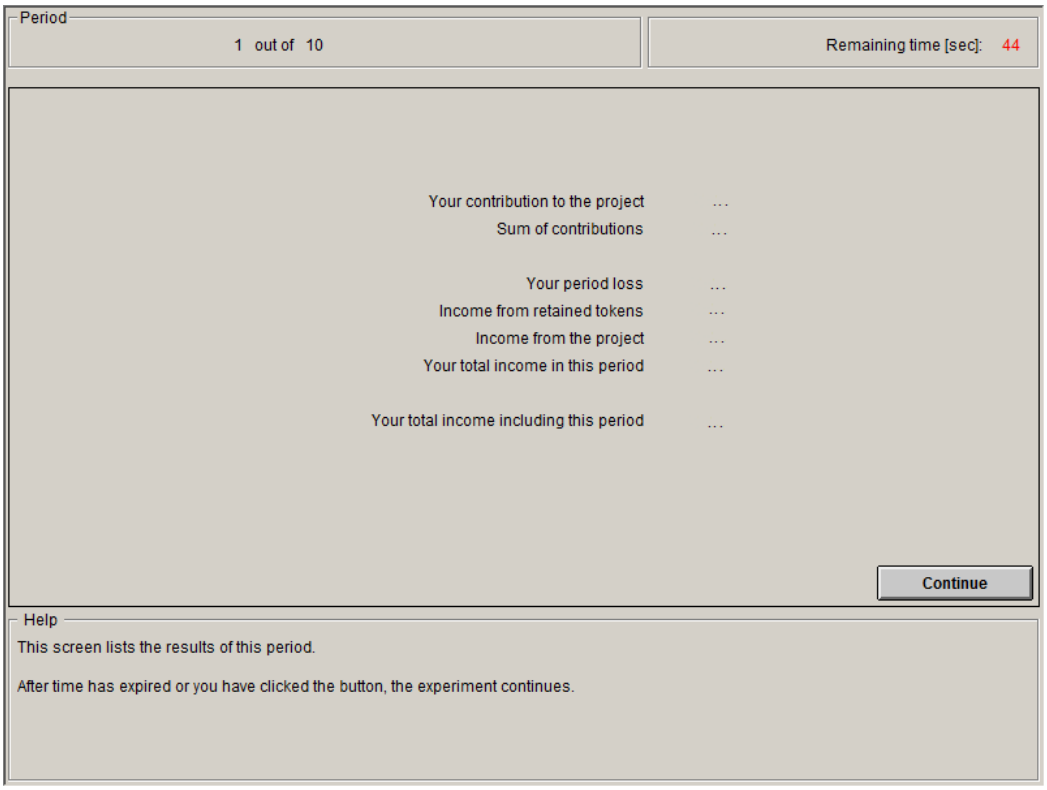

Fig. 2: Result Screen

For each token, which you keep for yourself, you earn an income of 1 ECU. Suppose you contributed this token to the project instead, then the total contribution to the project would rise by one token. Your income from the project would rise by 0.4 x 1 = 0.4 ECU. However, the income of all other group members would also rise by 0.4 ECU, so that the total income of the group from the project would increase by 1.6 ECU. Your contribution to the project therefore also raises the income of the other group members. On the other hand, you earn an income for each token contributed by the other members to the project. For each token contributed by any group member you earn 0.4 x 1 = 0.4 ECU.

In the first two periods you have 45 seconds and in the remaining periods 30 seconds to view your income. If you are finished before the time is up, please click the “Continue”-Button.

Next, the information screen appears, which reveals the contributions of the individual group members (see Fig. 3: Information Screen).

This screen shows how much each member of the group contributed to the project. Your contribution is displayed in blue in the first column, while the contributions of the other group members are shown in the remaining three columns. Please note that the order in which the contributions of the other players are displayed is changed randomly in each period. The contribution in the second column, for example, in general stems always from a different group member. The same holds for the contributions in the other columns. Beside the absolute contributions, the contributions as a percentage of the endowment are also displayed.

In the first two periods you have 45 seconds and in the remaining periods 30 seconds to view your income. If you are finished before the time is up, please click the "Continue"-Button.

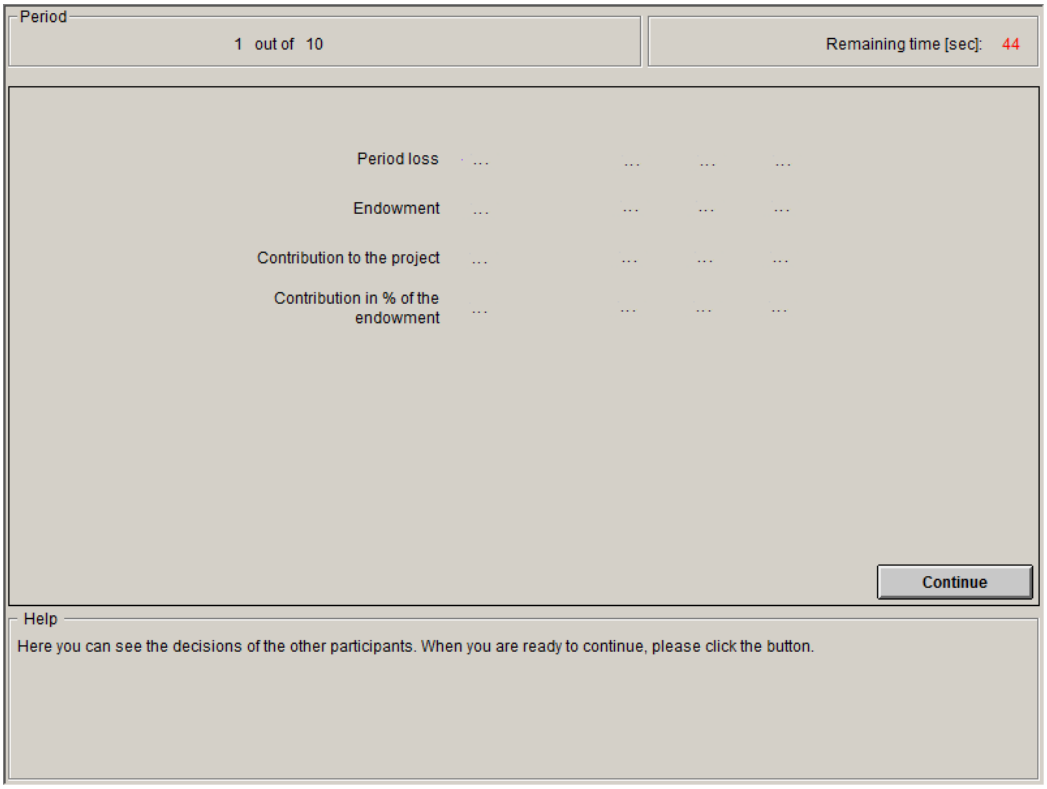

Fig. 3: Information Screen

3.2. Punishment Treatment

Course of the Experiment

We now repeat the experiment and introduce some changes. Each participant receives a lump-sum payment of 25 ECU at the beginning of the experiment. This payment can be used to pay

for additional losses during the experiment. At the end of the subsequent ten periods the whole experiment is finished and you receive:

Your income from the first 10 periods
+ Your income from the second 10 periods
(including the lump-sum payment of 25 ECU)
= Total sum of ECU

This experiment consists of two stages in each period and altogether there are 10 periods. The first stage is identical to the previous experiment. At the first stage you to decide how many tokens out of 20 you would like to contribute to a project (and hence you decide with it how many tokens you keep for yourself). Your income from the first stage is calculated exactly in the same way as in the previous experiment.

For each token you keep for yourself, you earn an income of 1 ECU. For any token you contribute to the project, you and all other group members will earn 0.4 ECU. Therefore, each token that another group member contributes to the project will increase your income by 0.4 ECU.

Differences in the New Experiment

Now there is a second stage introduced that follows the display of the result screen at the end of the first stage.

The Second Stage

At the second stage you see how many tokens each of the other group members contributed to the project. In addition, in this stage you can decrease the income of each other group member by assigning deduction points. Alternatively you can leave the income unchanged. The other group members can also decrease your income if they wish to. This is apparent from the input screen at the second stage (see Fig. 4: Input Dialog of the Second Stage).

You now have to decide whether, and if so, how many deduction points to assign to each of the other three group members. In any case you must enter a number for each of them. If you do not wish to change the income of a specific group member then you must enter 0. If you want to distribute deduction points, you must put a negative sign in front of the number (without spaces between them).

For this decision you have 180 seconds in the first two periods and 120 seconds in the remaining periods. You can move from one input field to the other by pressing the tab-key or by using the mouse.

If you distribute deduction points, you have costs in ECU that depend on the amount of deduction points you distribute. You can assign between -10 and 0 points to each group member. The larger the amount of deduction points that you assign, the larger your costs. The following formula indicates the relationship between the number of assigned points and the costs of assigning points:

Costs of assigning deduction points = Sum of assigned deduction points

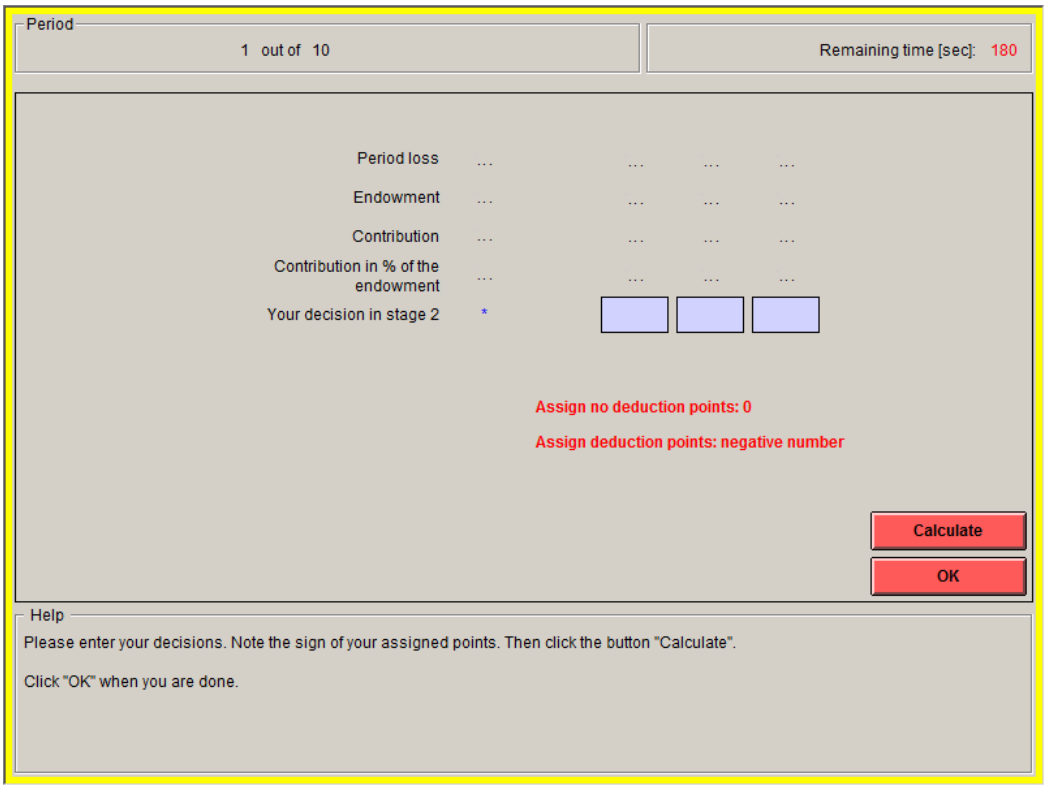

Fig. 4: Input Dialog of the Second Stage

Every assigned deduction point costs you 1 ECU. For example, if you assign 2 deduction points to one member, this costs you 2 ECU; if, in addition, you assign 9 deduction points to another member this costs you 9 Guilders. If you assign 0 points to the last group member this has no cost for you. In total you have assigned 11 deduction points and your total costs therefore amount to 11 (=2+9+0) ECU.

You can determine the total cost on the computer. To perform the calculation you have to click the button “Calculation” (see Fig. 4: Input Dialog of the Second Stage). You can do this after you have entered the deduction points. On the screen you will see the total costs of your

assigned points. As long as you have not yet clicked the "OK"-button, you can change your decision (within the remaining time). To recalculate the costs after a change of your assigned points, press the "Calculation"-button again.

If you assign 0 points to a particular group member (i.e., you enter "0"), you will not alter his income. If you assign one deduction point to a group member (i.e., you enter "–1") you will decrease the income of this group member by 3 ECU. If you assign a group member 2 deduction points (i.e., you enter "–2"), you will decrease the income of the group member by 6 ECU, and so on. Each deduction point that you assign to another group member will reduce his or her income by 3 ECU.

Whether or by how much the income at the second stage is decreased in total depends on the total of the received deduction points. If somebody, for instance, receives a total of 3 deduction points (from all other group members in this period), his or her income is decreased by 9 ECU. If somebody receives a total of 4 deduction points, his or her income is reduced by 12 ECU. Your total income from the two stages is therefore calculated as follows:

Total Income (in ECU) at the end of the second stage = income of the period

= Income from the first stage (1)
- 3 x Number of received deduction points (2)
- Costs for distributing deduction points

} up to -32 (= period loss)

If your income at the first stage (1) minus three times the received deduction points (2) is less than your period loss (= -32), then you only loose the period loss (-32). Please note, that in the end of the second stage your income in ECU can be less than the period loss (-32), if the costs of your assigned deduction points exceed your income from the first stage minus the income reduction by the received deduction points. You can, however, avoid losses larger than the period loss (-32) with certainty through your own decisions!

After all participants have made their decision, your income from the period will be displayed on the following screen (see Fig. 5: Income Screen at the End of the Second Stage).

In the first two periods you have 45 seconds and in the remaining periods 30 seconds to view your income. If you are finished before the time is up, please click the "Continue"-Button.

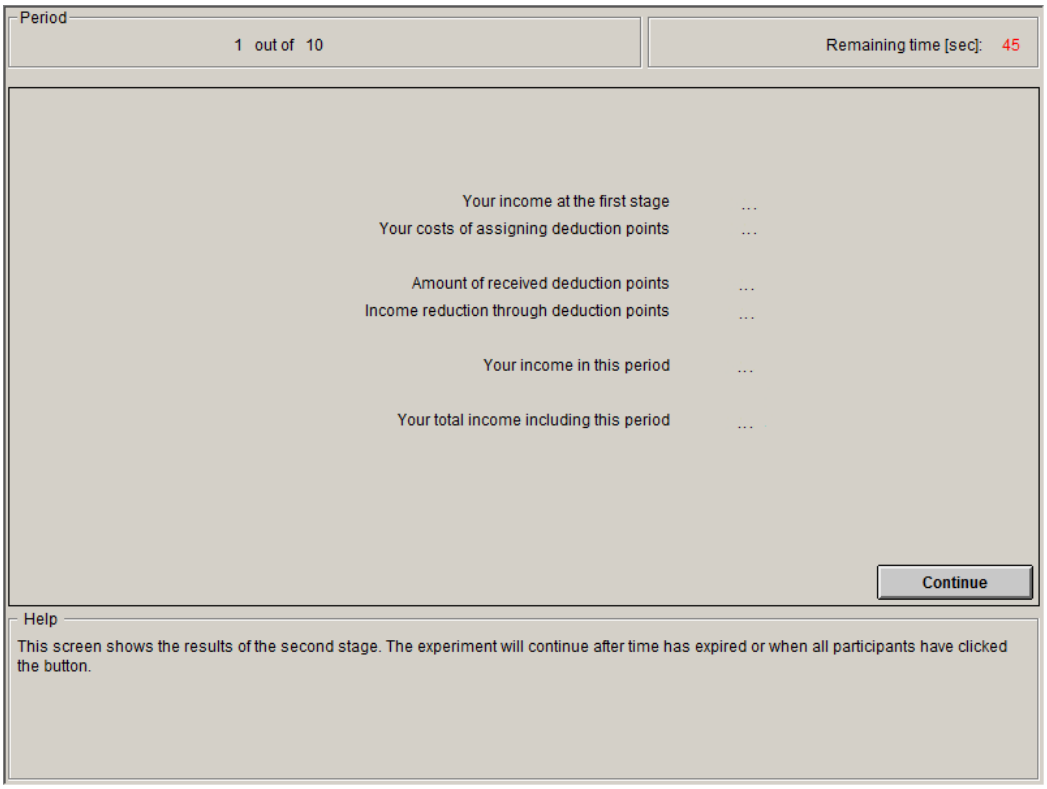

Fig. 5: Income Screen at the End of the Second Stage

4. Control Questions

After reading the experimental instructions, we asked the answer control questions. We showed the control questions to the participants using an zTree program (Fischbacher, 2007). We show the correct results in brackets [] behind the questions. Compared to the control questions of Herrmann et al. (Herrmann et al., 2008), we made the following changes:

- We specified the unit of the results (ECU) after the control questions.
- Question (6) was abbreviated in the original, as (Herrmann et al., 2008) presented the control questions on paper. In our experiments, we repeated the complete control question, as the participants could not see the control questions after answering them correctly.
- Question (9) replaces the corresponding question of Herrmann et al. as the original question was misleading after the introduction of the period loss.

4.1. No Punishment Treatment

(1) Each group member has an endowment of 20 tokens. Suppose nobody (including you) contributes any tokens to the project. What is:
   a. Your income (in ECU): [-12]
   b. The income of all other group members (in ECU): -12

(2) Every group member has an endowment of 20 tokens. Suppose you contribute 20 tokens to the project. All other group members each contribute 20 tokens to the project. What is:
    a. Your income (in ECU): [0]
    b. The income of all other group members (in ECU): [0]
(3) Every group member has an endowment of 20 tokens. Suppose the other three group members contribute a total of 30 tokens to the project. What is:
    a. Your income (in ECU), if you contribute 0 tokens to the project: [0]
    b. Your income (in ECU), if you contribute 15 tokens to the project: [-9]
(4) Every group member has an endowment of 20 tokens. Suppose you contribute 8 tokens to the project. What is:
    a. Your income (in ECU), if all other group members together contribute a total of 7 tokens to the project: [-14]
    b. Your income (in ECU), if all other group members together contribute a total of 22 tokens to the project: [-8]

4.2. Punishment Treatment

(5) Suppose at the second stage you assign the following deduction points to your three other group members: -9, -5, 0. What are the total costs (in ECU) of your assigned deduction points? [-14]
(6) Suppose at the second stage you assign the following deduction points to your three other group members: 0, 0, 0. What are the total costs (in ECU) of your assigned deduction points? [0]
(7) By how many ECU will your income from the first stage be changed, if you receive a total of 0 deduction points from the other group members? [0]
(8) By how many ECU will your income from the first stage be changed, if you receive a total of 4 deduction points from your group members? [-12]
(9) What is the height of your income (in ECU), if you receive a total of 15 deduction points from you group members, but du not distribute any deduction points your own? [-32]

5. Original Instructions

In the remainder of this section, we present the original German instructions as used throughout the experiments. We omit the original control questions and procedures. They are available upon request.

5.1. No Punishment Treatment

Herzlich willkommen zu diesem Experiment und vielen Dank für Ihre Teilnahme. Sie erhielten bereits 13,00 Euro für die Teilnahme an diesem Experiment. Diese Auszahlung kann sich im Folgenden abhängig von Ihren eigenen Entscheidungen und den Entscheidungen der Mitspieler verringern. Bitte lesen Sie daher diese Anweisungen – die für alle gleich sind – sorgfältig durch. Um sicherzugehen, dass Sie die Instruktionen verstanden haben, beantworten Sie bitte im Anschluss an das Lesen der Anleitung einige Kontrollfragen. Diese

Kontrollfragen werden Ihnen am Computer-Terminal angezeigt, sobald Sie das Lesen der Anleitung dort bestätigt haben.

Bitte verhalten Sie sich ruhig und schalten Sie Ihre Mobiltelefone aus. Kommunikation zwischen den Teilnehmern ist nicht erlaubt. Wenn Sie eine Frage haben, heben Sie bitte die Hand. Ein Experimentleiter wird dann zu Ihnen kommen und Ihre Frage unter vier Augen beantworten. Leisten Sie diesen Regeln nicht Folge, müssen wir Sie vom Experiment ausschließen. Sämtliche Zahlungen für die Teilnahme sind dann von Ihnen zurückzuzahlen.

Ihre Auszahlung während des Experiments hängt von Ihren eigenen Entscheidungen und den Entscheidungen anderer Teilnehmer ab. Die Auszahlung im Experiment wird in Einheiten der Experimentwährung (ECU) gemessen. Die ECU, die Sie im Experiment verdienen, werden am Ende des Experiments in Euro umgerechnet. Die Umrechnungsvorschrift lautet:

1 Einheit der Experimentwährung (ECU) = 0.025 Euro

Ihre Auszahlung werden wir am Ende des Experiments mit Ihnen abrechnen. Die Auszahlung wird im Privaten vorgenommen, so dass keiner der anderen Teilnehmer Ihre Auszahlung erfährt.

Ablauf des Experiments

Das Experiment besteht aus 10 getrennten Runden. In jeder Runde werden die Teilnehmer 4er-Gruppen zugeordnet. Sie sind also in einer Gruppe mit 3 anderen Teilnehmern. Die Zuordnung zu 4er-Gruppen ändert sich während der 10 Runden des Experiments nicht. Auf den folgenden Seiten wird das Experiment im Detail erläutert.

Jede Runde besteht aus einer Stufe. Zu Beginn jeder Runde erleiden Sie einen Verlust von –32 ECU. Zusätzlich erhalten Sie 20 Wertmarken. Im Folgenden wird dies als Ihre Ausstattung bezeichnet. Ihre Aufgabe ist es zu entscheiden, wie Sie mit Ihrer Ausstattung umgehen. Sie müssen entscheiden wie viele der 20 Wertmarken Sie zu einem Projekt beitragen wollen, und wie viele sie selbst behalten. Die Konsequenzen Ihrer Entscheidung werden unten im Detail erläutert. Zu Beginn jeder Runde sehen Sie die folgende Eingabemaske für die erste Stufe (siehe Abb. 1: Eingabemaske).

Die Rundennummer erscheint im oberen linken Eck der Eingabemaske. Im oberen rechten Eck sehen Sie wie viele weitere Sekunden Ihnen für Ihre Entscheidung bleiben. Während der ersten zwei Runden haben Sie hierfür 90 Sekunden, während der verbleibenden Runden 60 Sekunden, Zeit. Sie müssen Ihre Entscheidung während dieses Zeitlimits treffen.

Ihre Ausstattung beträgt während jeder Runde 20 Wertmarken. Sie müssen entscheiden, wie viele der Wertmarken Sie zum Projekt beitragen wollen indem Sie eine Zahl zwischen 0 und

20 in das Eingabefeld tippen. Sie erreichen das Feld indem Sie es mit der Maus anklicken. Durch die Entscheidung, wie viele Wertmarken Sie beitragen, entscheiden Sie auch, wie viele Wertmarken Sie für sich selbst behalten: Dies ist (20 – Ihr Beitrag) Wertmarken. Nachdem Sie Ihren Beitrag eingetragen haben, müssen Sie den „OK“-Button drücken. Sobald Sie dies getan haben, kann Ihre Entscheidung nicht mehr geändert werden.

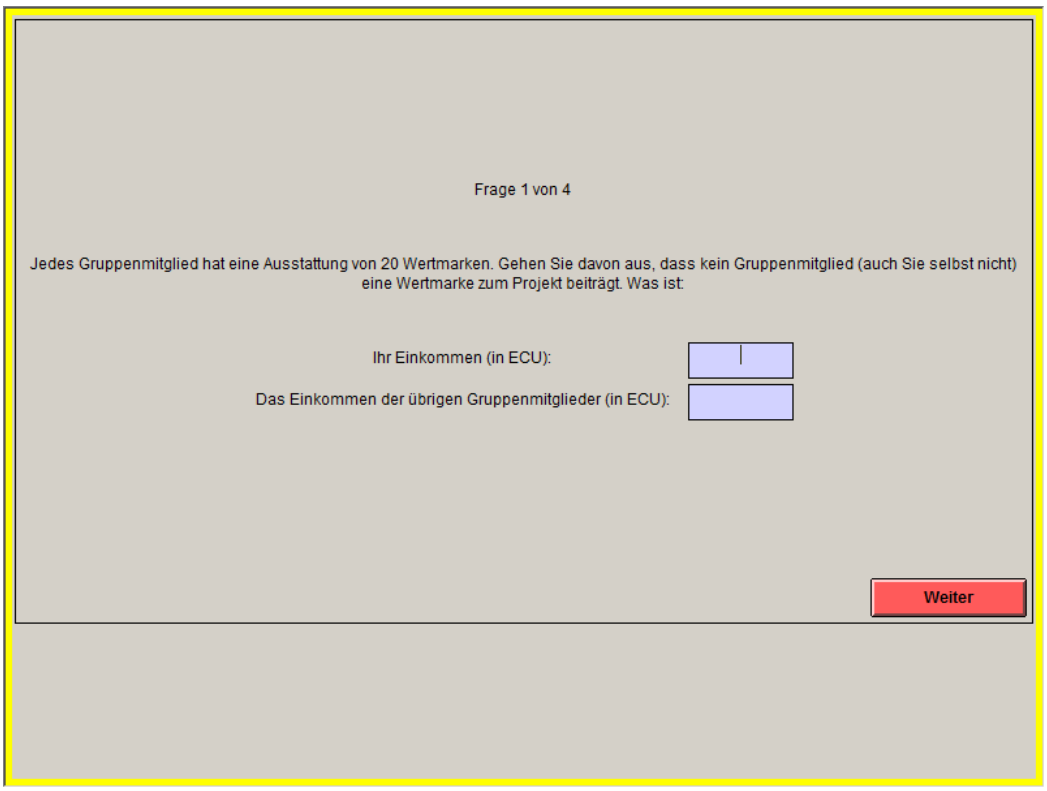

Abb. 1: Eingabemaske

Nachdem alle Mitglieder Ihrer Gruppe ihre Entscheidung getroffen haben, wird Ihnen im folgenden Dialog die Gesamtsumme der zum Projekt beigetragenen Wertmarken aller vier Gruppenmitglieder (einschließlich Ihres Beitrags) angezeigt (siehe Abb. 2: Ergebnisdialog). Der Dialog zeigt auch an, wie viele ECU Sie während der ersten Stufe verdient haben.

Ihre Auszahlung besteht aus drei Teilen:

(1) Dem Rundenverlust, den Sie zu Beginn der Runde erleiden.

Rundenverlust = – 32 ECU

(2) Den Wertmarken, die Sie für sich behalten („Einkommen aus behaltenen Wertmarken“) wobei gilt

1 Wertmarke = 1 ECU

(3) Dem „Einkommen aus dem Projekt“. Dieser Wert wird wie folgt berechnet:
Einkommen aus dem Projekt = 0,4 x Summe der Beiträge zum Projekt

Ihre Auszahlung in ECU einer Runde ist folglich:

– 32
+ (20 – „Ihr Beitrag zum Projekt“)
+ 0,4 x Summe der Beiträge zum Projekt

Abb. 2: Ergebnisdialog

Das Einkommen jedes Gruppenmitglieds aus dem Projekt wird auf dieselbe Weise berechnet, d.h. jedes Gruppenmitglied bezieht dasselbe Einkommen aus dem Projekt. Sei beispielsweise die Summe der Beiträge zum Projekt 60 Wertmarken. In diesem Fall ist das Einkommen jedes Gruppenmitglieds: 0,4 x 60 = 24 ECU. Ist der Gesamtbeitrag zum Projekt 9 Wertmarken, dann erhalten Sie und alle anderen Gruppenmitglieder ein Einkommen von 0,4 x 9 = 3,6 ECU aus dem Projekt.

Für jede Wertmarke, die Sie selbst behalten, erhalten Sie ein Einkommen von 1 ECU. Angenommen, Sie hätten diese Wertmarke zum Projekt beigetragen, so würde die Summe der

Beiträge zum Projekt um eine Wertmarke steigen. Ihr Einkommen aus dem Projekt würde dann um 0,4 x 1 = 0,4 ECU steigen. Gleichzeitig würde das Einkommen aller Gruppenmitglieder um 0,4 ECU steigen, so dass das Gesamteinkommen der Gruppe aus dem Projekt um 1,6 ECU steigen würde. Ihr Beitrag zum Projekt erhöht damit auch das Einkommen jedes anderen Gruppenmitglieds. Gleichzeitig verdienen Sie an jeder Wertmarke, die ein anderer Spieler zum Projekt beiträgt. Für jede Wertmarke, die ein anderes Gruppenmitglied zum Projekt beiträgt, erhalten Sie 0,4 x 1 = 0,4 ECU.

Während der ersten zwei Runden haben Sie 45 Sekunden und in den verbleibenden Runden 30 Sekunden Zeit, um Ihr Einkommen zu betrachten. Sind Sie damit vor Ablaufen der Zeit fertig, klicken Sie bitte auf den „Weiter“-Button.

Danach erscheint ein Informationsdialog, welcher Ihnen die Beiträge der einzelnen Gruppenmitglieder zeigt (siehe Abb. 3: Informationsdialog).

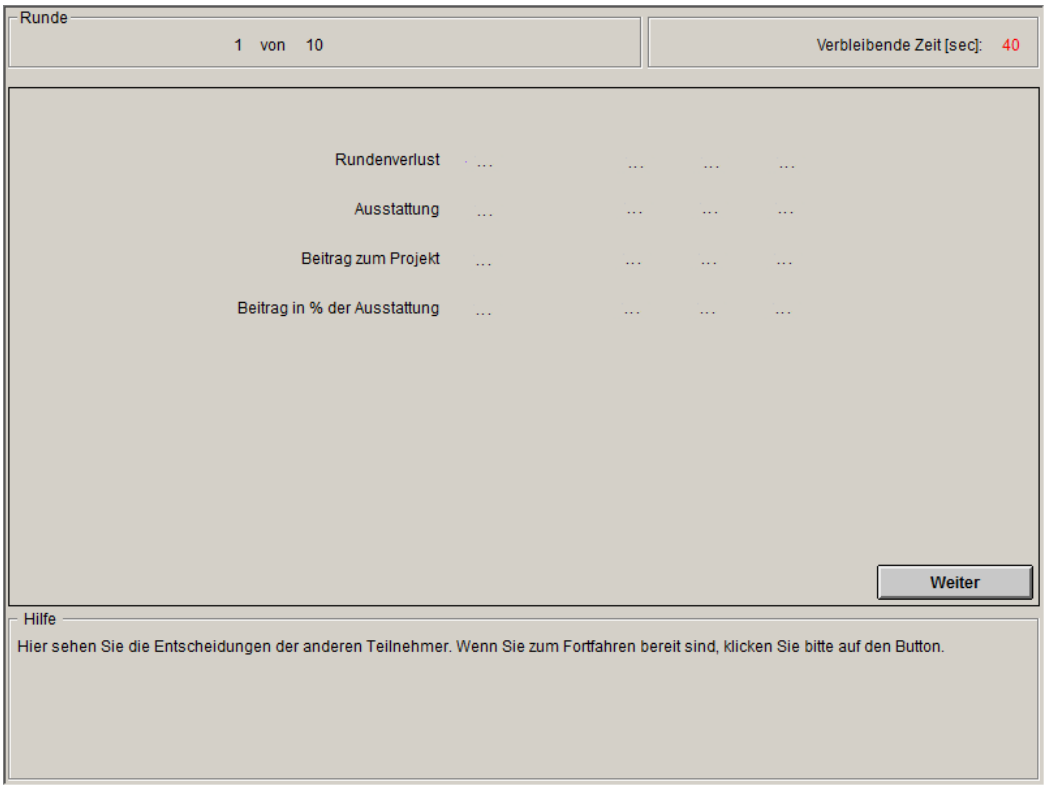

Abb. 3: Informationsdialog

Dieser Dialog zeigt, wie viel jedes der Gruppenmitglieder zum Projekt beitrug. Ihr Beitrag wird in der ersten Spalte in blau dargestellt, während die Beiträge der anderen Gruppenmitglieder in den verbleibenden drei Spalten dargestellt werden. Bitte beachten Sie, dass die Reihenfolge der Beiträge der anderen Spieler in jeder Runde zufällig neu bestimmt

werden. Der Beitrag in der zweiten Spalte, beispielsweise, stammt generell immer von einem anderen Gruppenmitglied. Dasselbe gilt für die Beiträge in den übrigen Spalten. Neben den absoluten Beiträgen werden die Beiträge als Anteil der Ausstattung gezeigt.

Während der ersten zwei Runden haben Sie 45 Sekunden und in den verbleibenden Runden 30 Sekunden Zeit, um diese Informationen zu betrachten. Sind Sie damit vor Ablaufen der Zeit fertig, klicken Sie bitte auf den „Weiter"-Button.

5.2. Punishment Treatment

Ablauf des Experiments

Im Folgenden wird das Experiment mit einigen Änderungen wiederholt. Jeder Teilnehmer erhält eine pauschale Zahlung von 25 ECU zu Beginn des Experiments. Dieser Betrag kann genutzt werden, um zusätzliche Verluste während des Experiments auszugleichen. Am Ende der folgenden 10 Runden ist das gesamte Experiment abgeschlossen und Sie erhalten:

Ihr Einkommen aus den ersten 10 Runden
+ Ihr Einkommen aus den zweiten 10 Runden
(einschließlich der Pauschalzahlung von 25 ECU)
= Gesamtsumme in ECU

Dieses Experiment besteht aus zwei Stufen in jeder Runde und insgesamt 10 Runden. Die erste Stufe ist identisch der Stufe im vorherigen Experiment. In der ersten Stufe entscheiden Sie, wie viele von 20 Wertmarken Sie zu einem Projekt beitragen wollen (und damit entscheiden Sie, wie viele Wertmarken Sie für sich selbst behalten). Ihr Einkommen aus der ersten Stufe wird exakt so ermittelt wie im vorherigen Experiment.

Für jede Wertmarke, die Sie behalten, verdienen Sie 1 ECU. Für jede Wertmarke, die Sie zum Projekt beitragen, erhalten Sie und alle Gruppenmitglieder 0,4 ECU. Deshalb erhöht jede Wertmarke, die ein Gruppenmitglied zum Projekt beiträgt Ihr Einkommen um 0,4 ECU.

Unterschiede im neuen Experiment

Jetzt wird eine zweite Stufe eingeführt, die auf das Darstellen des Ergebnisdialogs aus der ersten Stufe folgt.

Die zweite Stufe

In der zweiten Stufe sehen Sie, wie viele Wertmarken jedes der Gruppenmitglieder zum Projekt beigetragen hat. Zusätzlich können Sie in dieser Stufe das Einkommen jedes anderen Gruppenmitglieds verringern, indem Sie ihm Abschlagspunkte auferlegen. Alternativ können

Sie das Einkommen unverändert lassen. Die übrigen Gruppenmitglieder können auch Ihr Einkommen verringern, wenn Sie das wollen. Dies ist auf der Eingabemaske der zweiten Stufe ersichtlich (siehe Abb. 4: Eingabemaske in der zweiten Stufe).

Sie müssen jetzt entscheiden, ob und wenn ja wie viele Abschlagspunkte Sie jedem Ihrer drei anderen Gruppenmitglieder auferlegen. In jedem Fall müssen Sie für jeden von Ihnen eine Zahl angeben. Wollen Sie das Einkommen eines bestimmten Gruppenmitglieds nicht verringern müssen Sie 0 angeben. Wollen Sie Abschlagspunkte verteilen, so müssen Sie ein Minuszeichen vor die Zahl (ohne Leerzeichen dazwischen) schreiben.

Für diese Entscheidung haben Sie 180 Sekunden in den ersten zwei Runden und 120 Sekunden in den verbleibenden Runden Zeit. Sie können von einem Eingabefeld zum nächsten wechseln, indem Sie die Tabulator-Taste drücken oder die Maus benutzen.

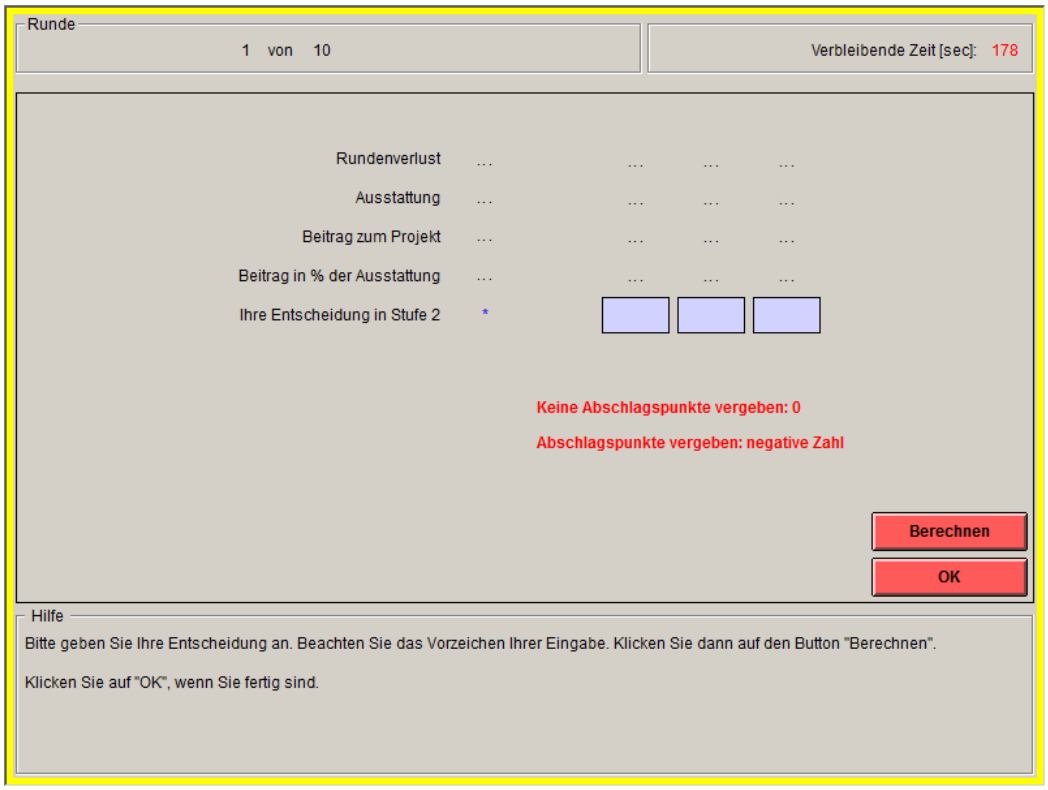

Abb. 4: Eingabemaske in der zweiten Stufe

Wenn Sie Abschlagspunkte verteilen, haben Sie Kosten in ECU, die von der Anzahl an Abschlagspunkten, die Sie verteilen, abhängen. Sie können jedem Gruppenmitglied zwischen -10 und 0 Abschlagspunkten zuweisen. Je höher die Anzahl der Abschlagspunkte, die Sie verteilen, umso höher sind Ihre Kosten. Die folgende Formel beschreibt den Zusammenhang

zwischen der Anzahl von verteilten Abschlagspunkten und den Kosten für das Verteilen von Abschlagspunkten:

Kosten für das Verteilen von Abschlagspunkten = Summe der verteilten Abschlagspunkte

Jeder verteilte Abschlagspunkt kostet Sie 1 ECU. Verteilen Sie beispielsweis 2 Abschlagspunkte auf ein Gruppenmitglied, so kostet Sie dies 2 ECU, sollten Sie zusätzlich 9 Abschlagspunkte auf andere Mitglieder verteilen, so kostet Sie dies 9 ECU. Verteilen Sie 0 Abschlagspunkte auf das letzte Gruppenmitglied, so entstehen für Sie keine Kosten. In Summe hätten Sie 11 Abschlagspunkte verteilt und Ihre gesamten Kosten dafür würden 11 (=2+9+0) ECU betragen.

Sie können die Gesamtkosten am Computer ermitteln. Um die Berechnung durchzuführen, müssen Sie den Button „Berechnen“ (siehe Abb. 4: Eingabemaske in der zweiten Stufe) anklicken. Sie können dies tun, sobald Sie die Abschlagspunkte eingetragen haben. Im Dialog sehen Sie die Gesamtkosten für die von Ihnen verteilten Abschlagspunkte. Solange Sie den Button „OK“ nicht angeklickt haben, können Sie (innerhalb der verbleibenden Zeit) Ihre Entscheidung ändern. Um nach der Änderung die Kosten für die verteilten Abschlagspunkte zu ermitteln, klicken Sie erneut auf „Berechnen“.

Verteilen Sie 0 Abschlagspunkte auf ein bestimmtes Gruppenmitglied (d.h. Sie tragen „0“ ein), ändert sich sein Einkommen nicht. Verteilen Sie einen Abschlagspunkt auf ein Gruppenmitglied (d.h. Sie tragen „-1“ ein), verringern Sie das Einkommen dieses Gruppenmitglieds um 3 ECU. Verteilen Sie 2 Abschlagspunkte auf ein Gruppenmitglied (d.h. Sie tragen „-2“ ein), verringern Sie das Einkommen des Gruppenmitglieds um 6 ECU, und so weiter. Jeder Abschlagspunkt, den Sie an ein Gruppenmitglied verteilen, wird sein oder ihr Einkommen um 3 ECU verringern.

Ob und wie sehr das Einkommen in der zweiten Stufe insgesamt verringert wird, hängt von der Summe der erhaltenen Abschlagspunkte ab. Erhält, beispielsweise, jemand insgesamt 3 Abschlagspunkte (von allen Gruppenmitgliedern in dieser Runde), so wird sein oder ihr Einkommen um 9 ECU verringert. Erhält jemand insgesamt 4 Abschlagspunkte, wird sein oder ihr Einkommen um 12 ECU verringert. Ihr gesamtes Einkommen dieser zwei Stufen berechnet sich also wie folgt:

Gesamteinkommen (in ECU) am Ende der zweiten Stufe = Einkommen in der Runde

= Einkommen aus der ersten Stufe (1)
- 3 x Anzahl der erhaltenen Abschlagspunkte (2)
- Kosten für das Verteilen von

} maximal -32 (= Rundenverlust)

Abschlagspunkten

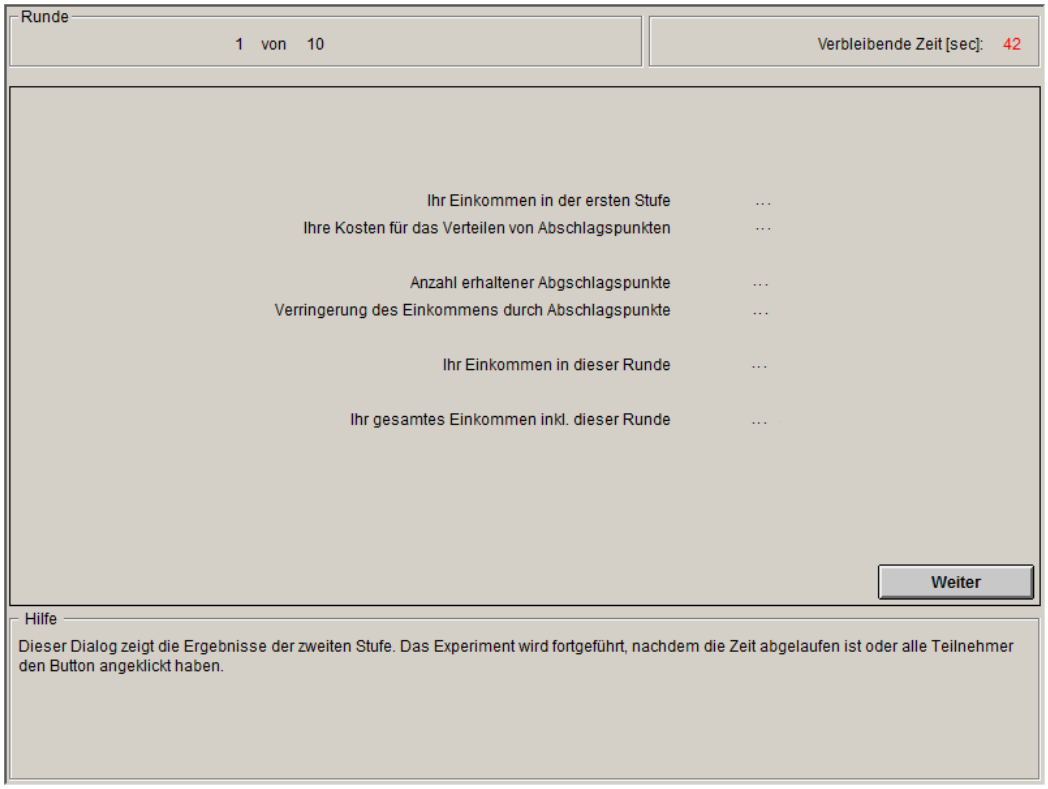

Abb. 5: Einkommensdialog am Ende der zweiten Stufe

Ist Ihr Einkommen der ersten Stufe (1) abzüglich dem dreifachen der Anzahl der erhaltenen Abschlagspunkte (2) geringer als Ihr Rundenverlust (= -32), so wird Ihnen nur der Rundenverlust (-32) abgezogen. Berücksichtigen Sie, dass Ihr Einkommen in ECU am Ende der zweiten Stufe geringer als der Rundenverlust (-32) sein kann, wenn die Kosten für die von Ihnen verteilten Abschlagspunkte größer als das Einkommen in der ersten Stufe abzgl. der Verringerung Ihre Einkommens durch das Erhalten von Abschlagspunkten ist. Sie können jedoch größere Verluste als den Rundenverlust (-32) sicher mit Hilfe Ihrer eigenen Entscheidungen vermeiden!

Nachdem alle Teilnehmer ihre Entscheidung getroffen haben, wird Ihr Einkommen in dieser Runde im folgenden Dialog angezeigt (siehe Abb. 5: Einkommensdialog am Ende der zweiten Stufe).

Während der ersten zwei Runden haben Sie 45 Sekunden und in den verbleibenden Runden 30 Sekunden Zeit, um diese Informationen zu betrachten. Sind Sie damit vor Ablaufen der Zeit fertig, klicken Sie bitte auf den „Weiter“-Button.

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