Civic Capital in Two Cultures:
The Nature of Cooperation in Romania and USA

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Abstract

We experimentally compare the nature of cooperation among Romanian students to that of U.S. students in various repeated games. We find stark differences in the students' propensity to sustain multilateral cooperation through bilateral rewards and punishments. Rather than being fundamentally more cooperative, U.S. groups perform well because cooperators are willing to discipline free riders, and these in turn respond by cooperating. Romanian subjects are less prone to jeopardize their productive bilateral relationships for the benefit of the group, and less successful when they do. Our findings corroborate and complement sociological explanations for cross-cultural productivity differences.

1. Introduction

Why are some societies more prosperous than others? Most modern observers agree that good institutions are crucial. However, we argue that it is easier to design good institutions than to implement them. The reason is that institutions are only successful when they are widely embraced, and it is often difficult to attain a widely shared understanding of what the rules are and how they are supposed to be enforced. Broadly speaking, we suggest that some societies prosper because they are good at building shared understanding. More specifically, we suggest that societies that encourage individuals to initiate collective action are also better at building shared understanding. Rules do not simply spring to life; they must be actively created and maintained by engaged individuals, whose actions are in turn sufficiently well understood by others.

To clarify our argument and begin to investigate its empirical validity, we conduct a comprehensive social dilemma experiment in two countries, Romania and USA. The idea is to study precisely how cooperation is maintained or breaks down in a variety of stylized contexts, with the hope of pinpointing crucial differences that may help to shed light on the contrasting fortunes of the two countries. These two particular countries were selected based on previous cross-cultural research using economic games in which group cooperation was successfully maintained using costly punishment in the USA, but failed in countries which are culturally similar to Romania (Herrmann et al (2008), Gächter et al (2010)). For example, take general trust levels as measured by the World Values Survey: agreement to the statement "Most people can be trusted" is very low in Romania (20.3 %), as in Ukraine (27.5 %) and Russia (26.2 %), whereas Americans are significantly more trusting (39.3 %).[1] Thus we have reason to expect substantially different cooperative outcomes in our two countries of study.

More precisely, we consider four experimental treatments. In all four treatments the subjects engage in some indefinitely repeated interaction. The simplest treatment is a repeated prisoners' dilemma (PD). The second-simplest treatment is a four-player public goods game (PGG). Our final two treatments are a four-player indefinitely[2] repeated public goods game (PGG) followed by bilateral interaction between each pair in the quartet. In our main treatment of interest, the contribution round is followed by bilateral play of a prisoners' dilemma among

[1] See World Value Survey 2005/2006, available online at www.worldvaluessurvey.org.

[2] Actually, subjects played 50 rounds, but they were given no information about the duration of the experiment.

all six pairs in the group. We call this design PGG+RN, to indicate that a player decides whether to pay a cost in order to reward (R) each of the other players. The last treatment, PGG+PN, is similar, except that the bilateral interaction is a punishment game (PN), where each subject may pay a cost to inflict a loss on the opponent.

The main finding is that U.S. students are significantly better at organizing cooperation in the two most complex settings, despite finding no differences in cooperation in the two simpler settings. This difference in the complex settings is apparently due to the presence of a sufficient fraction of "organizationally responsible" individuals among the U.S. students, whose actions are eventually understood and accepted by other group members. An organizationally responsible individual not only starts out with high contributions to the public good, but also promotes cooperation by risking productive personal relationships to discipline low contributors by withholding rewards, and refrains from targeting destructive costly punishment at high contributors. By comparison, in the PGG+RN treatment Romanian students only rarely condition their bilateral rewards on the opponent's behavior in the PGG, and often engage in antisocial punishment of high contributors in the PGG+PN treatment. Compared to the U.S. subjects, they are thus less prone to provide incentives for the other group members to contribute public goods.

This does not mean that Romanians play a bad equilibrium. Instead, the data suggest that Romanian subjects fail to reach an equilibrium at all. Behavior oscillates, with periods of low contributions coming to an end as some individual suddenly increases the contribution. Frequently, some of the other group members follow suit, but usually not all of them – and eventually the majority returns to low contribution levels, until a similar episode starts. Overall, the difference seems to be caused not by differences in preferences, but by a difference in the groups' ability to construct a productive shared understanding of (appropriate behavior in) the situation.

Before relating our findings to previous experimental work, let us indicate how it fits in with other approaches that emphasize informal institutions. A large literature on "social capital" or "culture" deals with the impact of social relationships on aggregate economic outcomes. In this connection, our contribution is perhaps best seen as a quest to identify the components of "civic capital", defined by Guiso, Sapienza and Zingales (2011) as *shared beliefs and values that help a group overcome the free rider problem in the pursuit of socially valuable activities*. Much of the empirical literature on social capital has a similar goal. However, it usually relies on survey data on values and beliefs that may be expected to impact or reflect free riding: How do people in different countries judge the acceptability of various

antisocial behaviors? To what extent do they trust strangers? While we find this literature very valuable, it leaves many questions unanswered. The survey measures are often uninformative about why free riding varies across countries. For example, low trust is an indicator of free riding, not a driver. And even when the surveyed value or belief might have a causal link to free riding in simple games, such as a one-shot prisoners' dilemma, we think that one-shot games often fail to depict the social environment within which most free riding occurs. Our approach is complementary, as it studies in detail how free riding is or is not kept in check in ongoing relationships.

Does the experiment reveal values or beliefs that deserve the *civic capital* epithet? We think so. According to our analysis, the crucial participants are those that both are willing to make sizeable own contributions for the benefit of the group and are willing to risk their bilateral relationships in order to discipline free riders. In the terminology of Dalton (2008), they display *engaged citizenship*. Such engaged citizenship is part of what Schwarz and Bardi (1997) call *egalitarianism* and Inglehart (1997) calls *self-expression values*. For what it is worth, we note that the World Values Survey suggests that countries differ across two major dimensions: secular values vs traditional values, and self-expression values vs survival values. Romania and U.S. are similar on the secularity scale, but polar opposites on the self-expression scale (Inglehart and Welzel, 2010). But we would not push the importance of individuals too hard. The ultimate reason that an engaged group member is able to foster cooperation is that the other group members understand what is going on and adjust their behavior both with respect to the group at large and with respect to the engaged group member. The common understanding is a group-level phenomenon, not reducible to individual beliefs.

Our experiment is the latest in a line of work initiated by Yamagishi (1986). That study is not only the first to consider the possibility of repetition in PGG experiments; it also introduces the possibility of targeted reaction in the form of bilateral punishment.[3] In a follow-up article, Yamagishi (1988) pioneers cross-cultural investigations of PGG behavior, comparing the behavior of American and Japanese subjects in a repeated PGG with one round of costly punishment opportunities between each round of public goods provision. However, Yamagishi

[3] Experimental studies of cooperation in one-shot public goods games (with more than two players) started a decade before, with Dawes, McTavish, and Shaklee (1977) and Marwell and Ames (1979, 1980). See Fischbacher and Gächter (2010) for a notable recent contribution to the literature on repeated public goods games.

assumed that the rules for whom to punish and how were all externally imposed. Subjects were merely allowed to decide how much to contribute to a centralized "punishment pool" which in turn would determine the severity of punishment for free-riders. Ostrom, Walker, and Gardner (1992) significantly modify Yamagishi's design by introducing peer sanctioning; each subject decides whom to punish. In another seminal contribution, Fehr and Gächter (2000) employ a similar peer sanctioning design, but introduce a treatment with re-matching of individuals after each round in order to study the propensity to punish in an environment where punishers cannot recoup the material punishment cost.[4]

For a long time, the conventional wisdom emanating from these and other related experiments was that the presence of punishment opportunities tends to stabilize cooperation at a high level, in stark contrast to the unraveling that tends to occur without punishment; see, e.g., Fehr and Gintis (2007). However, two recent sets of findings question the conventional wisdom. First, Herrmann, Thöni and Gächter (2008) and Gächter, Herrmann, and Thöni (2010) conduct standard versions of the PGG+PN experiment in numerous countries around the world. They find that punishment opportunities indeed stabilize cooperation in some well-functioning Western democracies, but that they generally fail to do so elsewhere. In many places, not least in Eastern Europe, cooperation unravels unchecked. There is substantial punishment in these countries too, but since it is often targeted at high contributors rather than free-riders, it mostly serves to generate an additional welfare loss.[5]

A second objection to the use of punishment has come from some evolutionary biologists, who argue that costly punishment is an unlikely explanation for the emergence of group-level cooperation. An individual who bears a private cost in order to help the group will tend to earn a lower payoff than other individuals in the group. To some extent, recent experiments on public goods provision support these intuitions. Punishers are not doing well in material terms, and punishment loses force when other incentives are available to the subjects:

[4] Fehr and Gächter (2000) specify the exact number of rounds (10), whereas Yamagishi (1988) was deliberately more vague, saying that there would be 15-20 rounds.

[5] Such 'anti-social punishment' may seem counterintuitive, but Rand et al. (2010) and Rand & Nowak (2011) present evolutionary game theoretic models demonstrating how natural selection can favor such behavior under a variety of circumstances.

Withholding of rewards is both more frequent and more successful than costly punishment (Dreber et al, 2008; Rand et al, 2009a; Rand et al, 2009b).[6]

In the present study, we consolidate these two objections to PGG+PN by making a cross-country investigation of PGG+RN together with a full set of control treatments, including a version of PGG+PN for comparison purposes. However, in keeping with our ultimate objective of understanding the organization of cooperation, rather than the exact nature of people's preferences, we revert to the fixed matching format. That is, unlike Gächter et al (2010), we do not shuffle the identifiers of each subject between rounds. Fixed matching serves two purposes. Firstly, we can more directly investigate the motives behind antisocial punishment, as this design allows us to differentiate between retaliation for previous punishments, pure antisocial punishment based only on the punished player's high contribution behavior, and indiscriminant (spiteful) punishment targeted at others regardless of their contribution level. Secondly, it allows us to ask whether antisocial punishment in PGGs persists when punishment behavior is observable, or whether such perverse behavior in previous PGG experiments was driven by lack of observability (and the accompanying safety from counter-counterpunishment).[7]

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[6] Offerman (2002) and Andreoni, Harbaugh, and Vesterlund (2003) were the first to study bilateral rewards as well as punishments in PGG experiments. However, these papers consider behavior in (a sequence of) one-shot relationships rather than the building of cooperation in stable groups. The work of Sefton, Shupp, and Walker (2007) is more closely related to the present study, since it considers the use of bilateral punishment and reward in stable groups. A major difference is that the rewards that they consider are mere transfers, whereas we consider rewards that are worth three times as much to the recipient as to the donor. Nonetheless, Sefton et al. find that rewards work as well or better than punishments in all but the final period. Also related is Sutter et al. (2010) who compare reward and punishment in fixed length repeated games, where the availability of reward versus punishment is either imposed exogenously (as in our experiments) or chosen endogenously. In the exogenous conditions, they find that neither reward nor punishment effectively promote cooperation when the sanctioning technology is 1:1, and that reward works as well as punishment in all but the final round with a 1:3 technology. In the endogenous conditions, subjects prefer punishment at 1:1 technology and reward at 1:3 technology. For a more detailed review of this literature, see Almenberg et al (2011).

[7] Recent studies of a "joy of destruction" game, which is essentially a punishment stage without a preceding PGG, find a large extent of spiteful/antisocial punishment when actions are not

Also note that the dichotomy between punishment and reward may be false, since the reward option is not always available. On the one hand, close relationships in workplaces, families, and neighborhoods can sometimes be maintained more efficiently through selective withholding of rewards than through active use of punishment. In many workplaces, the uncooperative colleague is not abused, neither physically nor verbally. Instead, he receives less support from the other group members.[8] Indeed, if both rewards and punishments are feasible, there is a simple theoretical case for basing enforcement on the withholding of rewards instead of the infliction of punishment. Consider the situation of a potential enforcer, i.e., someone who considers whether to discipline a violator of the group norm. Let a withheld reward and an act of punishment entail the same reduction of the violator's utility, and thus have the same potential for disciplining the violator. Then, the withholding of the reward is strictly preferable to the enforcer – who benefits from withholding the reward, but not from the act of punishing. That is, from the group's point of view, withholding the reward Pareto-dominates exerting the punishment.[9] But, clearly, there are also many cases in which there are no valuable rewards that

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easily observed, but little of such behavior when observability is high (Abbink and Herrmann (In press); Abbink and Sadrieh, (2009)). We also note that previous experimental research on retaliation in public goods games with punishment (e.g. Nikiforakis and Engelmann (2011) and Nikiforakis et al. (2012)) used several punishment- counter-punishment stages within each round.

[8] Of course, it is well known that successful common-pool resource management frequently involves stable user groups that have developed explicit rules that are enforced through punishment in a partly decentralized manner (Ostrom, 1990). However, such groups are usually relatively large (400 members is more typical than 4), and the punishment itself is often tightly regulated and its execution is left to a group leader, with only the monitoring being delegated to users.

[9] This efficiency gain is most immediately relevant when rewards/punishments are likely to be used either along the equilibrium path or in a learning phase, but there is an additional strategic benefit that matters even when rewards and punishments are only used out of equilibrium: If costly punishment is called for, then it is tempting to renegotiate, as both the punished and the punisher are then better off. Withholding a reward, on the other hand, is only costly for the target, so renegotiation is less of an issue.

can be withheld. In these cases, punishment may still be preferable to no sanction at all (e.g. Gächter et al. 2008, Rand et al. 2009a).

Although our above arguments may seem simple, they are more than merely special cases of established insights from the formal literature on infinitely repeated games (for an overview of that work, see Mailath and Samuelson, 2006). The most closely related formal models study the conditions under which it is beneficial to "link" games, playing one extensive supergame rather than two separate ones. Such linkage does not change the physical reality that players face, but merely changes the set of histories that the players pay attention to. In repeated games of complete information, it is rather obvious that linking games can only expand the set of sustainable Nash equilibrium outcomes – because players always have the option to condition their play on exactly the same history as before (Bernheim and Whinston, 1990; Spagnolo, 1999). A particularly relevant class of repeated linked games are those in which each round of a base game G is followed by a round of monetary transfers; see for example Malcomson and MacLeod (1989), Levin (2003), and Goldlücke and Kranz (2012). A monetary transfer from a violator to an enforcer corresponds qualitatively to the withholding of a reward, except the cost to the violator is the same as the benefit to the enforcer, whereas in our setting the cost to the violator is greater. (Costly punishment, on the other hand, is considerably less efficient than a monetary transfer.) Withholding of rewards is also a more potent enforcement technology in the sense that the violator has no veto power. In the games with transfer, the implementation of the transfer to the opponent is all up to the violator and ultimately sustained only by the threat of future withholding of cooperation by the enforcer.[10]

A shortcoming of most of the economic literature on infinitely repeated games is that it has paid scant attention to the question of which outcomes are most plausible. Results of the form that "everything is possible" are not helpful for making predictions.

While many equilibrium refinements have been proposed, common practice is to confine attention to efficient equilibria. But the focus on "best attainable" payoffs comes with the unreasonable prescription that punishments should be maximal, which in many games means

[10] A complication for the theoretical analysis of our experiment is that only the relevant pair observes the bilateral interactions. Thus, there is an element of private monitoring. For example, a player who withholds a reward and subsequently observes an increase in the relevant opponent's contributions cannot tell whether the opponent was also incentivized by the two other players in the group of four.

that a single deviation from maximally cooperative play will end cooperation forever. Our intuition for why PGG+RN or PGG+PN may enable cooperation is not that they increase the maximum punishment, but that they enable targeted responses. Thus deviations from maximum cooperation in the PGG need not destroy the possibility of subsequent PGG cooperation (harming all group members). Instead, the deviators can be selectively sanctioned in the context of the bilateral games.

Moreover, as demonstrated in recent theoretical and experimental work by Blonski, Ockenfels and Spagnolo (2011), efficiency is not a reliable selection criterion in repeated games. Arguably, the previous possibility results do not even guarantee that it is beneficial for the players to use linkage strategies.

Our view is that there is as yet no sharp and convincing theoretical prediction against which to confront our experimental evidence.[11] Hopefully, our findings will help to guide the development of such theories.

2. The Experiment

The experiment compares the behavior of American and Romanian student subjects. We chose to use students in order to keep relatively constant such variables as education, age, and comprehension. Moreover, since students are probably more similar across cultures than a representative sample would be, we think that the differences that we observe will not be exaggerated because of biased sampling.

In both countries, paper fliers were used to recruit subjects to join an online study pool, and subjects from that pool were randomly selected to be invited to experimental sessions. The experimental instructions and computer software (implemented using ZTree) were identical in both countries, except that they were presented in English in Boston and in Romanian in Iasi; one of the authors (Tarnita) is a native Romanian living in the United States. The same

[11] It seems likely that relevant theories will involve learning or evolution. Sethi and Somanathan (1996) study evolution of strategies in a situation of one-shot PGG followed by punishment. For our purposes, it would be necessary instead to consider the evolution of strategies in a repeated game setting. In this context, there are many non-trivial modeling choices.

experimenter (Rand) was present at all sessions, and conducted the experiments with the assistance of American research assistants in Boston and Romanian research assistants in Iasi.

Subjects and stakes

In the American sessions, conducted in a computer lab at Harvard University, the subjects were primarily undergraduate students from colleges around the Boston metropolitan area (mean age 21.3).[12] In the Romanian sessions, conducted in a computer lab at University of Iasi, the subjects were primarily undergraduate students from colleges around the Iasi metropolitan area (mean age 21.5).[13] The American subjects received a show-up fee of $15 and additional earnings at an exchange rate of 125 points = $1 (between $6.84 and $22.43, mean = $14.43, in additional earnings); the Romanian subjects received a show-up fee of 10 RON and additional earnings at an exchange rate of 100 points = 1 RON (between 1 RON and 36.5 RON, mean = 26.06 RON, in additional earnings). The point exchange rates were chosen to give roughly equivalent student-standard-of-living-adjusted earnings (at the time of the Iasi sessions, $1 was worth 3.52 RON). All subjects were paid in cash immediately following the end of the experiment.

Treatments

In all treatments, there is a fixed matching of subjects, every subject is assigned a persistent identification number, and interaction goes on for 50 rounds. Subjects are not informed about the number of rounds.[14]

There were four treatments altogether. Two of them are intended as control treatments.

In the first control treatment, subjects interact in fixed groups of four. Each round, they play a public goods game (PGG) in which each group member chooses a contribution from 0 to

[12] The USA data for the PGG, PGG+PN and PPG+RN treatments were originally reported in Rand et al. 2009a.

[13] The city of Iasi is a leading center of Romanian social, cultural, academic and artistic life, and at the time of our study the University of Iasi was the top ranked research university in Romania. Thus Iasi offered a natural contrast with Boston and Harvard University.

[14] Subjects only know roughly how long the experiment will take. To minimize potential end-game effects, the game is ended substantially before the time at which that experimental session is to conclude. Thus subjects do not 'see' the end of the game coming due to the approaching end of the session.

20 points. The sum of these contributions is multiplied by 1.6 and then divided evenly between the four members. We refer to this treatment as PGG.

In the second control treatment, subjects interact in fixed pairs within groups of four players. Each round, both players in each pair individually and independently decide either to reward the opponent, incurring a private cost of 4 points in order for the opponent to receive 12 points, or to take a neutral action yielding 0 points for each player. We refer to this treatment (which is a standard two-person prisoners' dilemma played between each of the six pairs) as RN.

In our main treatment, subjects again interact in fixed groups of four. Each round is divided into two stages. At the first stage, all four players play the same PGG as described above. At the second stage, after learning the behavior of all opponents at the first stage, each group member privately plays a Reward game with each of the other three members.[15] We refer to this treatment as PGG+RN.

Finally, the remaining treatment is similar to our main treatment, except the second stage game is a Punishment game instead of a Reward game. Each player, interacting individually with each of the three opponents, decides whether to incur a cost of 4 in order for the opponent to suffer a loss of 12. We refer to this treatment as PGG+PN.

[15] Formally, PGG+RN is a game with imperfect monitoring. All players perfectly observe the PGG history, but they can only observe the history of their own bilateral interactions. They are, however, informed of the choice of each of their partners in the bilateral stage, rather than being informed only of the aggregate amount of rewards (or punishments in the case of the PGG+PN treatment) received.

The number of subjects in each session is shown in Table 1:

Table 1. Treatments and number of subjects

Boston	PGG	N=64
	RN	N=52
	PGG+RN	N=44
	PGG+PN	N=40
Iasi	PGG	N=48
	RN	N=48
	PGG+RN	N=48
	PGG+PN	N=64

3. Results

We begin by characterizing the average levels of contribution, rewarding and payoff in each of the two countries. All statistical analysis is performed at the level of the decision, using linear regression clustered on subject and group to account for the non-independence of multiple observations from a single subject and of subjects from a single group.

3.1 Control treatments

First, consider the two unlinked control treatments (Figure 1). Visual inspection suggests that there is virtually no difference between the two countries when it comes to social dilemma behavior, either in the four person public goods setting (PGG) or in the two-person prisoners' dilemma setting (Reward game). The visual impression is confirmed statistically.[16] These findings give us confidence that the subjects in Romania understood the game structure as well as subjects in the United States did, and also suggest that basic social norms or preferences are not too different in the two subject pools.

[16] Predicting control PGG contribution using a country dummy reveals that there is no significant difference between Romania and the US (p=0.796); and predicting rewarding probability in the control rewarding game using a country dummy finds no significant difference between Romania and the US (p=0.234).

It is worth noticing that average behavior fluctuates quite strongly, especially in PGG. As one might suspect, this fluctuation reflects a much stronger oscillation at the group level; see figures A1 and A2 in the Appendix for disaggregated contribution behavior. Indeed, only a few groups display PGG behavior that is reminiscent of equilibrium. If there is a difference between the two countries, it is that a few of the U.S. groups experience extended tranquil periods, either at maximum contributions, or at minimal contributions. In Romania, the only group that eventually manages to stabilize behavior does so at an average contribution level of 10, that is, half the potential.

In two-person PDs, on the other hand, many pairs in each country manage to settle on steady cooperation (although there is still somewhat more fluctuation among Romanians). The natural interpretation is that PGG, unlike RN, lacks a mechanism for targeting punishments or rewards. It is impossible to selectively punish a single free-rider or reward a single cooperator in the PGG, and thus the presence of even one low contributor causes cooperation to unravel.

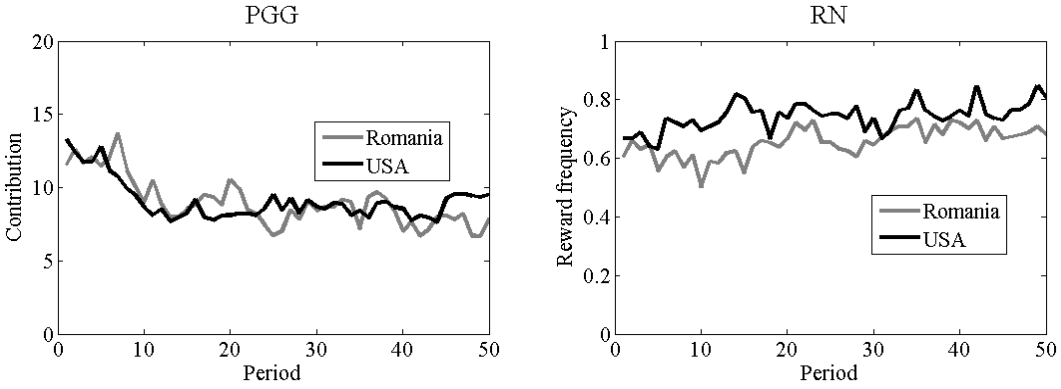

Figure 1. Behavior in Control PGG and Control reward.

3.2 Public goods game with linked Prisoner's Dilemma (PGG+RN treatment)

Next, in our main treatment PGG+RN, we examine how behavior changes when the PGG and the pairwise reward game are linked (Figure 2).

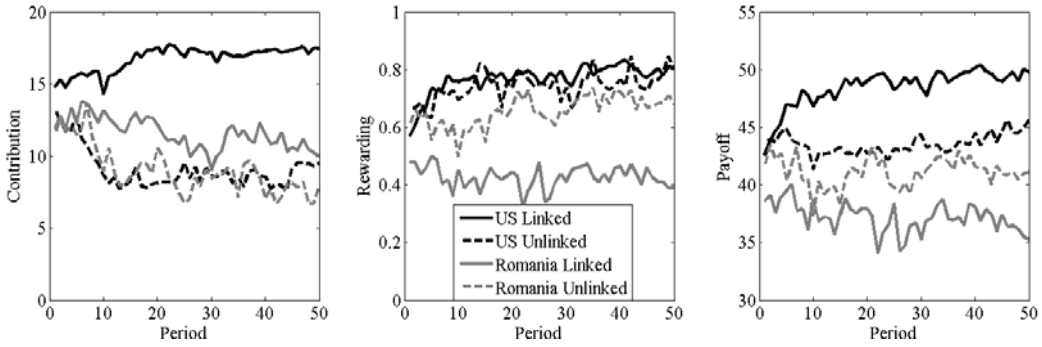

Figure 2. Contribution, rewarding and payoff in the unlinked and linked games.

Considering group contributions, Figure 2a, we find a marginally significant increase in contribution when the games are linked in Romania ($p=0.076$), and a highly significant increase in contribution when the games are linked in the U.S. ($p<0.001$). Comparing the behavior in the pairwise games, Figure 2b, there is no difference in average rewarding between linked and unlinked games in the U.S. ($p=0.834$); whereas there is a significant *decrease* in rewarding when the games are linked in Romania ($p=0.004$). Taken together, these two results imply an increase in efficiency/total payoff when linking the games in the U.S., and a decrease when linking in Romania (the substantial decrease in rewarding in Romania outweighs the modest increase in contribution), as summarized in Figure 2c.

The interpretation that U.S. subjects are better at coordinating receives further support from the disaggregated data; Figures A7 and A8 in the Appendix. Out of 11 groups, 5 manage to settle (virtually permanently) on maximal group contributions before the tenth round, whereas the same number for Romania is 0/12. In fact, all the Romanian groups display the same sort of oscillation in the contribution in PGG+RN as in PGG.

Let us now investigate the deeper sources of these discrepancies in PGG+RN behavior.

Responses to rewards

How do players update their PGG actions as a result of being rewarded? Figure 3 provides a first answer to this question, plotting the change in PGG contribution from period t to period t+1 as a function of (i) relative contribution in period t (below average contributor vs average/above average contributor) and (ii) the number of rewards received in period t (0 to 3). As the differences in contribution and payoff between linked and unlinked games develop in the earlier rounds of the game, as seen in Figure 2, we restrict attention to play in the first 10 periods.

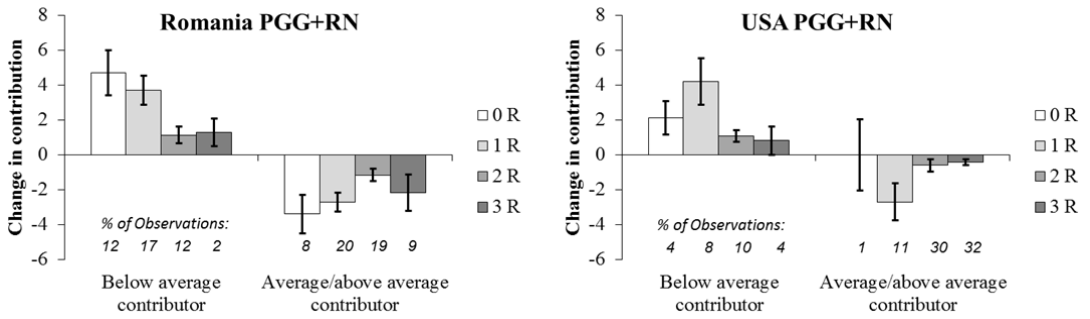

Figure 3. Change in PGG contribution over period 1 thru 10 as a function of contribution relative to the average in the previous PGG round, and number of rewards received in the previous pairwise round. Errors bars show standard errors clustered on subject and session.

We see little qualitative difference between the U.S. and Romania. In both countries, subjects who contributed less (more) than the average in the previous round tend to contribute more (less) this round. More interestingly, the behavioral change appears to correlate systematically with the rewards. The more a low contributor is rewarded, the less she increases her contributions. Or put differently, greater withholding of rewards entails a greater increase in contributions. Similarly, the more high contributors are rewarded, the less they decrease their contributions. Of course, these are mere correlations and do not prove causality; perhaps withholding of rewards is systematically linked to low contributions, but the subsequent increase in contributions merely reflect reversion to the mean. To address this issue, we perform a linear regression analysis in which we control for the previous round's contribution relative to the average group contribution. Table 2 reports the relevant coefficients.

Table 2. Change in contribution as a function of number of rewards received and country, controlling for magnitude of contribution in previous period relative to the average group contribution. Linear regression with robust standard errors clustered on subject and group.

	Below average contributors		Average/above average contributors	
# of Rs received	-0.722**	-1.032**	0.485*	0.462
	(0.275)	(0.509)	(0.252)	(0.342)
US	-0.465	-1.477	0.145	0.0444
	(0.819)	(1.705)	(0.407)	(1.217)
Rs received X US		0.750		0.0520
		(0.810)		(0.469)
Contribution relative to group in previous period	-0.370**	-0.371**	-0.360***	-0.360***
	(0.179)	(0.177)	(0.0791)	(0.0783)
Constant	1.998**	2.330**	-1.478*	-1.444
	(0.833)	(1.008)	(0.824)	(0.976)
Observations	289	289	539	539
R-squared	0.106	0.109	0.074	0.074

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The regression in column 1 reveals that much of the effect observed in the figures could represent reversion to the mean: If we neglect the impact of rewards, below average contributors raise their contributions by 1.998 units minus 0.370 times their relative contribution – meaning that the lowest contributors change more. However, the regressions also confirm that withheld rewards do have a significant effect on group members who contributed less than average in the previous round. Each withheld reward increases the contribution by an additional 0.72 units. Thus, the low contributors respond to incentives. To the extent that there is a difference between the U.S. and Romania, the (statistically insignificant) interaction term in column 2 suggests that Romanians respond more strongly.

As one would expect, rewards have a qualitatively similar effect on the change in behavior of high contributors; the more rewards, the less they change their behavior. But since the change in contributions is negative on average in their case, the coefficient on the reward variable is positive. Also, the change is smaller and not statistically significant.

Provision of rewards

Let us next turn to the provision of rewards. Figure 4 displays the probability of player *i* rewarding player *j* as a function of two variables: (i) player *j*'s contribution relative to player *i* in the previous PGG round (< player *i* vs >= player *i*), and (ii) player *j*'s action towards player *i* in the previous pairwise round (N vs R). Again we restrict our attention to the first 10 periods.

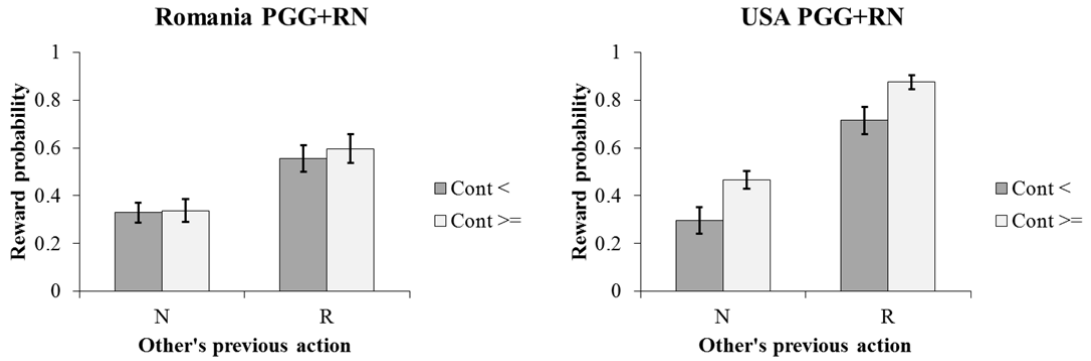

Figure 4. Probability of reward in periods 1 thru 10 as a function of target's relative contribution and previous pairwise action. Errors bars show standard errors clustered on subject and session.

As expected, subjects in both countries are more likely to reward opponents that they were rewarded by in the previous round. But consider how the reward depends on the opponent's behavior in the previous round of PGG: In Romania, subjects appear to pay no attention to relative contributions; the grey bar is as large as the white. In the U.S. on the other hand, there is a sizeable difference: Subjects are significantly more likely to reward an opponent who contributed as much as or more than they themselves did. The corresponding regression results are reported in Table 3. In Romania we see a significant positive main effect of the other's previous pairwise rewarding, but no effect of the other's PGG contribution. In the U.S., conversely, we see significant positive main effects of both variables. In other words,

U.S. subjects use rewards to incentivize contributions, whereas Romanian subjects do not. Here, then, is the key difference between the two subject pools.

Another difference between U.S. and Romania is that rewards are more strongly linked to the opponent's pairwise action in U.S. At first sight, this is surprising. Since Romanian subjects are less prone to selectively withhold rewards in order to punish free riders, they should have an easier time sustaining their bilateral relationships. On the other hand, it is difficult for a subject to know what other subjects base their decisions on. In PGG+RN there are many more possible interpretations of bilateral behavior than in the RN control treatment, and perhaps this suffices to create misunderstandings and erode bilateral trust.

Rows 3 and 4 of Table 3 beg the question: Who in the U.S. is it that promotes cooperation by withholding rewards? The short answer is that it's the prosocial subjects who take on the responsibility for enforcing a high-contribution norm. In order to establish this result, compare the rewarding behavior of high and low contributors. Take a median split based on contribution in the first round. Across all participants (all treatments from both countries), the median first round contribution is 13 points (out of 20). Thus the half of subjects who contribute more than 13 units in the first period are classified as high contributors, and the other half of subjects who contribute 13 or few units in the first period are classified as low contributors. Table 4 reports a set of regressions, taking rewarding decision as the dependent variable (0=N, 1=R) and a low/high contributor dummy as the independent variable.

Table 3. Reward probability as a function of target's contribution relative to actor (0=less, 1=equal or greater) in previous PGG round and target's action (0=N, 1=R) towards actor in the previous pairwise round. Linear regression with robust standard errors clustered on subject and group.

	Romania		US	
Other's relative contribution	0.0220	0.00752	0.165***	0.170***
	(0.0461)	(0.0532)	(0.0439)	(0.0467)
Other's pairwise action	0.246***	0.227***	0.413***	0.420***
	(0.0427)	(0.0565)	(0.0281)	(0.0621)
Other's cont X action		0.0330		-0.00941
		(0.0569)		(0.0757)
Constant	0.321***	0.329***	0.300***	0.296***
	(0.0399)	(0.0417)	(0.0557)	(0.0548)
Observations	1,296	1,296	1,188	1,188
R-squared	0.062	0.062	0.219	0.219

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4. Reward probability as a function of the first period contribution of the subject choosing whether to give out the reward (0=lower contributor, at or below median of 13 MUs, 1=higher contributor, above median of 13 MUs). Linear regression with robust standard errors clustered on subject and group.

Other's previous contribution level	Other's previous action to you	Romania	USA
Low	N	0.117	0.130
		(0.091)	(0.113)
Low	R	0.052	0.095
		(0.093)	(0.129)
High	N	0.123	0.057
		(0.108)	(0.085)
High	R	0.016	0.267***
		(0.076)	(0.086)
Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1			

In Romania, for each combination of other's relative contribution and other's previous pairwise action, we find no significant effect of the low/high contributor dummy ($p>0.20$ for all). Thus neither low nor high contributors condition their rewarding on the other's PGG play.

Among the Americans, the reward pattern again looks similar, with one exception: considering situations in which the other player chose reward in the previous pairwise interaction, low contributors do not discriminate based on the PGG contribution ($p=0.963$), whereas high contributors are significantly more likely to reward those who contributed as much or more in the PGG ($p=0.008$). Thus high contributors give more rewards than low contributors to others who both contributed as much or more in the PGG and rewarded in the previous pairwise interaction. This result is further confirmed by a significant positive three-way interaction between other's relative contribution, other's previous pairwise action, and being a high contributor (coeff=1.66, $p<0.001$). Thus in the US, it is only the high contributors who are using rewards as an incentive for increased PGG contribution.

Overall, the contributions data are consistent with the following story. Prosocial Americans are willing to enforce a high contribution norm through selective withholding of

rewards. This willingness is at least partly anticipated by less prosocial Americans, who start out contributing at a higher level in the PGG+RN than in Control PGG. In Romania, on the other hand, few are willing to risk their bilateral relationships in order to sustain cooperation in the larger group. Hence, bilateral interactions only have a small effect on multilateral relationships there.

The different willingness to provide contribution incentives through bilateral relationships begs the next question: Is the cost of providing such incentives, in terms of forgone bilateral cooperation, higher in Romania?

Effect of withholding on bilateral relationships

Table 6 investigates the effect on the relationship of withholding the reward to a lower contributor in the first round.

We see that withholding rewards is associated with a negative effect on the relationship in the beginning in both countries. However, over time the relationship is repaired in the U.S., and if anything becomes even better than relationships where the higher contributor gives the reward in the first round. In Romania, on the other hand, the relationship tends to be persistently bad.

Perhaps one reason why withheld rewards create persistent damage to bilateral relationships in Romania is that the provision of incentives overall tends to be insufficient. Therefore, in most groups contributions tend to fall. In view of this failure to establish high contribution levels, a punished (i.e. not rewarded) subject B may have more reason to be upset with the punisher A than when the incentives succeed in establishing high and stable cooperation.

Table 6. Rewards received from lower contributor as a function of whether a given player withheld reward from the lower contributor in period 1. Linear regression with robust standard errors clustered on subject and group.

	Periods 1-10		All periods	
	Romania	USA	Romania	USA
Withheld R in Period 1	-1.079**	-1.019**	-5.757**	2.158
	(0.527)	(0.404)	(2.686)	(2.749)
Period 1 Average Group Contribution	-0.0372	0.209***	-0.672	0.912**
	(0.219)	(0.0634)	(1.011)	(0.385)
# of Others Withholding R from Low Contributor in Period 1	-0.448	0.0773	-3.880	3.413**
	(0.666)	(0.613)	(3.267)	(1.638)
Constant	5.536*	3.451***	33.53**	18.40***
	(3.112)	(0.916)	(14.93)	(5.949)
Observations	65	44	65	44
R-squared	0.040	0.122	0.057	0.109
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				

3.3 Public goods game with punishment (PGG+PN treatment)

Finally, we turn to behavior in the PGG+PN condition (Figure 3). We selected Romania as our cross-cultural comparison country based on our prediction that punishment would not successfully promote cooperation there, as was the case in countries studied by Herrmann et al (2008) and Gächter et al (2010) that were culturally similar to Romania.

As is clear from Figure 5, this prediction is correct. While punishment leads to a significant increase in contribution in the United States ($p<0.001$), punishment has no significant effect on contributions in Romania ($p=0.807$). As a result, punishment significantly increases efficiency in the United States ($p=0.043$), but significantly *reduces* efficiency in

Romania ($p<0.001$). Thus the PGG+PN condition establishes that Romania is a country in which sanctioning norms differ from the United States, and where costly punishment is not an effective stabilizer of cooperation. The PGG+PN condition also demonstrates that anti-social punishment persists even when individual punishment decisions are observable by those being punished. This finding expands the sphere of real-world settings in which anti-social punishment is a potentially relevant factor.

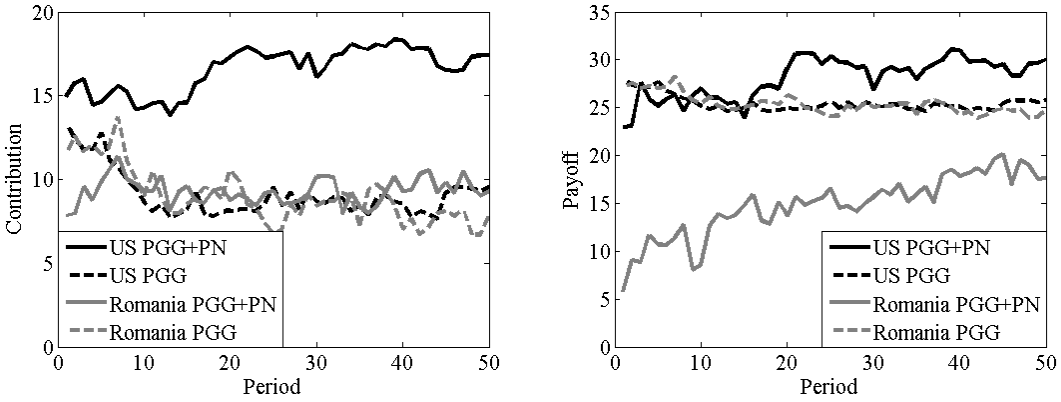

Figure 5. Contribution and payoffs in the control PGG and PGG+PN.

We now explore the basis of these cross-cultural differences using a similar set of analyses as those in the previous section.

Responses to punishments

The change in PGG contribution from period *t* to period *t*+1 as a function of (i) relative contribution in period *t* (below average contributor vs average/above average contributor) and (ii) the number of punishments received in period *t* (0 to 3) is shown in Figure 6, again restricting our attention to play in the first 10 periods.

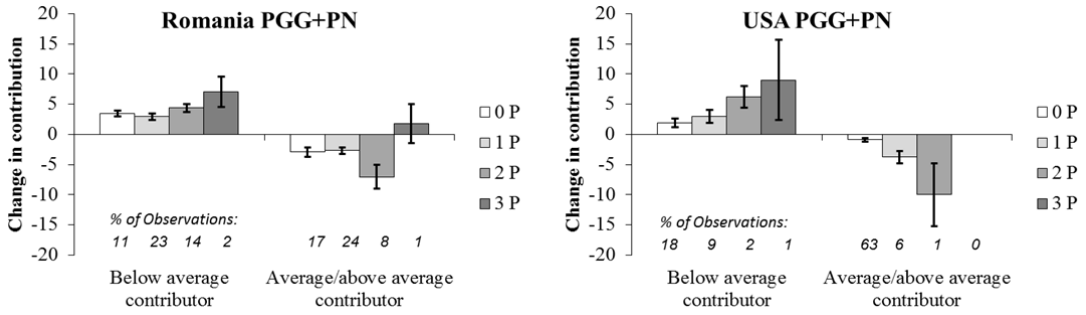

Figure 6. Change in PGG contribution over period 1 thru 10 as a function of contribution relative to the average in the previous PGG round, and number of punishments received in the previous pairwise round. Errors bars show standard errors clustered on subject and session.

As in the PGG+RN treatment, there is little difference between the U.S. and Romania in the response to punishment in the PGG+PN treatment. In both countries, punishment appears to have an opposite effect of rewarding: the more a low contributor is punished, the more she increases her contribution; and the more a high contributor is punished, the more she decreases her contribution. If true, a consequence of this behavioral pattern is that antisocial punishment undermines cooperation. Punishment targeted at high contributors will lead to lower cooperation rates.

Of course, Figure 6 only displays a correlation, and cannot establish a causal relationship from punishment to contribution. Table 7 reports the corresponding regressions on change in contribution as a function of punishments received and country, controlling for the previous round's relative contributions. Consistent with the visual appearance of Figure 6, we find no significant main effects of, or interactions with, the country dummy. Perhaps more remarkably, the impact of punishment on contribution is not statistically significant, suggesting that the pattern in Figure 6 may not be causal, but rather reflect reversion to the mean. In contrast to withheld rewards, which do have a significant impact on next round's contributions, as reported in Table 2, we thus conclude that punishment has a smaller or less predictable immediate effect.

Table 7. Change in contribution as a function of number of punishments received and country, controlling for magnitude of relative contribution in previous period. Linear regression with robust standard errors clustered on subject and group.

	Below average contributors		Average/above average contributors	
# of Ps received	0.474	0.334	-0.684	-0.584
	(0.385)	(0.349)	(0.688)	(0.767)
US	-0.671	-1.102	-0.0808	0.0908
	(0.806)	(0.869)	(0.874)	(0.912)
# of Ps received X US		0.658		-0.627
		(1.257)		(2.146)
Relative contribution in previous period	-0.384**	-0.374**	-0.625***	-0.615***
	(0.155)	(0.157)	(0.167)	(0.172)
Constant	1.301*	1.506**	0.174	0.0415
	(0.704)	(0.679)	(0.995)	(1.068)
Observations	398	398	538	538
R-squared	0.060	0.061	0.159	0.160

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Assignment of punishments

We now examine how subjects choose to punish. Figure 7 displays the probability of player *i* punishing player *j* as a function of two variables: (i) player *j*'s contribution relative to player *i* in the previous PGG round (< player *i* vs >= player *i*), and (ii) player *j*'s action towards player *i* in the previous pairwise round (N vs P); and Table 8 shows the associated regressions. Again we restrict our attention to the first 10 periods.

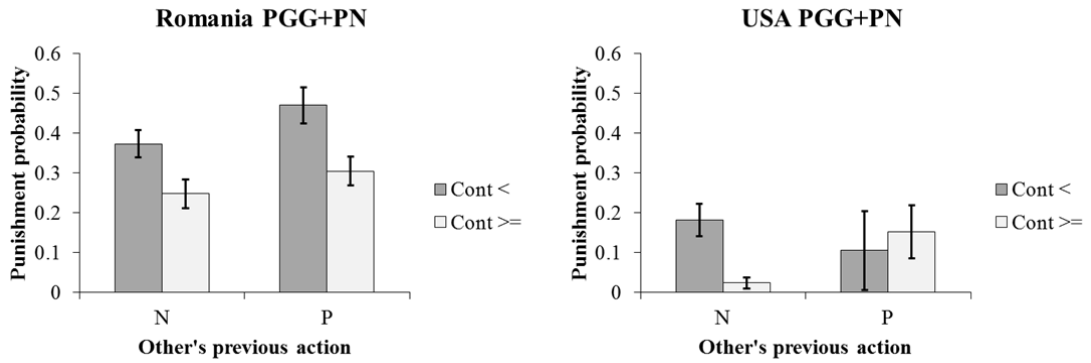

Figure 7. Probability of punishing in periods 1 thru 10 as a function of target's relative contribution and previous pairwise action. Errors bars show standard errors clustered on subject and session.

Here we see marked differences between the U.S. and Romania. The most striking result is that across all four combinations of previous contribution and pairwise action, there is substantially more punishment in Romania compared to the U.S (as reflected by constants which are more than twice as large in the Romania regressions compared to the US regressions).

Of particular relevance is the much greater frequency of punishment targeted at high contributors in Romania. Interestingly, retaliation for previous punishment does not seem to be a major motivator of this antisocial punishment. Table 8 shows that in Romania the coefficient on having been punished last period is only marginally significant, and Figure 6 reveals that most of this marginal effect is driven by punishment targeted at those who contributed less than you (i.e. not antisocial punishment). Those who contributed as much or more than you, and did not punish you in the previous round, are over 10 times more likely to be punished in Romania (24.8%) compared to the U.S. (2.4%).

Furthermore, analyzing punishment in the very first round, where retaliation is impossible as no previous punishment has occurred, shows an even more pronounced version of the same pattern: equal or higher contributors were punished 33.6% of the time in Romania, compared to only 5.2% of the time in the U.S. (Chi^2-test, $p<0.001$). These Period 1 results suggest that the lack of retaliation evident in Table 8 is not an artifact of longer memory punishment strategies,

but in fact reflects a baseline inclination to punish high contributors irrespective of punishment received.[17]

Examining first round punishment also allows a clean separation of antisocial punishment specifically targeted at high contributors versus indiscriminate (spiteful or competitive) punishment of both lower and higher contributors. Among the 29 Romanian subjects that had the opportunity to engage in both prosocial and antisocial punishment in the first round, 8 engaged in both kinds of punishment whereas only 3 exclusively punished antisocially (another 9 punished exclusively prosocially).[18] This analysis, however, necessarily leaves out the subjects that were the lowest contributors in their group, and therefore did not have the chance to punish prosocially. Among the 12 subjects who were the unique lowest contributor in their group, 9 punished higher contributors while 3 engaged in no punishment. Among the 7 subjects that were tied for lowest contributor with one or more others in their group, 2 punished only higher contributors, 1 punished only equal (lowest) contributors, and 4 did not punish at all (no subjects punished both equal and higher contributors). Thus we find evidence of both indiscriminate punishment and punishment selectively targeted at higher contributors.

Finally, consistent with the findings regarding organizationally responsible individuals in the PGG+RN condition, we find that antisocial punishment occurs predominantly among low contributors. We find a significant negative correlation between contribution in the first period and punishing those who contribute as much or more than you (linear regression with robust standard errors clustered on subject and group: coeff=-0.010, p=0.050).

[17] An analysis performed by Rand & Nowak (2011) shows a similar large extent of antisocial punishment in Period 1 of Herrmann et al (2008)'s data on antisocial punishment across societies, indicating that antisocial punishment in those experiments also is not driven by attempts at explicit retaliation in previous rounds. Antisocial punishment there, as well as in in one-shot experiments (Gächter and Herrmann (2009), Gächter and Herrmann (2011)), could potentially have been triggered by anticipation of punishment.

[18] These figures stand in stark contrast to the analogous subset of American students, none of whom engaged in antisocial punishment in period 1.

Table 8. Punishment probability as a function of target's contribution relative to actor (0=less, 1=equal or greater) in previous PGG round and target's action (0=N, 1=P) towards actor in the previous pairwise round. Linear regression with robust standard errors clustered on subject and group.

	Romania PGG+PN		US PGG+PN	
Other's relative contribution	-0.138***	-0.125***	-0.143***	-0.158***
	(0.0353)	(0.0388)	(0.0494)	(0.0454)
Other's pairwise action	0.0733*	0.0970*	0.0817	-0.0766
	(0.0392)	(0.0512)	(0.0505)	(0.0830)
Other's cont X action		-0.0408		0.204**
		(0.0500)		(0.100)
Constant	0.380***	0.373***	0.170***	0.182***
	(0.0337)	(0.0343)	(0.0420)	(0.0406)
Observations	1,728	1,728	1,080	1,080
R-squared	0.026	0.026	0.066	0.074
Standard errors in parentheses				
*** p<0.01, ** p<0.05, * p<0.1				

4. Final remarks

Nowadays, experiments are often used to test well-defined theories. The current experiment instead attempts to sharpen and evaluate a loosely formulated theory about civic capital. The evidence supports the broad notion that U.S. participants have a greater inclination to take responsibility for disciplining other group members, and also indicates that this greater inclination to enforce desirable group norms is justified by a rational calculus of material costs and benefits. Romanian participants are less inclined to assume such a social leadership role, and that too appears to be rational. Long-run costs in terms of damaged relationships outweigh the small gains in terms of improved group performance.

The experiment also highlights the general message that the linking of games comes with costs as well as benefits. While the best feasible equilibrium outcome is never worse with a link than without, it is quite possible that the linkage reduces the probability of implementing any

equilibrium, and may also contribute to eventual coordination on a bad equilibrium. Sophisticated institutions are good when they work, but could be more fragile than simple institutions. In Romania, linkage did more harm than good. Our results show that this failure to link games productively is a general feature of linking public and private interactions, and not specific to the setting of costly punishment. There is a need for more theoretical work explaining why game linkage may reduce efficiency.

A natural question that arises from our experiments is what interventions might encourage organizational responsibility and facilitate group cooperation in countries such as Romania. One possibility involves explicit monetary incentives, such as financial payments to those that discipline free-riders. Alternative approaches might involve adjusting the framing of the decision setting; supplying selective information about previous play to give the impression that a norm of withholding exists; or even just directly encouraging subjects to withhold rewards from free-riders before the experiment begins. Investigating these and other possibilities is a compelling direction for future research.

Evidence from laboratory experiments comes with many caveats. We do not know how robust our findings will be to changes in the subject pool or the experimental protocol. The simplicity of our design comes at the cost of subduing natural coordination mechanisms, such as direct communication among the participants. Hopefully, future work will address these concerns.

The greatest drawback of laboratory experiments is that we do not know to what extent patterns in the experiment reflect general propensities that are important in the field. However, recent empirical studies indicate that laboratory cooperation is predictive of field behavior. In a study of Ethiopian forest user groups, Rustagi, Engel and Kosfeld (2010) find that individuals' conditional cooperation in the laboratory is correlated with the respective group's success in forest commons management. They also uncover clues that the causation flows from a propensity to engage in conditional cooperation through participation in costly monitoring to better forest outcomes. Likewise, Fehr and Leibbrandt (2011) document that the field behavior of fishermen operating under conditions of open access can to a significant degree be predicted by laboratory measures of patience and cooperativeness.

For us too, a desirable next step is to consider field behavior. However, our hypothesis concerns groups' ability to form congruent beliefs rather than the preferences of individual participants. To probe the hypothesis in the field, we would therefore need to observe whole groups in action, preferably in environments of varying complexity. We propose that field studies of the emergence of informal organization in work-groups would be a valuable

complement both to our laboratory experiment and to recent cross-country comparisons of formal organization, such as Bloom, Sadun, and van Reenen (2009).

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Appendix A: Decisions disaggregated by group

Figure A1: Romania PGG

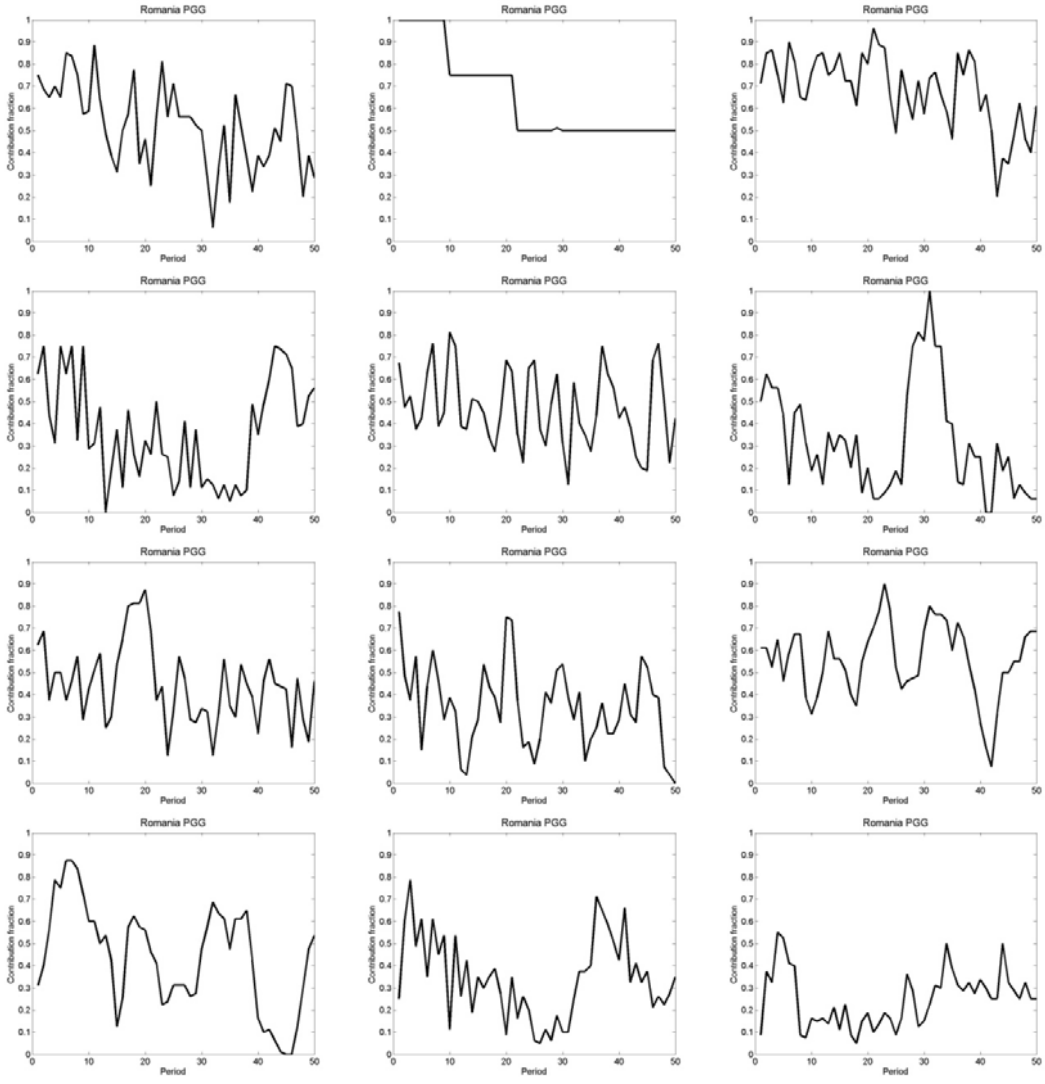


Figure A2: USA PGG

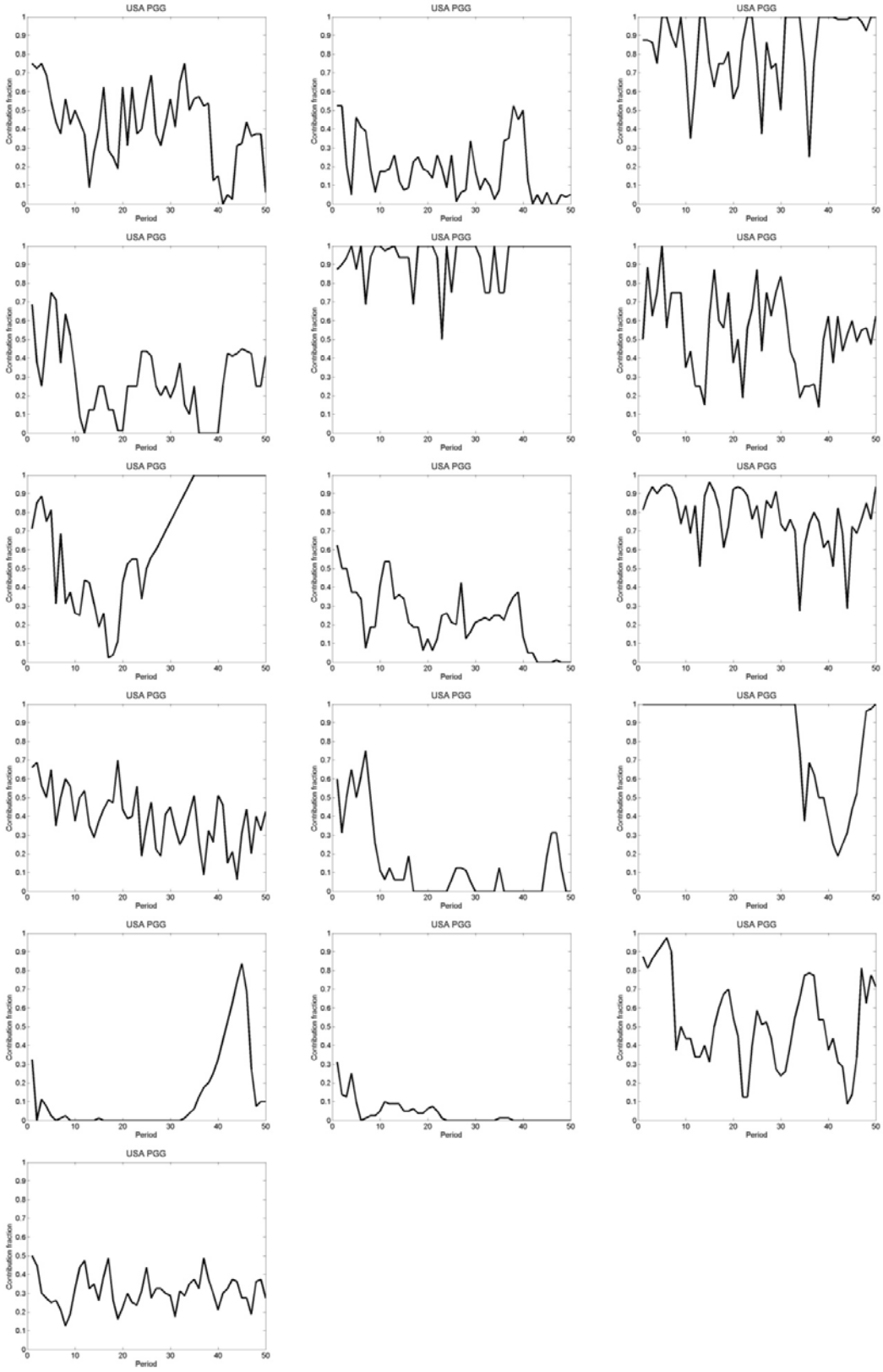


Figure A3: Romania RN

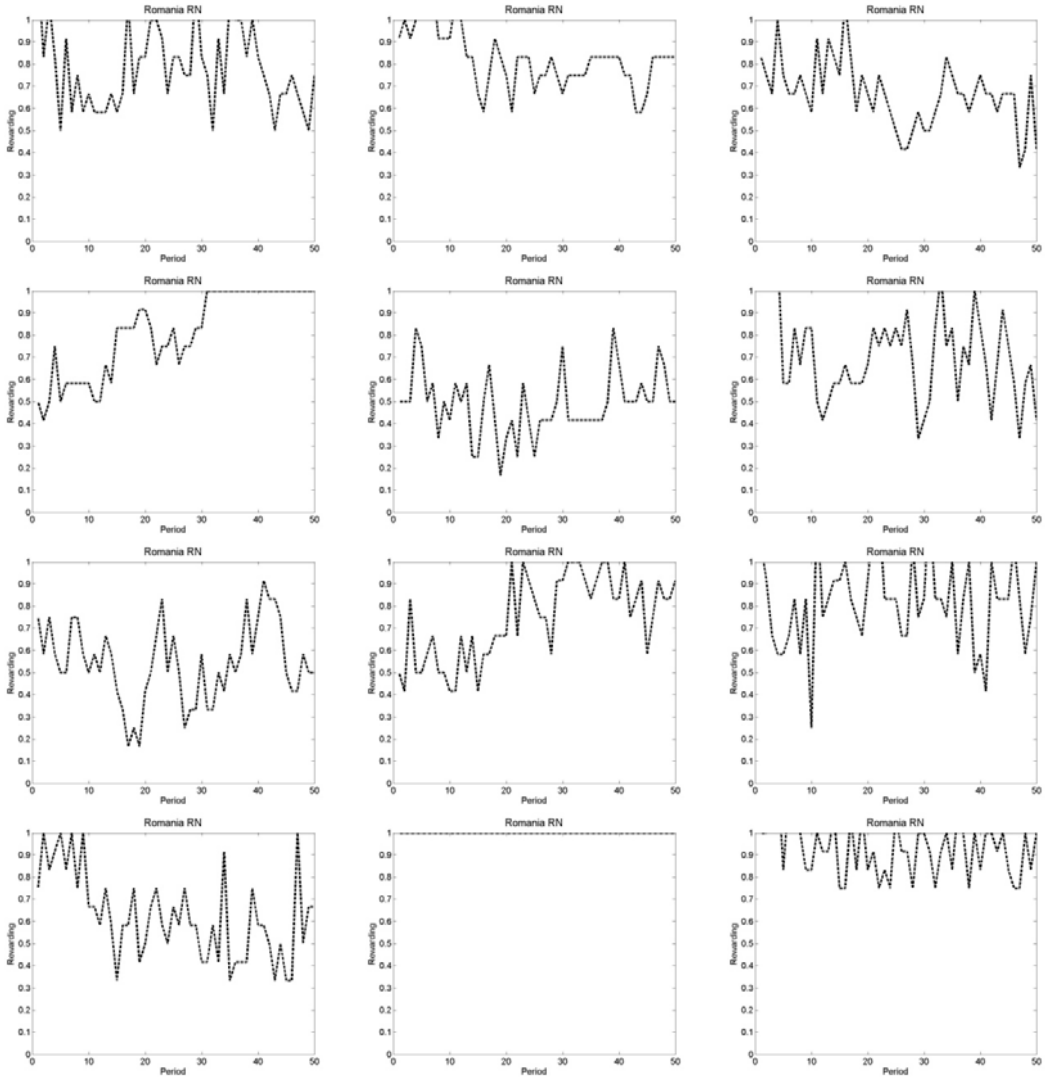


Figure A4: USA RN

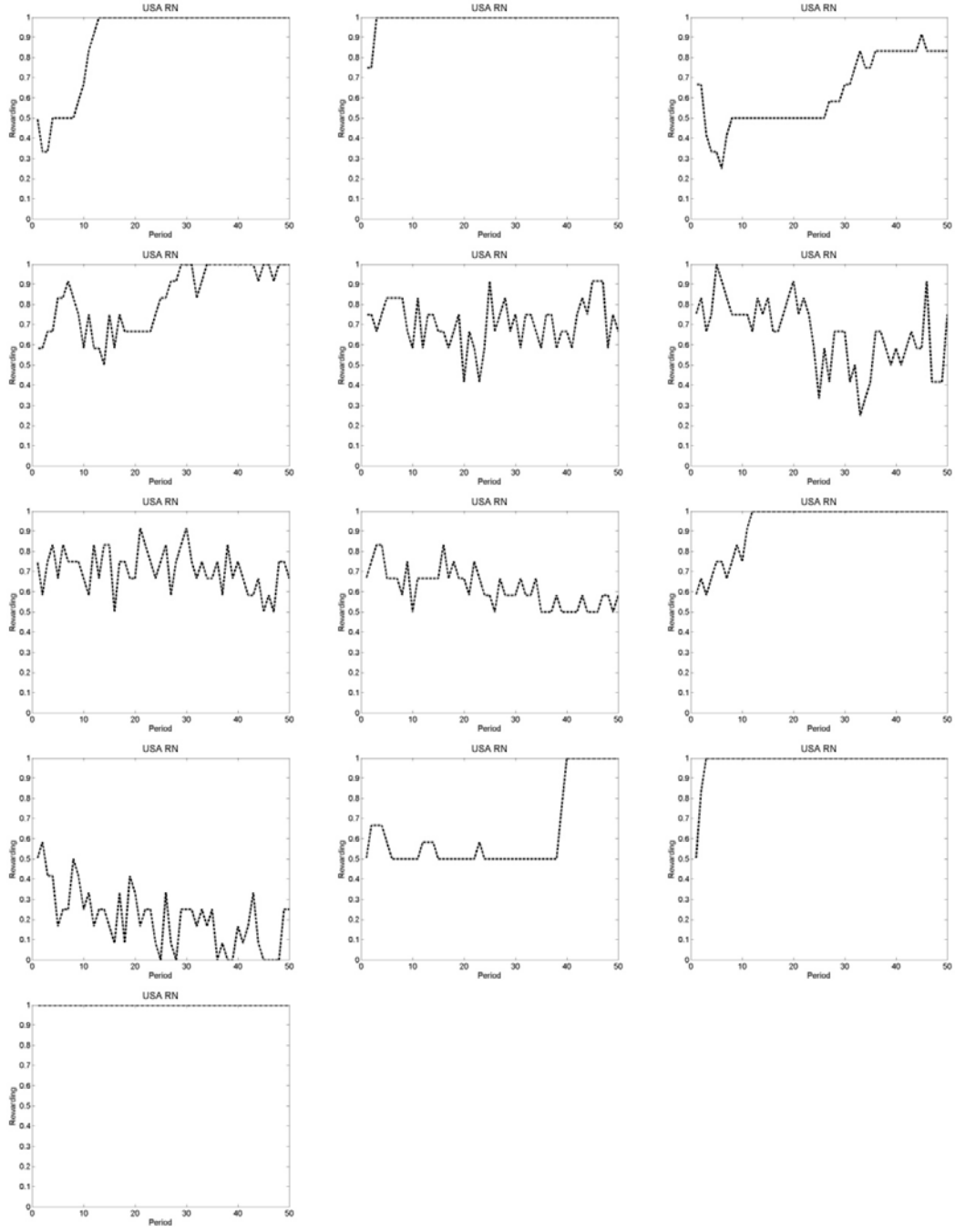


Figure A5: Romania PGG+PN

[Dashed = punishment frequency; solid = fraction contributed]

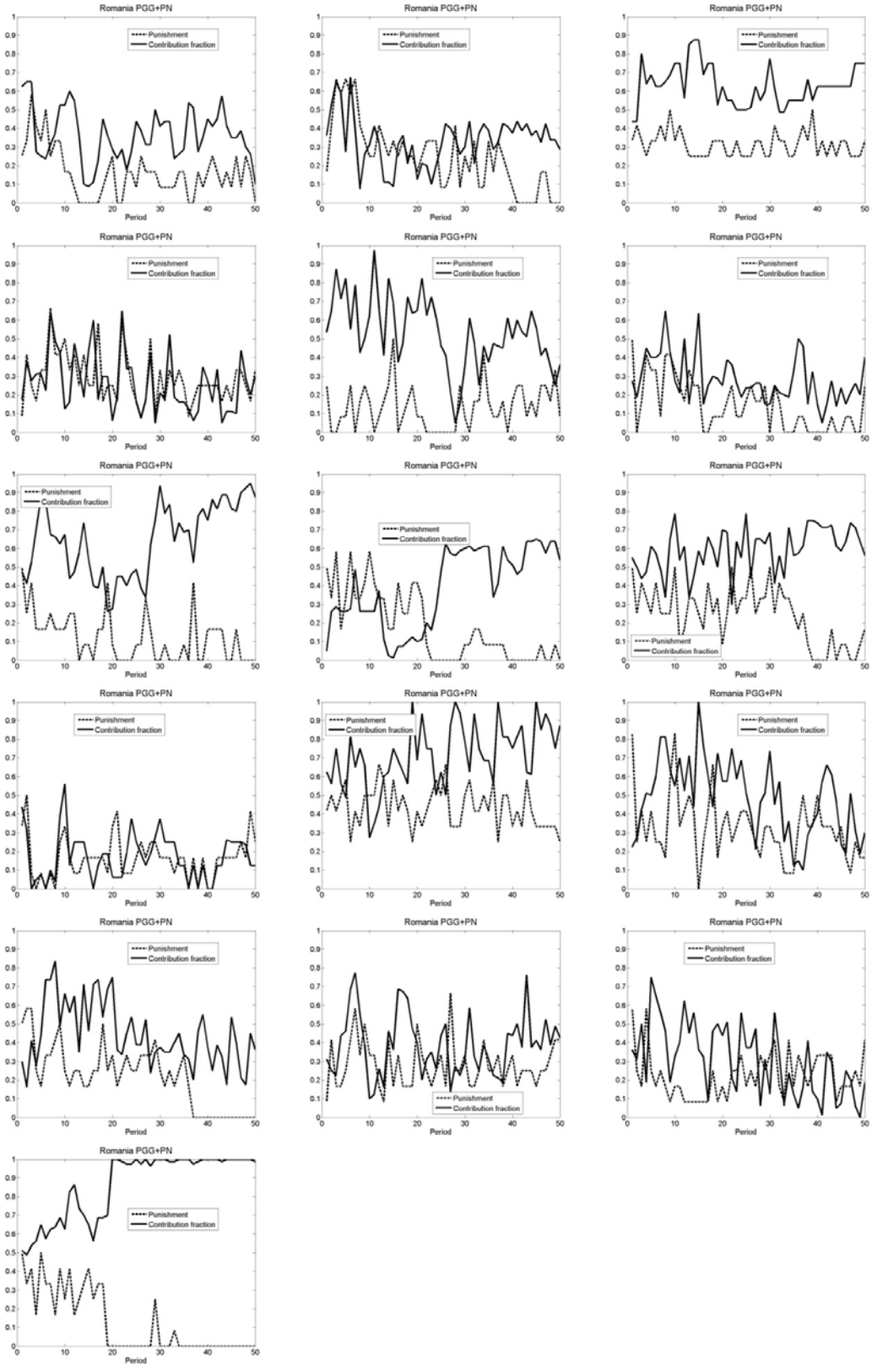


Figure A6: USA PGG+PN

[Dashed = punishment frequency; solid = fraction contributed]

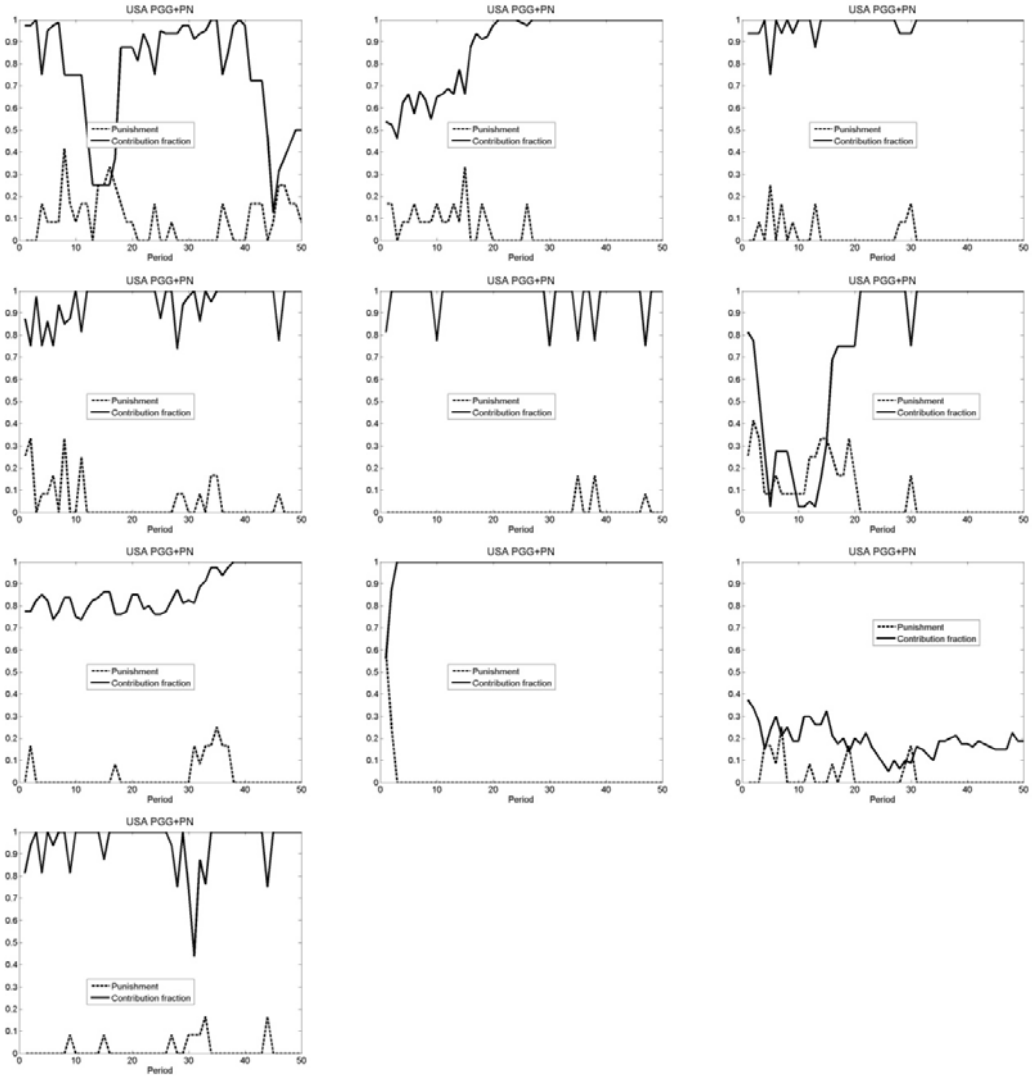


Figure A7: Romania PGG+RN

[Dashed = reward frequency; solid = fraction contributed]

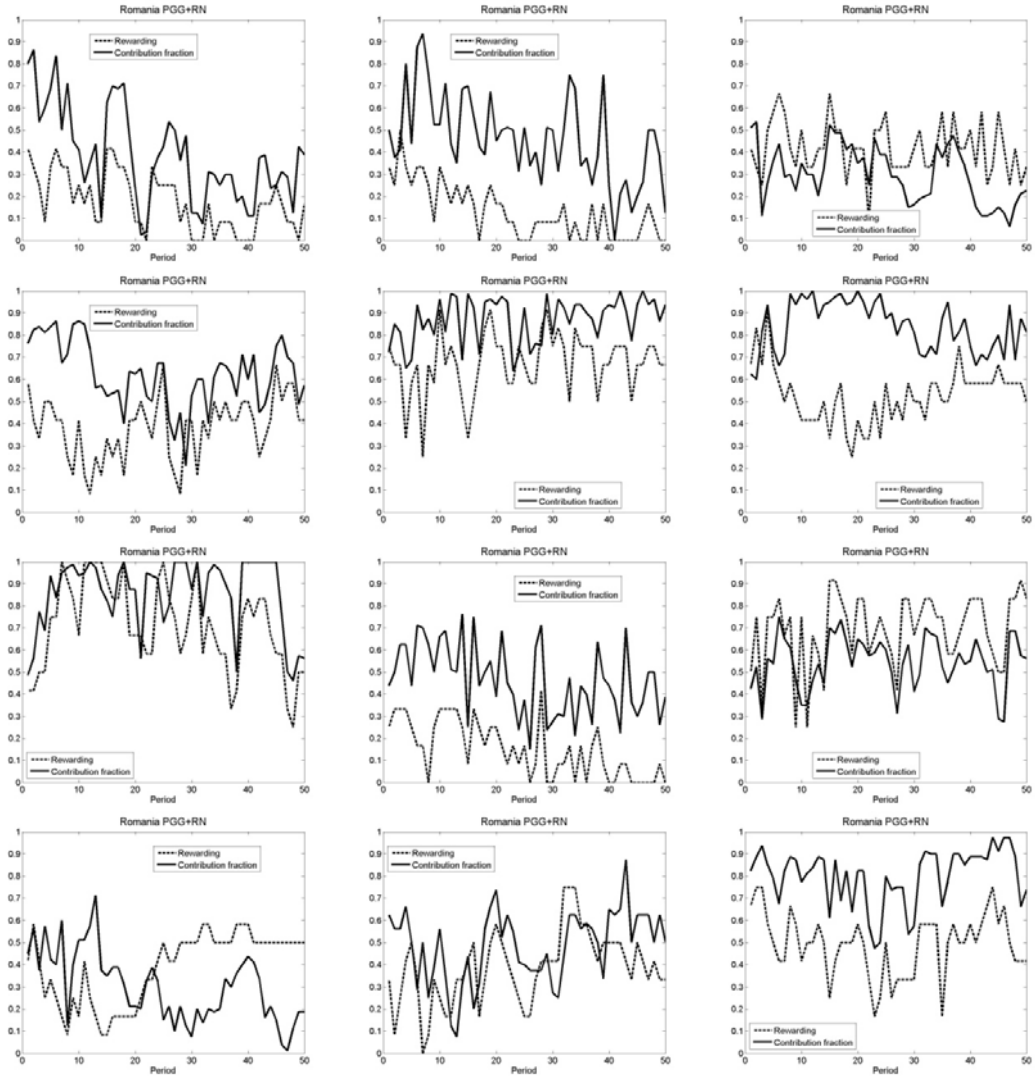
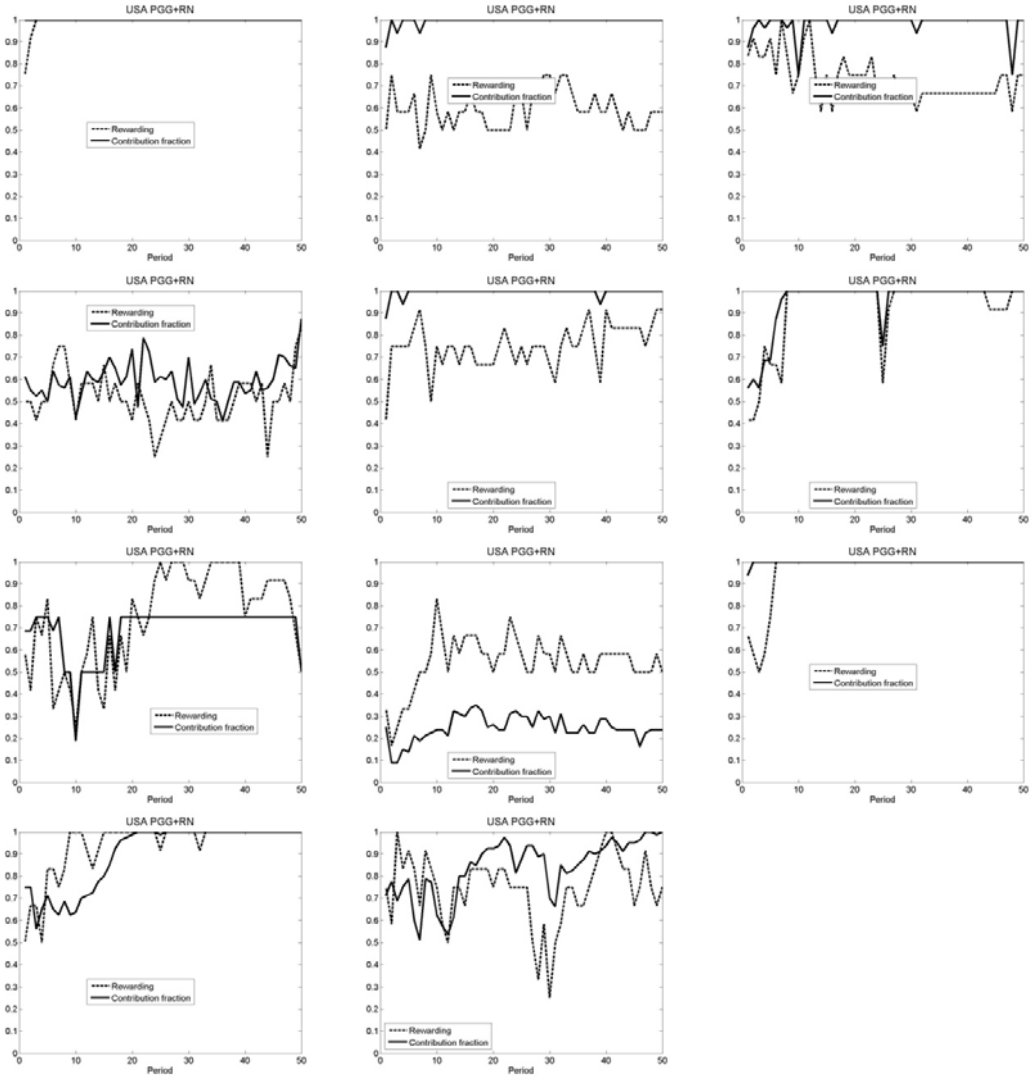


Figure A8: USA PGG+RN

[Dashed = reward frequency; solid = fraction contributed]



For Online Publication

Appendix B: Instructions (English versions)

Control PGG

Instructions:

Thank you for participating in this experiment.

Please read the following instructions carefully. If you have any questions, do not hesitate to ask us. Aside from this, no communication is allowed during the experiment.

This experiment is about decision making. You have been randomly matched with 3 other people in the room. Neither of you will ever know the identity of the other. Everyone will receive a fixed amount of $15 for participating in the experiment. In addition, you will be able to earn more money based on the decisions you make in the experiment. Everything will be paid to you in cash immediately after the experiment.

Based on the choices made by you and the three other people in your group, you will receive between $0 and $25, in addition to the $15 show-up amount. Your additional income from the experiment consists of an initial endowment of 100 units plus the sum of all your earnings in each round. The exchange rate is 100 units = $1.

Each member of your group will be assigned a number (1-4) that represents his/her identity throughout this experiment.

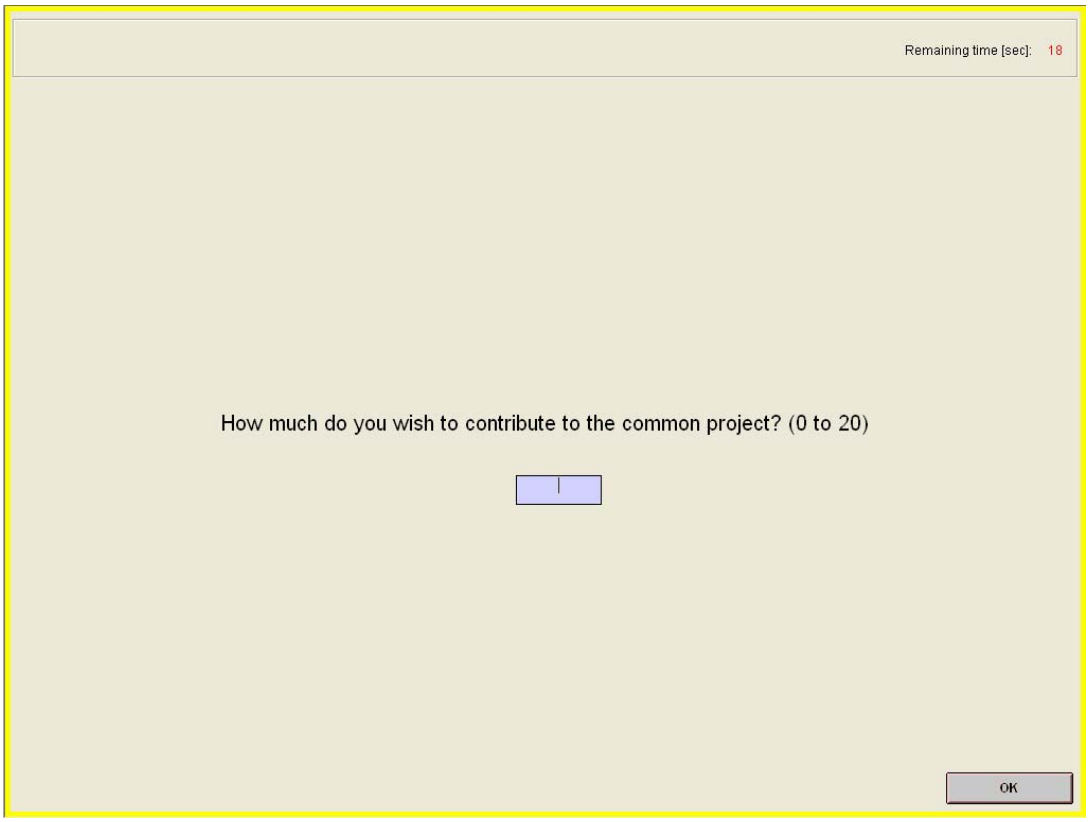
The Interaction:

You have to decide how much you want to contribute to a project that benefits all participants.

The setup will now be explained in more detail.

Contribution to the Project: In each round, each person in your group is endowed with 20 units. You have to decide how many of the 20 units you are going to contribute to the project and how many of them to keep for yourself.

The following input-screen will appear:



You must enter your contribution within 20 seconds.

Calculation of your income:

The contributions of all 4 players are added up. The total sum is multiplied by 1.6 and then evenly split among all 4 players. Each player gets the same share from the project.

In addition to your earnings from the project, you also receive the units you chose not to contribute.

Thus, **your income** is:

20 – (your contribution to the project) + 1.6 x (sum of all contributions) / 4

Here are two **examples**:

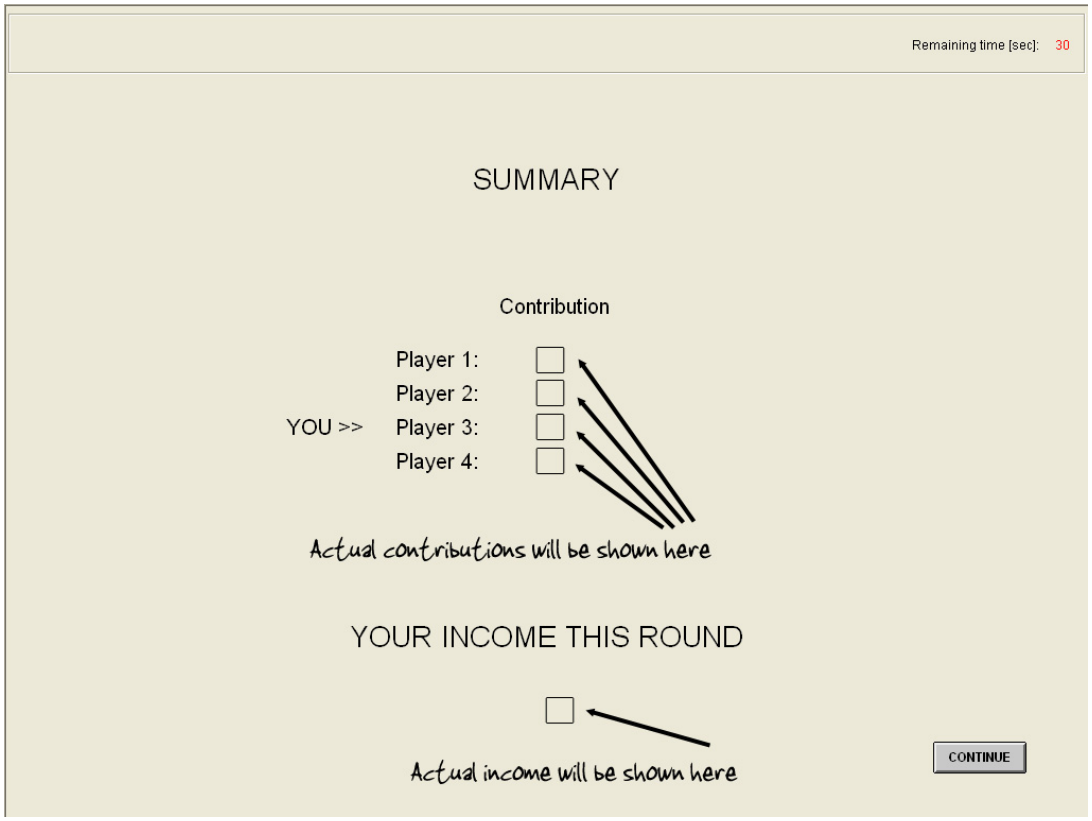
Example 1:
Each player contributes 20 units to the project.
Then each player receives 32 units = 20 – 20 + 1.6 x (20+20+20+20)/4

Example 2:
Three players contribute 20 and one player contributes 0. Then
the contributing players receive 24 units = 20 – 20 + 1.6 x (20 + 20 + 20) / 4
the non-contributing player receives 44 units = 20 – 0 + 1.6 x (20 + 20 + 20) / 4

Next:

You will see the contribution of each other person as well as your total score for this round.

The following screen will appear:



Then we will move to the next round. Every round looks the same.
You always interact with the same three people. All players keep their identification numbers.

The interaction will end after an unknown number of rounds. Your behavior has no effect on the number of rounds.

In addition to the $15 show up fee, your income from the experiment consists of an initial endowment of 100 units plus the sum of all your earnings in each round. The exchange rate is 100 units = $1.

Control PD

Instructions:

Thank you for participating in this experiment.

Please read the following instructions carefully. If you have any questions, do not hesitate to ask us. Aside from this, no communication is allowed during the experiment.

This experiment is about decision making. You have been randomly matched with 3 other people in the room. Neither of you will ever know the identity of the other. Everyone will receive a fixed amount of $15 for participating in the experiment. In addition, you will be able to earn more money based on the decisions you make in the experiment. Everything will be paid to you in cash immediately after the experiment.

Based on the choices made by you and the three other people in your group, you will receive between $0 and $25, in addition to the $15 show-up amount. Your additional income from the experiment consists of an initial endowment of 100 units plus the sum of all your earnings in each round. The exchange rate is 125 units = $1.

Each member of your group will be assigned a number (1-4) that represents his/her identity throughout this experiment.

The Interaction:

The interaction is divided into rounds.

In each round, you choose actions that influence the earnings of you and the other members of your group.

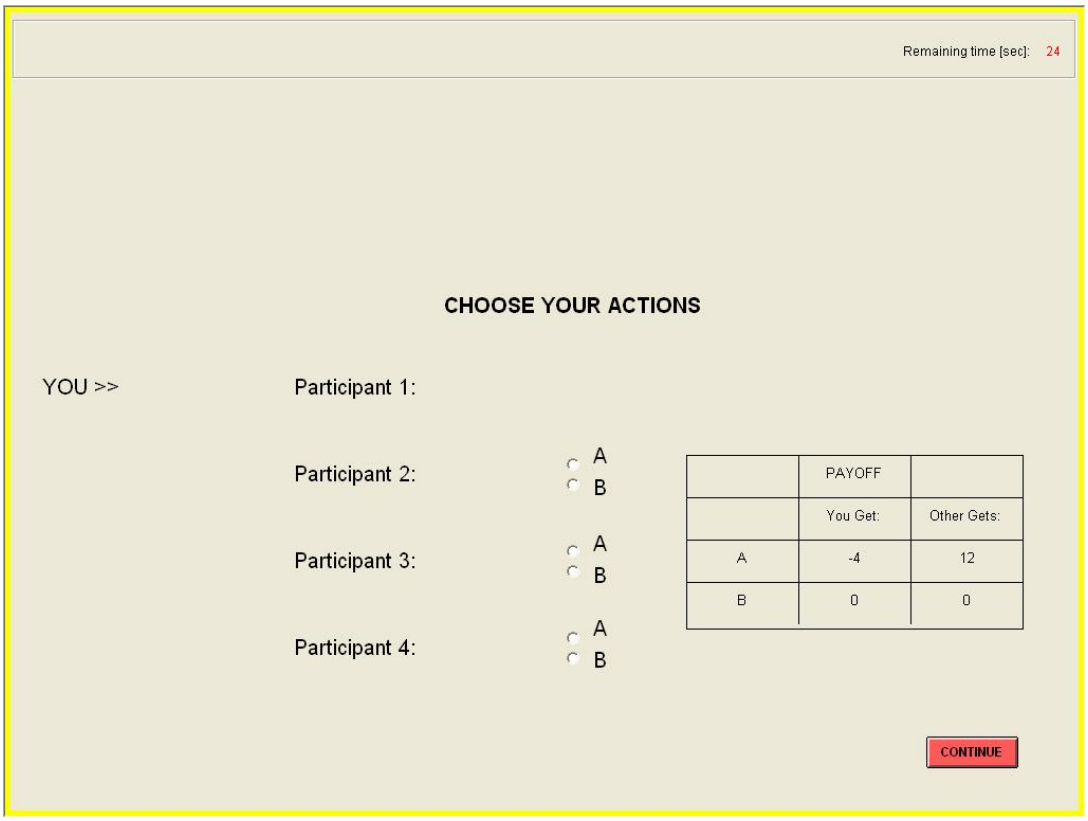
The setup will now be explained in more detail.

In each round, you receive 20 units and then interact with each of the three other players individually. The other 3 players also receive 20 units, and also interact with each other and with you.

You must decide between one of two possible actions, A or B, toward each of the three other players; each of them will also pick an action towards you.

If **you choose A** then **you** get **−4 units**, and the **other player** gets +**12 units**.
If **you choose B** then **you** get +**0 units**, and the **other player** gets +**0 units**.

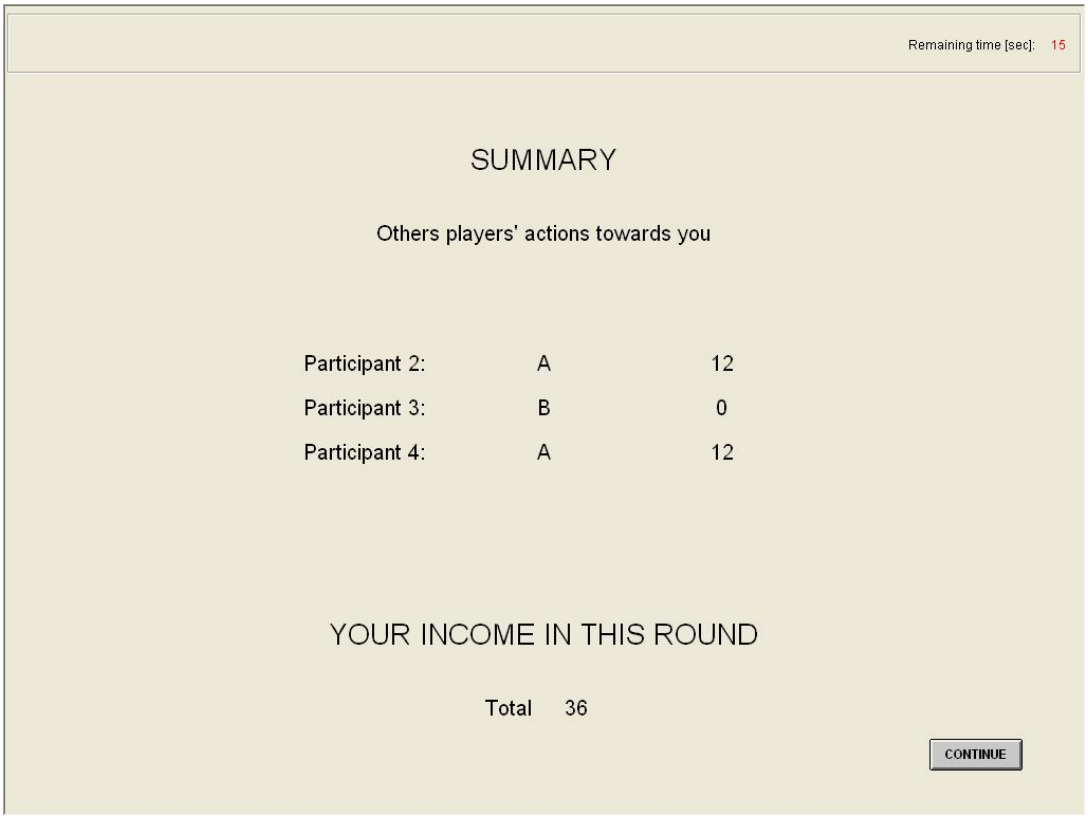
The following screen will appear:



<u>You must decide within 30 seconds otherwise random choices will be made.</u>

Calculation of your income in each round: Your income is the sum of two components:
· the number of units you have received **from your decisions**
· the number of units you have received from **the decisions of the other participants**

You will then see what the others have chosen when interacting with you.
You will also see your score for this round.
The following screen will appear:



Then we will move to the next round. Every round is the same. You always interact with the same three people. All players keep their identification numbers. The interaction will end after an unknown number of rounds. Your behavior has no effect on the number of rounds.

In addition to the $15 show up fee, your income from the experiment consists of an initial endowment of 100 units plus the sum of all your earnings in each round. The exchange rate is 125 units = $1.

PGG+RN

Instructions:

Thank you for participating in this experiment.

Please read the following instructions carefully. If you have any questions, do not hesitate to ask us. Aside from this, no communication is allowed during the experiment.

This experiment is about decision making. You have been randomly matched with 3 other people in the room. Neither of you will ever know the identity of the other. Everyone will receive a fixed amount of $15 for participating in the experiment. In addition, you will be able to earn more money based on the decisions you make in the experiment. Everything will be paid to you in cash immediately after the experiment.

Based on the choices made by you and the three other people in your group, you will receive between $0 and $25, in addition to the $15 show-up amount. Your additional income from the experiment consists of an initial endowment of 100 units plus the sum of all your earnings in each round. The exchange rate is 100 units = $1.

Each member of your group will be assigned a number (1-4) that represents his/her identity throughout this experiment.

The Interaction:

The interaction is divided into rounds. Each round consists of 2 stages.

In **Stage 1**, you have to decide how much you want to contribute to a project that benefits all participants.

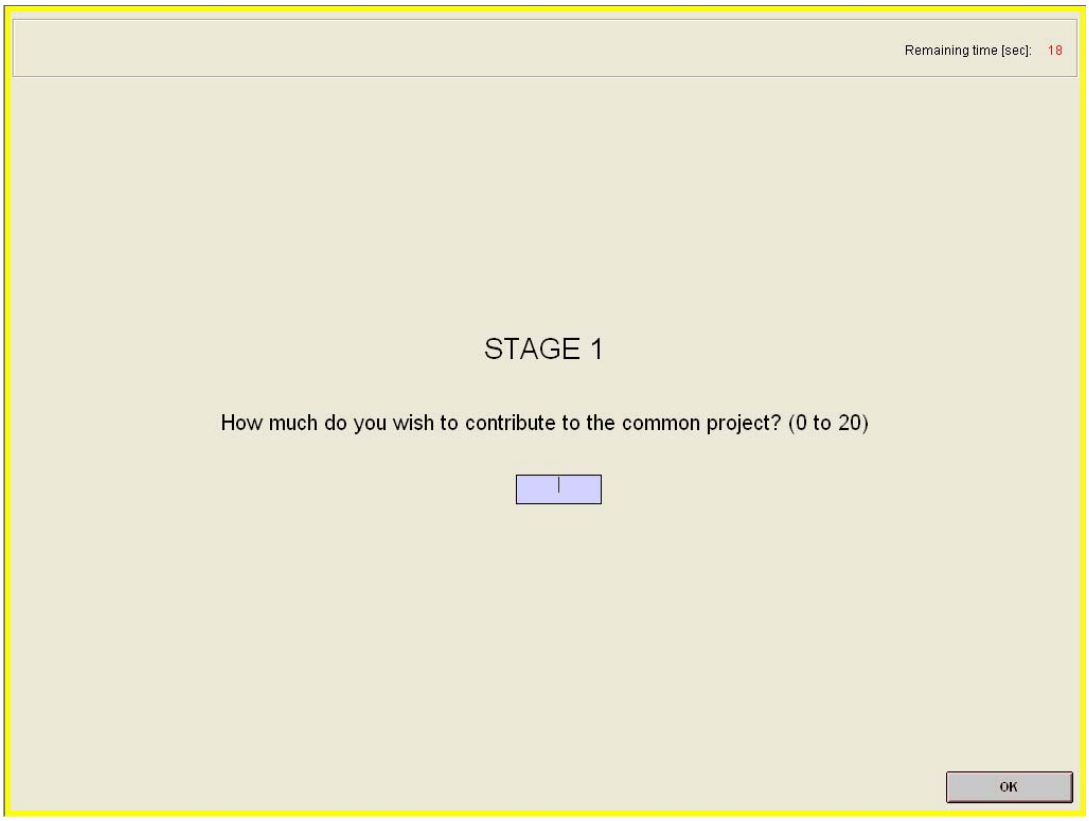
In **Stage 2**, you are informed about the contributions of the other participants, and you can then choose actions that influence your and their earnings.

The setup will now be explained in more detail.

Stage 1:

Contribution to the Project: In stage 1 of each round, each person in your group is endowed with 20 units. You have to decide how many of the 20 units you are going to contribute to the project and how many of them to keep for yourself.

The following input-screen for Stage 1 will appear:



You must enter your contribution within 20 seconds.

Calculation of your income in Stage 1:

The contributions of all 4 players are added up. The total sum is multiplied by 1.6 and then evenly split among all 4 players. Each player gets the same share from the project.

In addition to your earnings from the project, you also receive the units you chose not to contribute.

Thus, **your income in Stage 1** is:

20 – (your contribution to the project) + 1.6 x (sum of all contributions) / 4

Here are two **examples**:

Example 1:
Each player contributes 20 units to the project.
Then each player receives 32 units = 20 – 20 + 1.6 x (20+20+20+20)/4

Example 2:
Three players contribute 20 and one player contributes 0. Then
the contributing players receive 24 units = 20 – 20 + 1.6 x (20 + 20 + 20) / 4
the non-contributing player receives 44 units = 20 – 0 + 1.6 x (20 + 20 + 20) / 4

Stage 2:

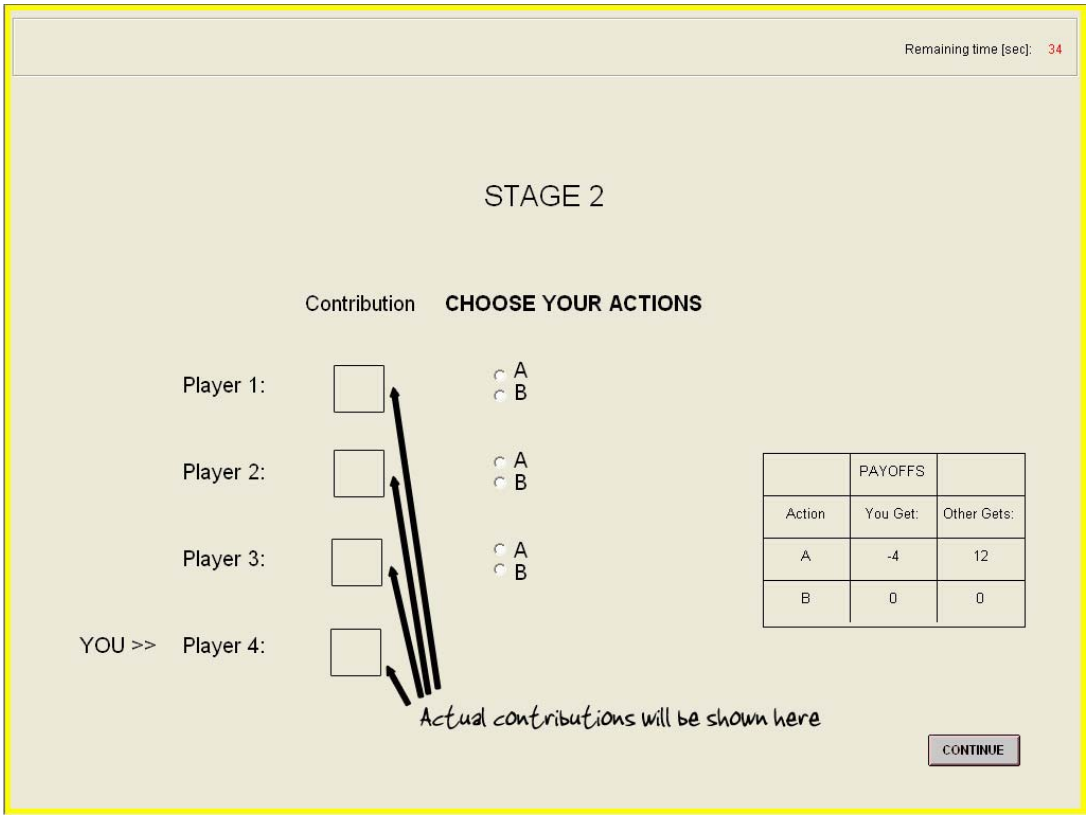
In this stage, you interact with each of the three other players individually.

You can see the contributions of all 4 players to the project in Stage 1.

You must decide between one of two possible actions, A or B, toward each of the three other players.

If **you choose A** then **you** get **−4 units**, and the **other player** gets +**12 units**.
If **you choose B** then **you** get +**0 units**, and the **other player** gets +**0 units**.

The following screen will appear:



You must decide within 30 seconds otherwise random choices will be made.

Calculation of your income in Stage 2: Your income in Stage 2 is the sum of two components:
· the number of units you have received **from your decisions**
· the number of units you have received from **the decisions of the other participants**

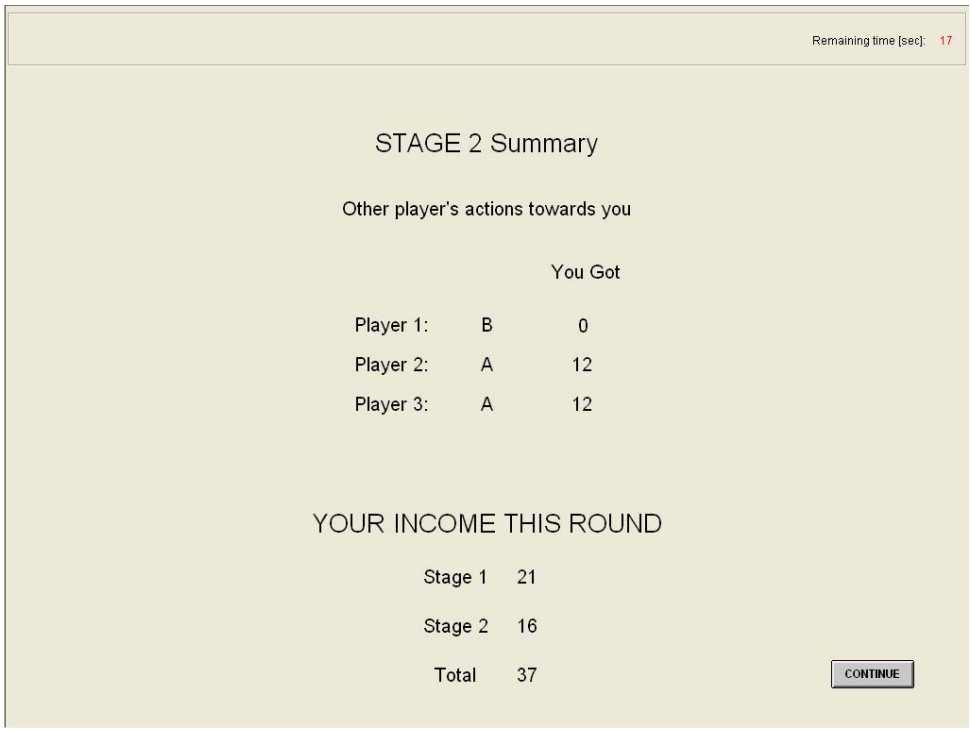
To summarize, every round of the experiment has two stages:

***Stage 1:* Contribution to the project**
Each participant is endowed with 20 units. You have to decide how many of the 20 units you are going to contribute to the project. The remaining units will be kept in your private account.

***Stage 2*: Pair-wise interactions**
You have to choose between one of two actions, A or B, toward each of the three other players.

After Stage 1 and 2:

You will see what the others have chosen when interacting with you in Stage 2.
You will see your score from Stage 1 and Stage 2 and your total score for this round.
The following screen will appear:



Then we will move to the next round. Every round consists of the same two stages.
You always interact with the same three people. All players keep their identification numbers. The interaction will end after an unknown number of rounds. Your behavior has no effect on the number of rounds.

In addition to the $15 show up fee, your income from the experiment consists of an initial endowment of 100 units plus the sum of all your earnings in each round. The exchange rate is 100 units = $1.

PGG+PN

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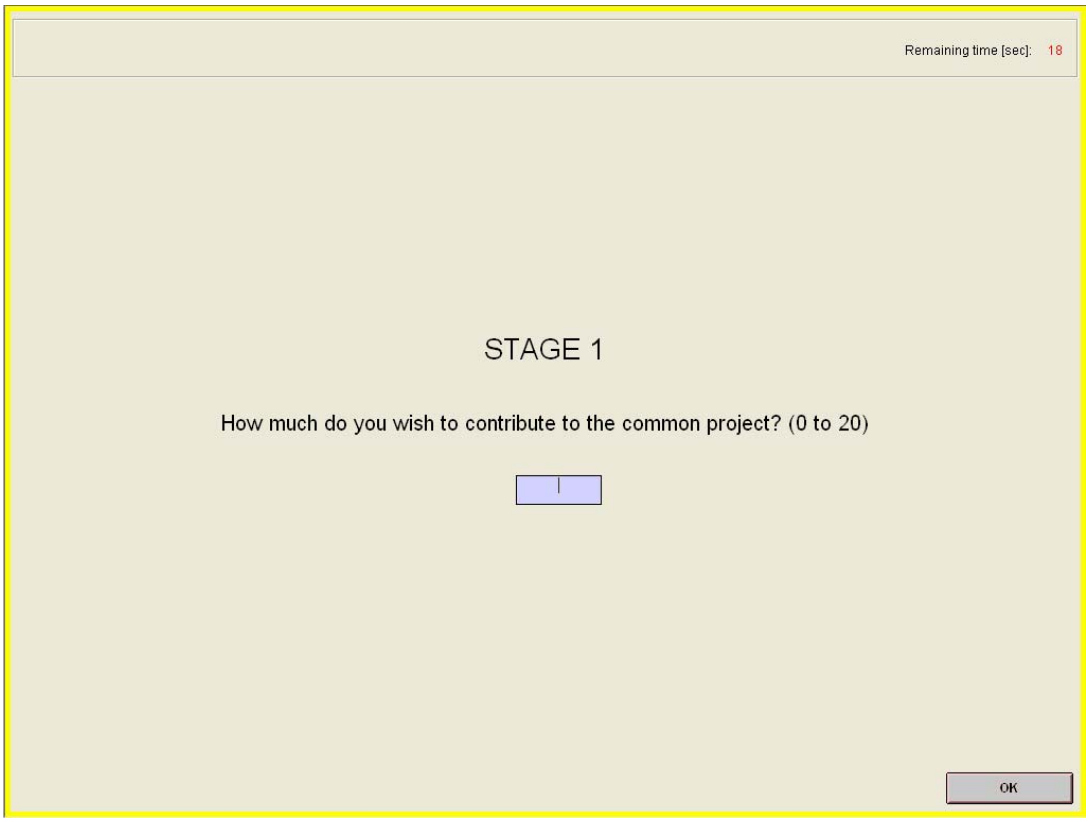

You must enter your contribution within 20 seconds.

Calculation of your income in Stage 1:

The contributions of all 4 players are added up. The total sum is multiplied by 1.6 and then evenly split among all 4 players. Each player gets the same share from the project.

In addition to your earnings from the project, you also receive the units you chose not to contribute.

Thus, **your income in Stage 1** is:

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Example 2:
Three players contribute 20 and one player contributes 0. Then
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the non-contributing player receives 44 units = 20 – 0 + 1.6 x (20 + 20 + 20) / 4

Stage 2:

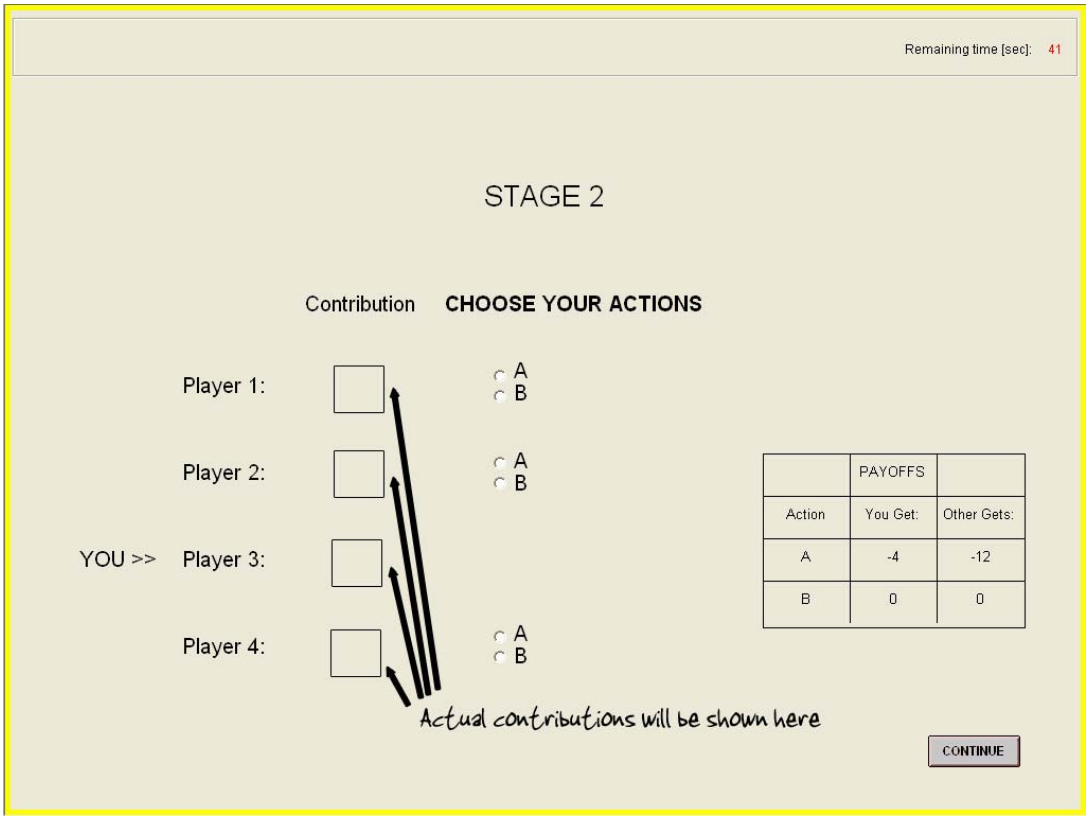
In this stage, you interact with each of the three other players individually.

You can see the contributions of all 4 players to the project in Stage 1.

You must decide between one of two possible actions, A or B, toward each of the three other players.

If **you choose A** then **you** get **−4 units**, and the **other player** gets **−12 units**.
If **you choose B** then **you** get **+0 units**, and the **other player** gets **+0 units**.

The following screen will appear:



You must decide within 30 seconds otherwise random choices will be made.

Calculation of your income in Stage 2: Your income in Stage 2 is the sum of two components:
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To summarize, every round of the experiment has two stages:

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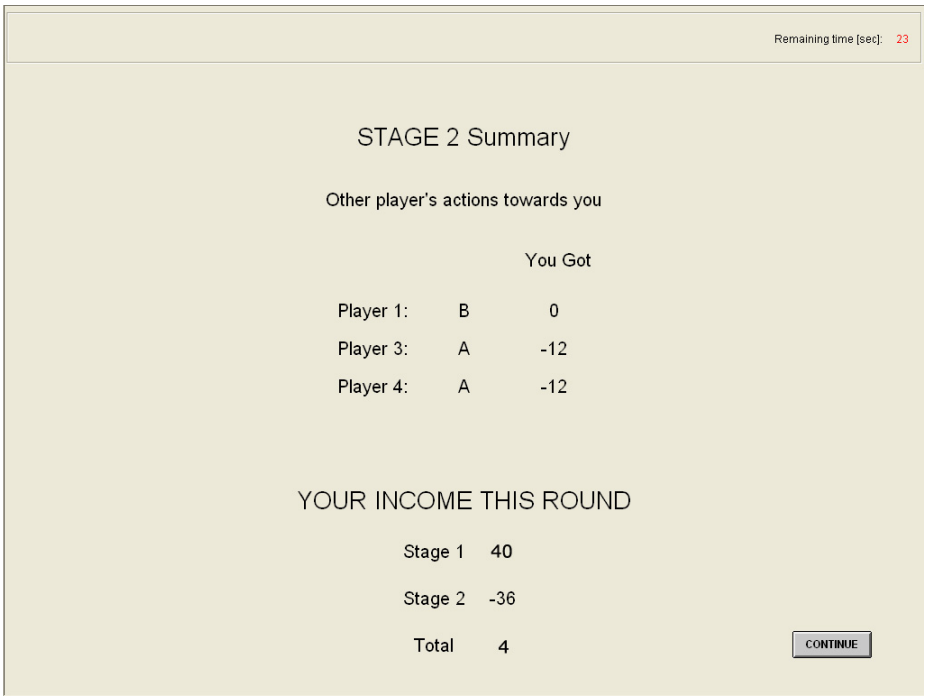
***Stage 2*: Pair-wise interactions**
You have to choose between one of two actions, A or B, toward each of the three other players.

After Stage 1 and 2:

You will see what the others have chosen when interacting with you in Stage 2.
You will see your score from Stage 1 and Stage 2 and your total score for this round.
The following screen will appear:



Then we will move to the next round. Every round consists of the same two stages.
You always interact with the same three people. All players keep their identification numbers. The interaction will end after an unknown number of rounds. Your behavior has no effect on the number of rounds.

In addition to the $15 show up fee, your income from the experiment consists of an initial endowment of 100 units plus the sum of all your earnings in each round. The exchange rate is 100 units = $1.