Environmental & Resource Economics (2005) 32: 241–271
DOI 10.1007/s10640-005-3359-9

Individual and Collective Choice and Voting in Common Pool Resource Problem with Heterogeneous Actors

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Accepted 6 March 2005

Abstract. In this paper we investigate the effects of heterogeneity in common pool resource (CPR) problems. We examine whether heterogeneity impedes or facilitates coordination on an efficient use of a CPR by proposing and voting on allocation schemes. In a full information design we compare extractions and voting behavior in heterogeneous and homogeneous groups. If the CPR is extracted individually, we find no difference in efficiency between heterogeneous and homogeneous groups. However, when groups can vote on allocation schemes, homogeneous groups are more likely to reach an efficient agreement than heterogeneous groups.

Key words: common pool resources, experiment, heterogeneity, voting

JEL classifications: C91, C92, D70, D74, H41

1. Introduction

Common Pool Resources (CPRs) like fisheries, forest resources, grazing areas, or irrigation systems are characterized by the fact that an individually rational use of the CPR leads to a collectively irrational exploitation of the CPR. However, during the past decade, theoretical and empirical research has shown that institutional features like face-to-face communication, the capability to monitor and sanction one another, or the exclusion of outsiders can substantially reduce individual appropriation levels, leading to a more efficient use of a CPR (Ostrom 1990, 1992; Ostrom et al. 1992). Numerous experimental studies (see Carpenter 2000, for an overview, or Fischer et al. 2004) have confirmed that cooperation exists where conventional theory predicts it will not occur. Walker et al. (2000) have found that voting on the use of a CPR can lead to socially optimal outcomes. In their experimental study, members of a group with access to a CPR can propose appropriation levels for each group member, and vote on the proposals put forward. If any proposal gets a majority, the proposal is implemented accordingly. In case a majority is failed, group members appropriate the CPR non-cooperatively. Walker et al. find that the use of the CPR is more efficient in case a proposal is adopted than in case group members appropriate the CPR individually. In most cases adopted proposals are socially optimal, indicating that groups can coordinate on an efficient use of a CPR. However, the fact that group members have identical costs and benefits from appropriating the CPR might facilitate an agreement on any of the group members' proposals on the use of the CPR. Since many CPR-problems are characterized by unequal interests of the parties involved, Walker et al. wonder 'how individuals with asymmetric interests will cope with similar problems' (2000, p. 232). In our paper, we experimentally address this question by comparing appropriation of a CPR in heterogeneous and homogeneous groups. In the laboratory, it is possible to induce asymmetric interests in a controlled way, which will enable us to contribute to a better understanding of the effects of heterogeneity on the use of a CPR.

In recent years, the role of economic heterogeneity in terms of asymmetries in costs, payoffs, or wealth has been extensively addressed in the literature on CPR, both in theoretical models as well as empirical or experimental studies. From a theoretical point of view, the effects of heterogeneity on contributions to a public good or on appropriations from a CPR are ambiguous (i.e. Hackett 1992; Bardhan and Dayton-Johnson 2001; Dayton-Johnson and Bardhan 2002). Olson (1965) finds that inequality has a positive effect on collective action. Moreover, he provides evidence that wealthier people tend to take on a larger share of providing the public good than their poorer counterparts. Bergstrom et al. (1986) find the 'Olson' effect enhanced by great income inequality, however their results are sensitive to the assumptions about preferences for the public good. Baland and Platteau (1999) observe that in case of inequality wealthier group members compensate for the poorer members' lack of participation. Heckathorn (1993) shows that heterogeneity can either facilitate or impede collective action, depending upon the group members' incentives to free ride and the benefits of contribution. Whenever incentives to free ride are substantial and benefits of contribution are uncertain, heterogeneity supports socially optimal collective action. However, when members have attained a high degree of solidarity and the rewards from social cooperation are considerable, heterogeneity impedes collective action.

As regards empirical field studies, Vedeld (2000) finds little direct relationship between the degree of heterogeneity and the success of collective action observing different village politics in the Niger Delta. It seems that heterogeneity is no hindrance to collective action per se, but it is also not positively correlated to the success of collective action. A study by Varughese and Ostrom (2001) on forest users in 18 locations in Nepal reveals that heterogeneity might be overcome by good institutional design. They also note that field research on the effect of heterogeneity on CPR-usage faces a challenging dilemma. Only those institutional designs, which can ensure an (almost) efficient use of CPR, given heterogeneous interests, will exist when the researcher screens the field for institutional rules governing CPR-usage. Institutional designs' which have failed to coordinate heterogeneous interests will not have survived. Hence, field studies bear the problem of endogenous institutional survival. Finding efficient CPR-usage in the field, given heterogeneous interests, will thus teach us little about the effects of inequality of interests.

In experimental studies, however, it is rather easy to compare homogeneous with heterogeneous groups and track the efficiency of CPR-usage in both types of groups. Hackett et al. (1990) show in an experimental study that communication is a powerful tool to resolve commons dilemmas, both in homogeneous as well as in heterogeneous groups. Though, Hackett et al. provide no direct comparison of the ability of homogeneous or heterogeneous groups to coordinate on an efficient use of a CPR. A meta-analysis of the data of Hackett et al. by Chan et al. (1999) reveals that there is a positive influence of heterogeneity on efficiency in the use of a CPR. In their own experimental study on public goods provision, Chan et al. (1999) find a positive effect of heterogeneity in individual endowments on aggregate contributions to a public good. On the contrary, Isaac and Walker (1988) observe a negative impact of endowment heterogeneity on efficiency in a public good game.

Given that the literature is inconclusive about the effects of heterogeneity in CPR-problems, we regard further evidence as necessary. Since communication and heterogeneity might interfere in the field, we have chosen an experimental approach in which we can control for the effects of heterogeneity by excluding communication. Our experiment relies on Walker et al. (2000) and examines the ability of heterogeneous actors to coordinate on an efficient use of a renewable CPR by proposing and voting on CPR-appropriation. We investigate the differences between heterogeneous and homogeneous groups with respect to the efficiency of CPR-use, the types of proposals made, the frequency of agreements on a proposal, and the level of appropriation in case adoption of an agreement fails.

The remainder of the paper is organized as follows. Section 2 introduces the model with heterogeneous actors and states our predictions. Section 3 describes the experimental design and Section 4 reports our results. Section 5 concludes the paper.

2. CPR Model and Predictions

2.1. THE BASIC MODEL

Our model extends the basic model of Walker et al. (2000), who have homogeneous actors, to the case of heterogeneous actors. Heterogeneity is introduced by varying the appropriation costs of two different types of actors: a high-cost-type and a low-cost-type. Benefits from appropriating the CPR are equal for both types, but costs differ, making it optimal for high-cost types to appropriate less than low-cost types.

Consider N group members with access to a CPR. Let n_l (n_h) denote the number of low-cost (high-cost) types in the group. We assume $n = n_l = n_h$ and $N = n_l + n_h$. Each group member simultaneously appropriates an amount x_{ij} from the CPR, where subscript i denotes the type (either l for low-cost or h for high-cost) and j denotes the subject number of type i. Total appropriation within a group is given by $X = X_h + X_l = \Sigma x_{hj} + \Sigma x_{lj}$.

Benefits B_{ij} from the CPR only depend on the amount x_{ij}, but do not differ between types otherwise. Assuming diminishing returns, benefits are given by

$$B_{ij}(x_{ij}) = \alpha x_{ij} - \beta x_{ij}^2, \text{ with } \alpha > \beta > 0. \tag{1}$$

Whereas benefits are independent of other members' appropriation, costs depend on own appropriation x_{ij} as well as total group appropriation X. Thus, individual j of type i faces the following cost function:

$$C_{ij}(x_{ij}, X) = x_{ij}(\gamma + \delta_i X), \tag{2}$$

where γ is a non-negative base cost of appropriation (with $\alpha > \gamma > 0$) and δ_i a positive incremental cost parameter for type i, linking appropriation costs to total appropriation. Assuming $\delta_l < \delta_h$ implies $C_{lj}(x_{lj}, X) < C_{hj}(x_{hj}, X)$, given $x_{lj} = x_{h,j}$. Introducing the parameter δ_i constitutes the extension of the basic model of Walker et al. (2000). Replacing $\delta_l \neq \delta_h$ by $\delta_l = \delta_h = \delta$ will simplify our model to the homogeneous model. A subject's payoff u_{ij} (x_{ij}, X) is given by

$$u_{ij}(x_{ij,X}) = B_{ij}(x_{ij}) - C_{ij}(x_{ij}, X) = \alpha x_{ij} - \beta x_{ij}^2, x_{ij}(\gamma + \delta_i X) \tag{3}$$

There exists a unique Nash equilibrium in pure strategies where each player of cost type i chooses x_{ij}^e. We focus on this equilibrium. For the sake of completeness, we also state the Nash equilibrium solution x_{bj}^e for our baseline treatment with homogeneous groups.[1]

$$x_{lj}^e = \frac{(\alpha - \gamma)[2\beta + \delta_h + n(\delta_h - \delta_l)]}{4\beta^2 + (1 + 2n)\delta_h\delta_l + 2(1 + n)\beta(\delta_h + \delta_l)}, \tag{4a}$$

$$x_{hj}^e = \frac{(\alpha - \gamma)[2\beta + \delta_l + n(\delta_l - \delta_h)]}{4\beta^2 + (1 + 2n)\delta_h\delta_l + 2(1 + n)\beta(\delta_h + \delta_l)}, \text{ and} \tag{4b}$$

$$x^e_{bj} = \frac{\alpha - \gamma}{2\beta + (2n+1)\delta}. \tag{4c}$$

From $\delta_l < \delta_h$ it follows immediately that $x^e_{lj} > x^e_{hj}$. It also holds that $x^e_{lj} > x^e_{bj} > x^e_{hj}$.[2]

Maximizing the total group payoff and respecting the symmetry of players with the same cost-type *(l* or *h)* in heterogeneous groups, we derive the socially optimal appropriation levels x^o_{lj} and x^o_{hj} respectively, which, of course, do not constitute a Nash equilibrium; x^o_{bj} refers to the socially optimal extraction in homogeneous groups.

$$x^o_{lj} = \frac{(\alpha - \gamma)(\beta + n\delta_h)}{2\beta^2 + 3n\beta(\delta_h + \delta_l) + n^2(\delta_h + \delta_l)^2}, \tag{5a}$$

$$x^o_{hj} = \frac{(\alpha - \gamma)(\beta + n\delta_l)}{2\beta^2 + 3n\beta(\delta_h + \delta_l) + n^2(\delta_h + \delta_l)^2}, \tag{5b}$$

and

$$x^o_{bj} = \frac{\alpha - \gamma}{2\beta + 4n\delta}. \tag{5c}$$

For $n > 1$, we get $x^e_{ij} > x^o_{ij}$. Payoff levels $u^e_{ij}(x_{ij}, X)$ and $u^o_{ij}(x_{ij}, X)$ for all x_{ij} are specified in Appendix A.1. In the social optimum payoff levels are higher than in the Nash equilibrium for heterogeneous and homogeneous groups, respectively. Additionally, the difference in payoffs between both cost-types in heterogeneous groups is smaller in the social optimum than in the Nash equilibrium.

Individual efficiency $E(x_{ij})$ of an extraction level x_{ij} *is* defined as payoff u_{ij} (x_{ij}) divided by the payoff in case all group members choose the socially optimal appropriation, $u_{ij}(x^o_{ij})$. Individual efficiency at the Nash equilibrium is computed by $E(x^e_{ij}) = u_{ij}(x^e_{ij})/u_{ij}(x^o_{ij})$. Social efficiency $\bar{E}(x)$, with x indicating the vector of individual extractions, is then simply the sum of individuals' payoffs with extraction vector x divided by the sum of payoffs associated with all group members choosing the socially optimal appropriation. It follows from (A.3a) and (A.3b), given in Appendix A.2, that for a given number of group members social efficiency increases with the number of low-cost types and decreases with the degree of heterogeneity in the group, measured by $|\delta_h - \delta_l|$.

2.2. STRUCTURE OF THE GAME AND PREDICTIONS

As in Walker et al. (2000) our CPR-game has two parts,[3] consisting of 10 rounds each. In the first part, group members choose the appropriation level simultaneously and non-cooperatively, without any device for coordination.

Standard economic theory leads us to the following prediction for the first part, henceforth called *individual choice part:*

> *Prediction 1: Actors will play the Nash equilibrium in the individual choice part. This applies both to homogeneous and heterogeneous groups, with* $x^e_{ij} > x^e_{bj} > x^e_{hj}$.

The second part of the game, called *collective choice part,* has the following sequential structure in each of 10 rounds: First, each group member s of cost-type r has to propose an appropriation vector $\mathbf{x}_{rs}$ stating the proposed amounts x_{ij} for member ij, including the proposer. Second, group members have to vote on which of the $2n$ proposals shall be adopted. There is only one simultaneous vote on all proposals, and each group member can cast his vote for only one proposal. If any of the proposals gets a simple majority of votes, i.e. at least n + 1 votes, it is implemented. Third, in case no proposal gets a simple majority, each group member has to choose an appropriation level for himself individually.

For the rest of this section, we are going to elaborate on the types of proposals and possible differences between heterogeneous and homogeneous groups in the collective choice part. A rational proposal should ensure the proposer a payoff at least as high as in the Nash equilibrium. Thus, we expect member rs to make a proposal $\mathbf{x}_{rs}$ such that u_{rs} $(\mathbf{x}_{\mathrm{rs}}) > u_{rs}$ $(\mathbf{x}^{\mathrm{e}})$, where $\mathbf{x}^{\mathrm{e}}$ denotes the vector of appropriation levels in the Nash equilibrium. Furthermore, a proposal $\mathbf{x}_{rs}$ should satisfy $u_{ij}(\mathbf{x}_{rs}) > (\mathbf{x}^{\mathrm{e}})$ for at least $n + 1$ group members, including the proposer rs, to have a chance of receiving a simple majority of votes and to be implemented.

We show in Appendix A.2 that given the parameters we use in the experiment, the minimum-winning-coalition proposal $\mathbf{x}^{\mathrm{MWC}}$ satisfies individual rationality, because $u_{rs}(\mathbf{x}^{\mathrm{MWC}}) > u_{rs}(\mathbf{x}^{\mathrm{e}})$. Proposal $\mathbf{x}^{\mathrm{MWC}}$ allocates the amount $x_{ij} = x^e_{ij}$ to $n + 1$ members, which is the minimum winning coalition with a group size of $2n$, but $x_{ij} = 0$ to $n - 1$ non-coalition members. Hence, proposal $\mathbf{x}^{\mathrm{MWC}}$ is attractive for all members of the winning coalition, since $u_{ij}(\mathbf{x}^{\mathrm{MWC}}) > u_{ij}(\mathbf{x}^{\mathrm{e}})$ for coalition members, and increases collective payoffs above the Nash level, as $\sum_{ij\in \mathrm{MWC}} u_{ij}(\mathbf{x}^{\mathrm{MWC}}) > \sum_{i=l,h;j=1,s...,n} u_{ij}(\mathbf{x}^e)$. Thus, any proposal which decreases collective payoffs (compared to the Nash equilibrium) could be voted down rather easily in favor of proposals increasing collective payoffs.

> *Prediction 2: When actors propose appropriation levels in the collective choice part, proposals are more efficient than at the Nash equilibrium, improving the proposer's payoff and collective payoff.*

Since there is no proposal which is a Condorcet winner,[4] Prediction 2 refers only to the Nash appropriation level as a benchmark. If a proposal is accepted by a simple majority, the proposed appropriation levels become binding and deviation is not possible. In case adoption fails, actors have to decide simultaneously and in a non-cooperative way on their appropriation level. Then, actors have no longer an incentive to aim for a collectively optimal appropriation. Therefore, only adopted proposals will lead to higher efficiency levels in the collective choice part.

Prediction 3: In the collective choice part, adopted proposals lead to higher efficiency levels than in case no proposal is adopted and appropriation levels are chosen individually.

In homogeneous groups it is rather straightforward to propose a vector of appropriation levels for which either all members of the group receive the same amount from the CPR (strictly symmetric proposal) or the members of a minimum winning coalition (MWC-proposal) receive an amount $x_{ij} > 0$, but non-coalition members receive zero. On the contrary, in heterogeneous groups a strictly symmetric proposal might be less likely than in homogeneous groups as it has different effects on payoffs for the high- and the low-cost-type. Therefore, homogeneous groups may have a relative advantage to adopt a proposal relative to heterogeneous groups. In case of equally sized subgroups (with $n_l = n_h$) the adoption of a proposal in heterogeneous groups becomes also tricky because actors are forced to look for proposals that obtain the vote of at least one member of the other cost-type. One feasible proposal would be to offer each member of a given cost-type the same amount, but to offer different amounts to different types. We call such a proposal type-symmetric. There are basically two different variants of type-symmetric proposals: The first variant allocates a larger amount to low-cost-types, which preserves the order of appropriation levels in the social optimum. In the second variant high-cost-types receive a larger amount than low-cost-types in order to equalize payoff levels.[5]

Heterogeneity within groups enlarges the set of feasible MWC-proposals. Whereas it seems straightforward for actors in homogeneous groups to propose the same appropriation level for all coalition members, actors in heterogeneous groups may propose different appropriation levels for coalition members, depending on their cost-type. Furthermore, actors in heterogeneous groups can vary the composition of coalition and non-coalition members. For instance, excluded members might be exclusively of the other cost-type, the same cost-type, or from both cost-types. Summarizing, we expect the types of proposals to be different between both heterogeneous and homogeneous groups.

Prediction 4: Homogeneous versus heterogeneous groups:
4a: The distribution of types of proposals is different between heterogeneous groups and homogeneous groups. Homogeneous groups make more strictly symmetric proposals.

The total number of different proposals is important for the outcome of the simultaneous vote on all proposals. Completely identical proposals increase the chances of getting a simple majority for the identical proposals. It might rather easily happen that two or more actors choose an identical proposal in homogeneous groups. In heterogeneous groups, however, actors have the opportunity to make either strictly symmetric or one of the two different variants of type-symmetric proposals. For this reason, we expect actors in heterogeneous groups to make more distinct proposals than actors in homogeneous groups. In turn, it is less likely that a proposal will be adopted in heterogeneous groups.[6]

4b: The number of distinct proposals in any round is larger in heterogeneous groups than in homogeneous groups.
4c: Heterogeneous groups reach an agreement less often than homogeneous groups.

If predictions 3 and 4c are valid it follows immediately that overall efficiency is lower in heterogeneous groups than homogeneous groups in the collective choice part.

4d: Overall, heterogeneous groups reach less efficient outcomes than homogeneous groups in the collective choice part.

3. Experimental Design and Model Specifications

Table I summarizes the parameters for the heterogeneous and homogeneous groups. Each group consists of six subjects. In heterogeneous groups, three group members are of the low-cost-type and three members of the high-cost-type $(n_l = n_h = 3)$. We set $\alpha = 0.761$ and $\beta = 0.007$ in the benefit function. Costs of appropriating one unit (token) from the CPR are specified with $\gamma = 0.005$ (base cost, equal to both types), and $\delta_l = 0.006$ (low-cost type), respectively $\delta_h = 0.008$ (high-cost type). In homogeneous groups we let $\delta = 0.007$, being equivalent to the average cost increment in heterogeneous groups. Token orders x_{ij} have to be in integers from the interval [0, 80]. In the Nash equilibrium, subjects of the low-cost-type order 16 tokens, earning 33.6 Taler,[7] and subjects of the high-cost-type order 8 tokens, earning 9.7 Taler. In homogeneous groups, subjects order 12 tokens and earn 20.2 Taler.[8]

The collectively optimal solution is given by each subject of the low-cost-type (high-cost-type) ordering 8.5 (6.9) tokens. Since token orders have to be in integers, earnings are 21.3 and 36.5 Taler, respectively, if high-cost-types order 7 tokens and low-cost-types order 9 tokens. If low-cost-types order 8 tokens instead, they earn 34.4 Taler and the payoff for high-cost-types increases to 26.8 Taler. In homogeneous groups, the socially optimal appro-

Table I. Design parameterization

Specification			
Group size (= number of subjects per group = $2n$)	6		
Number of independent observations per treatment	9		
Voting mechanism	simple majority rule		
Number of rounds in each part	10 – Individual choice part		
	10 – Collective choice part		
Available range of token orders	[0,80]		
Benefit function ($\alpha x_{ij} - \beta x_{ij}^2$)	$\alpha = 0.761$		
	$\beta = 0.007$		
Base cost for token order (γ)	$\gamma = 0.005$		
	Heterogeneous		Homogeneous
	LC	HC	B
Token cost increment (δ)	$\delta_l = 0.006$	$\delta_h = 0.008$	$\delta = 0.007$
Nash equilibrium strategy (token order)	16.0	8.0	12.0
Optimal strategy (token order)	8.5	6.9	7.7
Payoff per round at Nash equilibrium	33.6	9.7	20.2
Payoff per round at social optimum	35.6	23.2	29.2
Efficiency at Nash equilibrium (in per cent)[b]	94.0	41.8	69.1
Payoff per round for members of a minimum winning coalition (token orders as in the Nash equilibrium)[c]			40.32
3 LC and 1 HC in heterogeneous groups	49.3	20.2	
2 LC and 2 HC	56.9	25.3	
1 LC and 3 HC	64.6	30.4	

[a] HC – high cost type, LC – low cost type, B – baseline (homogeneous groups).
[b] Social efficiency (at the group level) is 67.9% in homogeneous groups, and 69.1% in homogeneous groups.
[c] Non-coalition members receive 0. Coalition members are assumed to order the same amount of tokens as in the Nash equilibrium.

priation level is 7.7 tokens per group member. If all order 8 tokens, each group member earns 29.2 Taler. Relating payoffs at the Nash equilibrium to those at the social optimum, average individual efficiency of the Nash equilibrium is already 94% for low cost-types, but only 42% for high cost-types, implying a social efficiency of the Nash equilibrium of 68%. The corresponding efficiency level in homogeneous groups is 69%.

In the individual choice part of the experiment subjects have to order x_{ij} tokens anonymously and simultaneously, without any communication. Prior to the individual choice part of the experiment subjects are informed that there will be 10 rounds, preceded by three trial rounds with randomly chosen and new partners in each trial round, but not that there will be a second part. In the heterogeneous treatment, subjects get full information on the costs of token orders for both cost-types (see instructions in Appendix B). At the end of each round, each subject is informed of the total sum of token orders in his group, the average token cost (for each type) and his individual payoffs for the current round as well as accumulated over the whole experiment. Subjects received no information on individual token orders of other group members.

After 10 rounds of the individual choice part subjects are told that there will be another 10 rounds in the collective choice part before the experiment will terminate. In each round of the collective choice part, each group member has to propose a token order for every group member, including the proposer. After that, subjects are informed about all six proposals, identified only by an anonymous ID-number.[9] Thereafter they have to cast a single vote on which one of the six proposals shall be implemented. If two or more proposals are identical, it is clearly indicated on the subjects' screens and all votes for these identical proposals are summed up. After casting their votes, subjects are informed about the number of votes for each proposal. If any proposal receives a simple majority of four votes, this proposal is implemented automatically in the respective round. Otherwise, group members have to order tokens independently in this round, like in the individual choice part.

The experiment was conducted with the help of Z-Tree (Fischbacher 1999) at the University of Innsbruck in March 2001. In total, 108 subjects, mainly students of economics and business administration, participated in six sessions with 18 subjects each. Group size was set at six subjects and group composition remained fixed for the whole experiment. We ran three sessions (i.e., nine independent observations) for each treatment. Sessions lasted between 75 and 90 min. Average earnings per subject were 150 Austrian Schillings (11€). In addition, subjects were paid a show-up fee of 50 Austrian Schillings (3.60€).

4. Results

Average token orders are shown in Figure 1.[10] With the exception of round 1, low-cost-2-types have the highest token orders, and average token orders in homogeneous groups are always in between the average orders of high-cost-types and low-cost-types in heterogeneous groups. Aggregating over the individual choice part (rounds 1 to 10) we find that low-cost-types order, on average, 15.3 tokens, which is about 4% below the Nash equilibrium of 16 tokens. High-cost-types order 9.7 tokens, which is approximately

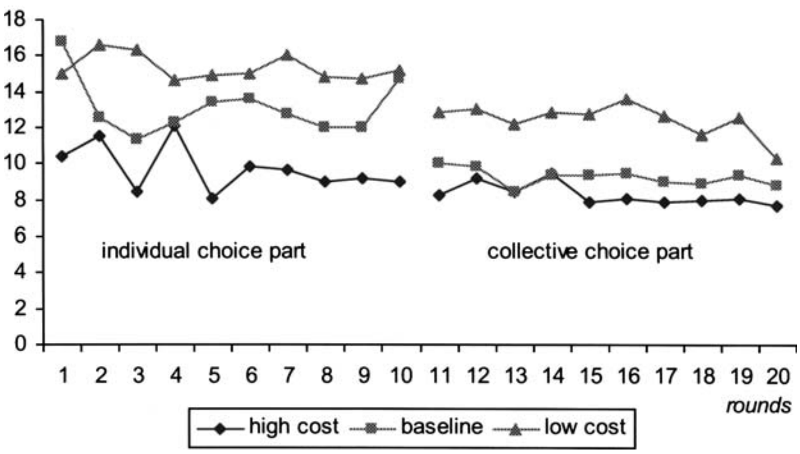

Figure 1. Token order – treatment averages.

20% above the Nash equilibrium. Averaging extraction behavior over both types, 12.5 tokens are ordered per group member (compared to 12.0 in the Nash equilibrium).[11] The corresponding figure for homogeneous groups is 13.1. The difference in extraction levels between both treatments is not significant (see Table II). Though there is a fairly high appropriation level of homogeneous groups in round 1 (16.8 tokens). Considering only rounds 2 to 10, average token orders are 12.5 in heterogeneous groups and 12.7 in homogeneous groups.

Referring to Prediction 1 we conclude that subjects extract, on average, slightly more than predicted by the Nash equilibriun.[12] From Figure 1 we can see immediately that average extraction levels are lower in the collective choice part (rounds 11–20) than in the individual choice part. Heterogeneous (homogeneous) groups extract on average 10.4 (9.3) tokens per group member. The decrease of extraction levels compared to the individual choice part is highly significant (see Table II). Additionally, we observe a significant decline of extraction levels over the number of rounds. Regarding different cost-types in heterogeneous groups, we find that token orders of low-cost-types decrease significantly from 15.3 tokens in the individual choice part to 12.4 tokens in the collective choice part. However, the decrease of high-cost-types from 9.7 tokens to 8.3 tokens is not significant.

Lower token orders in the collective choice part lead to an increase of efficiency levels in heterogeneous (homogeneous) groups of about 10 (27) percentage points, compared with the individual choice part (Wald test using an OLS model with robust standard errors that account for within session correlation and heteroskedasticity;[13] $p < 0.01$). Efficiency levels for single groups in both parts of the experiment and for both treatments are presented in Table III.

Table II. Extraction levels

Dependent variable: individual extraction levels

Coefficients	OLS Model 1 All data			OLS Model 2 Only heterogeneous groups			OLS Model 3 All data without adopted proposals in 2nd part		
	Value	Std. error	*p*-Value	Value	Std. error	*p*-Value	Value	Std. error	*p*-Value
Intercept	13.780	0.509	> 0.001	16.093	1.115	> 0.001	13.014	0.205	> 0.001
Round	−0.120	0.053	0.024	−0.144	0.080	0.070			
2nd part	−2.681	0.654	> 0.001	−1.421	0.438	0.001	−1.411	0.448	0.002
Heterogenous	−0.632	0.496	0.203				−0.374	0.326	0.251
Heterogenous: 2nd part	1.722	0.556	0.002						
High cost type				−5.578	1.401	< 0.001			
High cost type: 2nd part				1.419	1.056	0.179			
Number of observations	2160			1080			1626		

Note. Standard errors are adjusted according to the Hurber–White–Efron robust-cluster covariance matrix estimator. The adjusted standard errors take arbitrary correlation within one session and heteroskedasticity into account (see Rogers 1993).

According to Prediction 2, proposals in the collective choice part generate payoffs and efficiency levels above the Nash equilibrium. 99% of proposals satisfy individual rationality, such that the proposer gets a higher payoff from his own proposal than from the Nash equilibrium. In 94% (93%) of proposals in heterogeneous (homogeneous) groups total group payoffs are higher than at the Nash equilibrium, thus satisfying also collective rationality.

As stated in Prediction 3, efficiency levels are higher if a proposal is adopted than if adoption is failed and group members have to order tokens individually. To test this, we compare average efficiency levels at the group level for those rounds in the collective choice part where a proposal is adopted with those rounds where adoption is failed.[14] Averaging over all nine groups, social efficiency is 91% (99%) with adopted proposals in heterogeneous (homogeneous) groups, but only 67% (66%) in case of no adoption (Wald test; $p = 0.01$). Comparing average token orders in the individual choice part with token orders in case no proposal is adopted in the collective choice part, we find that token orders are still significantly lower in the latter part, where they are 11.5 (11.3) tokens in heterogeneous (homogeneous) groups (Wald test; $p < 0.01$; see Table II). This result implies that when subjects are not able to coordinate their voting behavior successfully on one proposal, they reach still higher efficiency levels than in the individual choice

Table III. Average efficiencies in individual and collective choice part

Group	Homogeneous treatment		Homogeneous treatment	
	IC[a] Rounds 1–10	CC Rounds 11–20	IC Rounds 1–10	CC Rounds 11–20
1	78%	64%	63%	95%
2	63%	86%	57%	95%
3	63%	77%	43%	89%
4	52%	60%	47%	100%
5	79%	88%	63%	92%
6	56%	67%	63%	17%
7	58%	85%	57%	87%
8	−14%[b]	69%	55%	96%
9	67%	79%	−9%[b]	78%
Average	56%(65%)	75%	49%(56%)	83%

[a] IC – individual choice part; CC – collective choice part.

[b] Due to an inefficient decision by one or more appropriators, the whole group suffered losses. Figures in parentheses indicate the efficiency levels if the respective groups were excluded.

part. Making proposals offers an opportunity to signal how efficient allocations of tokens could look like, which might facilitate efficient coordination of extraction levels, even in case no proposal gets a simple majority. However, since efficiency levels are clearly higher when a proposal is adopted in the voting stage, the signal associated with making proposals is not enough to reach (almost) full efficiency, even though it seems to increase efficiency, compared with the individual choice part.[15]

So far, we have examined the differences between both parts of the experiment *within* a given treatment. Our results clearly confirm the earlier findings of Walker et al. (2000). In the following, we concentrate on differences *between* treatments. First, we examine the types of proposals made in both treatments. We distinguish three general patterns of proposals. Under symmetric proposals we subsume both strictly symmetric proposals as well as type-symmetric proposals. Minimum winning coalition (MWC)-proposals include only 4 out of 6 group members, with excluded members receiving nothing.[16] All proposals neither fitting the symmetric nor the MWC type of proposal are subsumed under other proposals.

Table IV states the relative frequencies of the different types of proposals for rounds 11 to 20. We report the frequency of symmetric proposals, which are socially optimal (SYM^o) separately from the other symmetric proposals (SYM). Whereas in the homogeneous treatment symmetric and socially optimal proposals are made in 56% of the cases, this is only true in 4% of the cases in the heterogeneous treatment.[17] However, the overall frequency of symmetric proposals (SYM plus SYM^o) is not considerably lower in the heterogeneous groups (67%) than in the homogeneous groups (73%). Minimum winning coalitions are proposed in 10%, respectively 13% of cases in the heterogeneous and the homogeneous treatment. None of the MWC-proposals is adopted in the heterogeneous treatment, whereas this happens in 7 cases (out of 55 adopted proposals) in the homogeneous treatment. Figures for adopted proposals are summarized in Table V which includes the absolute frequencies of different types of proposals and of those adopted, classified either as symmetric (including type-symmetric), minimum winning coalition or other proposal. The distribution of proposals differs significantly between both treatments at the 5% level ($\chi^2 = 16$; df = 2; $N = 1080$) for all proposals and for adopted proposals ($\chi^2 = 7.6$; df = 2; $N = 83$). Thus, we find statistical support for Prediction 4a.

In Figure 2, we show the average number of distinct proposals per round. In the heterogeneous treatment, the average number of distinct proposals ranges from 3.9 proposals in round 18 to 5.6 distinct proposals in round 12 with an overall average of 4.7 proposals per round. In the homogeneous treatment, the number of distinct proposals is considerably smaller, falling monotonically from 4.3 in round 11 to 3.0 in round 20, with an overall average of 3.6. The decrease over the number of rounds is significant as is the

Table IV. Distribution of proposals

Round	Relative frequency of proposals[a] (in %) MWC		SYM		SYM°		Other	
	Het[b]	Hom[c]	Het	Hom	Het	Hom	Het	Hom
11	2	4	67	26	7	46	24	24
12	4	4	61	26	4	50	31	20
13	7	7	69	19	3	54	20	20
14	13	11	61	15	6	54	20	20
15	11	13	65	15	2	59	22	13
16	13	15	61	17	4	57	22	11
17	11	17	67	7	2	69	20	7
18	9	20	63	13	4	56	24	11
19	11	20	56	15	2	56	31	9
20	17	19	59	17	2	57	22	7
Overall	10	13	63	17	4	56	23	14

[a] MWC – minimum winning coalition, SYM – symmetric proposals, SYM° – symmetric and socially optimal proposals. For the heterogeneous setting, the symmetric proposals include the type-symmetric proposals.
[b] Het – heterogeneous treatment.
[c] Hom – homogeneous treatment.

higher number of distinct proposals in heterogenous groups (likelihood ratio test; Poisson model with robust standard errors; $p < 0.01$) and confirms Prediction 4b.

Figure 3 displays how many proposals have been adopted in a given round. In 29 out of 90 possible cases a proposal got a simple majority in the heterogeneous treatment. The corresponding figure for the homogeneous treatment is almost twice as high with a total of 55 adopted proposals. On

Table V. Distribution of proposals over all rounds

Treatment	All proposals[a]				Adopted proposals			
	SYM	MWC	Other	Treatment	SYM°	MWC	Other	Sum
Heterogeneous	358	53	129	Heterogeneous	27	0	2	29
Homogeneous	392	70	78	Homogeneous	48	7	0	55

[a] MWC – minimum winning coalition, SYM – symmetric proposals, SYM° – symmetric and socially optimal proposals. For the heterogeneous setting, the symmetric proposals include the type-symmetric proposals.

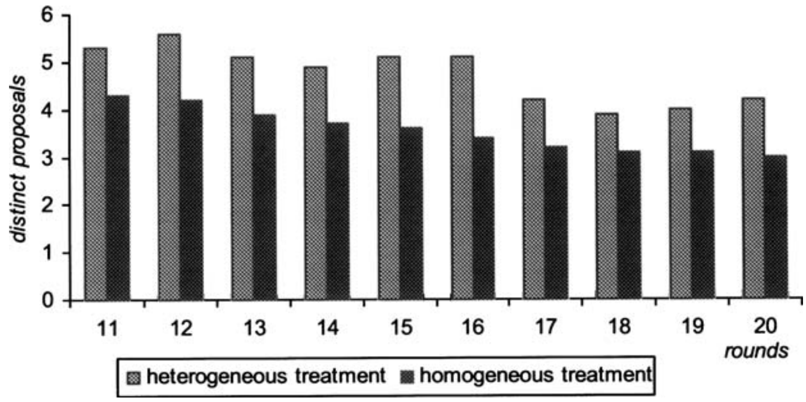

Figure 2. Average number of distinct proposals.

average, homogeneous groups adopt a proposal in 6.1 out of 10 rounds, whereas heterogeneous groups adopt only 3.2 proposals. Considering the frequency of adopted proposals on the group level, we find that homogeneous groups adopt significantly more proposals than heterogeneous groups (likelihood ratio test; probit model with robust standard errors; $p < 0.01$). Hence, Prediction 4c is confirmed. Heterogeneity makes it more complicated to reach a simple majority on a proposal. However, after some rounds, groups become more successful in coordinating on a single proposal. This difference can, however, be explained by the higher number of proposals in heterogenous groups (see Table VI) Similarily, the increase in the number of adopted proposals over time can be explained by a decrease in the number of distinct proposals.

Finally, we are interested whether heterogeneous groups can match efficiency levels of homogeneous groups. Whereas they perform slightly better

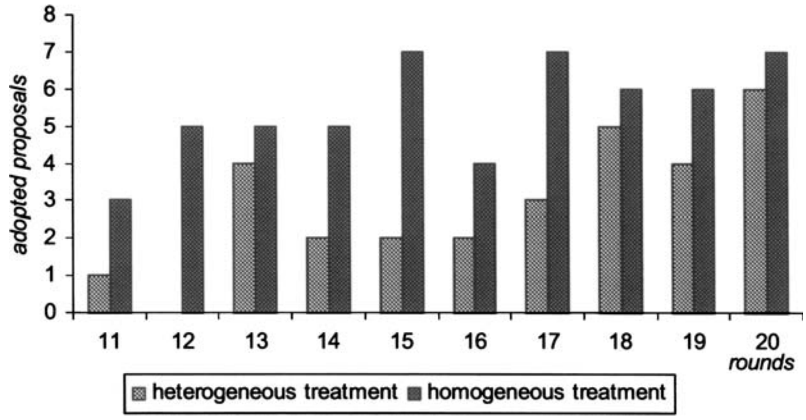

Figure 3. Adoption of proposals.

during the individual choice part, overall efficiency in the collective choice part is slightly lower for heterogeneous groups than for homogeneous groups. These differences are, however, not significant (Wald test; $p > 0.07$), This relative disadvantage of heterogenous groups in the collective choice part originates from the high number of proposals that lead to less likely adoptions and from lower efficiency gains in case of adopted proposals in heterogeneous groups (Wald test; $p = 0.01$). Non-cooperative decisions on token orders lead to relatively low efficiency levels in both treatments and do not differ between treatments if no proposal is adopted.

5. Conclusion

Common pool resources are often characterized by asymmetric interests of users. Field studies (Hackett et al. 1990; Ostrom 1990; Varughese and Ostrom 2001) provide evidence that heterogeneous actors are, general, able to coordinate on a socially efficient use of a CPR. Yet, heterogeneity seems to weaken the effect of social norms and sanctions to enforce cooperative behavior and collective agreements. Heterogeneity affects the system performance, the degree to which irrigators follow the rules, as well as the types of rules chosen.

In this paper we have analyzed the effects of heterogeneity on the use of a CPR in a controlled experimental environment. We keep out any verbal communication between experimental subjects and compare behavior of homogeneous and heterogeneous groups in a CPR-game. When actors have to decide individually (in a non-cooperative way) on the use of the CPR, we

Table VI. Determinants of adopting a proposal

Dependent variable: successful proposal adoption						
	Probit model 1			Probit model 2		
Coefficient	Value	Std. error	*p*-Value	Value	Std. error	*p*-Value
Intercept	−2.793	0.919	0.002	3.425	1.450	0.019
Round	0.212	0.059	< 0.001	0.078	0.070	0.269
Heterogeneous	−1.301	0.330	< 0.001	−0.349	0.406	0.389
Number of distinct proposals				−1.109	0.188	< 0.001

Note. The models were estimated as generalized linear models (GLM) with probit link functions. The standard errors are adjusted to allow for arbitrary correlation within one session.

find no significant difference in the efficiency of using the CPR between heterogeneous groups and homogeneous groups. Hence, heterogeneity neither impedes nor facilitates the efficient use of a CPR in a non-cooperative setting.

Allowing actors to propose appropriation levels and to vote on these proposals reveals differences between homogeneous and heterogeneous groups. In heterogeneous groups, a larger number of distinct proposals is put forward. In turn, a larger number of distinct proposals makes it more difficult to achieve a simple majority of votes for a proposal to be implemented. Actually, the necessary simple majority threshold is almost twice as often passed in homogeneous groups than in heterogeneous ones.

Whenever a proposal is adopted, the resulting use of the CPR is very close to the social optimum and more efficient than if group members decide individually on how much of the CPR to use. This result holds both for homogeneous and heterogeneous groups. A promising explanation for the difference in efficiency between adopted proposals and individual decisions is conditional cooperation. Brandts and Schram (2001), Fischbacher et al. (2001), Keser and van Winden (2000) or Sutter and Weck-Hannemann (2003) have shown that (many) people are conditionally cooperative, meaning that they are willing to contribute more to a public good, the more others contribute. Our results can also be interpreted in this vein: The implementation of a proposal guarantees other group members' cooperation as stated in the proposal. If no proposal passes the simple majority threshold, then group members face uncertainty about other group members' cooperation. Consequently, they might reasonably extract an amount close to the Nash equilibrium, since they expect others to do so as well, which drives down efficiency.

Since homogeneous groups implement a proposal more often and the use of the CPR is more efficient in case a proposal is adopted, homogeneous groups have a higher overall efficiency than heterogeneous groups. Particularly in the early rounds of the collective choice part it is very hard for heterogeneous groups to reach an agreement. Yet, we find evidence that heterogeneous groups improve in their ability to reach an agreement when they have more experience. Hence, the loss of efficiency relative to homogeneous groups in the early rounds of the collective choice part constitutes the real costs of heterogeneity.

Acknowedgements

We would like to thank two anonymous referees and Michael Rauscher for their helpful comments. Financial support from the University of Innsbruck and the Center for Experimental Economics at the University of Innsbruck (sponsored by *Raiffeisen Landesbank Tirol*) is gratefully acknowledged.

Notes

1. Note that group size in homogeneous groups is $2n$ in our notation (whereas it is n in Walker et al. 2000). The index j runs from 1 to $2n$, accordingly, in homogeneous groups.
2. Payoff levels and parameter specifications are shown in Appendix A.
3. Since we were interested in the differences between homogeneous and heterogeneous groups, but not in possible effects of ordering the two parts in a different sequence, the order of the two parts was fixed.
4. A Condorcet winner-proposal would get a simple majority against any other possible proposal in pairwise voting.
5. In the field, sharing rules, where appropriation levels depend on characteristics, such as the area of land owned by a peasant or the costs associated with an activity for an appropriator, are quite frequently adopted among heterogeneous appropriators. For an overview see Hackett et al. (1990, p. 102).
6. The possible problem of reaching an agreement less often due to the higher number of different proposals in heterogeneous groups is in real political processes often resolved by having several institutional stages in which the number of proposals to be voted upon is reduced (Shepsle 1979 or Shepsle and Weingast 1981). The costs of heterogeneity can, therefore, show up in two different types, either by making it less likely to reach an agreement (in the absence of institutional structures to induce an agreement) or by requiring more stages and longer negotiating to reduce the number of proposals before reaching an agreement. Both types of costs can possibly be examined in an experiment. In our experimental design we have chosen to focus on the first type of less often reaching an agreement. An alternative approach to examine the second type would have been to introduce sequential voting or implementing multiple ballots.
7. Payoffs are reported in experiment currency. The exchange rate between the experimental currency Taler and Austrian Schillings was 10 Taler = 4 Austrian Schillings (0.39€).
8. Parameters were deliberately chosen such that the unique Nash equilibrium of the game required choosing integer numbers to which subjects were restricted in the experiment. Of course, the social optimum, to be discussed below, could not be chosen perfectly since it would have required choosing fractions. Yet, since the social optimum is no equilibrium of the game, the restriction to integer numbers in the experiment has no influence on the theoretical solution of the game.
9. For a sample screen see the instructions in Appendix B.
10. The token orders of the homogeneous group are referred to as baseline.
11. Due to the excess extraction of high-cost types, *both* cost types earn less than in case they had extracted the Nash levels.
12. In homogeneous groups, 49.6% of individual token orders in rounds 1 to 10 range from 10 to 14, which is the Nash equilibrium ± 2 tokens. High-cost-types in heterogeneous groups order 6–10 tokens (Nash equilibrium of 8 tokens $\pm$ 2 tokens) in 45.6% of cases, low-cost-types order 14–18 tokens in 30.7% of cases.
13. All tests are done using the appropriate (generalized) linear model for the individual data with adjusted standard errors that take arbitrary within session correlation into account. Thus, even though we use the individual data for the regression estimation, only each session is one independent observation.
14. See below for more details on whether a proposal is adopted or not.
15. We checked whether there is a positive relation between actual efficiency levels (in case of individual extraction when no agreement has been reached) and the efficiency levels associated with the proposals made within a group. Indeed, actual group efficiency (in case of individual extraction) and efficiency levels associated with the proposals are positively correlated, but only significantly in homogeneous groups (with $r = 0.39$; $p < 0.05$;

$N = 35$), but not in heterogeneous groups ($r = 0.19$; $p = 0.15$; $N = 61$). Hence, proposals can act as a signal, thereby increasing efficiency, but only in homogeneous groups.

16. We also classified those proposals as MWC, where the two excluded members were allocated 1 token. That happened 26 times in heterogeneous groups (out of 53 MWC-proposals), and 12 times (out of 70) in homogeneous groups. Our test statistics referring to the distribution of proposals would not change if we classified only those proposals as MWC where excluded members receive exactly zero tokens.
17. Note that the following two vectors of token orders are classified as (type)symmetric and socially optimal (SYM°): 7 for high-cost types and either (i) 8 tokens or (ii) 9 tokens for low-cost types.

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Appendix A

A.1. PAYOFFS

For x^e_{hj} to be non-negative, the chosen parameters must satisfy x^e_{hj} $(2\beta + \delta_l)/n > (\delta_h - \delta_l)$. Payoff levels in the Nash equilibrium are given as

$$u_{lj}(x^e_{lj}) = \frac{(\alpha - \gamma)^2(\beta + \delta_l)[2\beta + \delta_h + n(\delta_h - \delta_l)]^2}{[4\beta^2 + (1 + 2n)\delta_h\delta_l) + 2(1 + n)\beta(\delta_h + \delta_l)]^2}, \tag{A.1a}$$

$$u_{hj}(x^e_{hj}) = \frac{(\alpha - \gamma)^2(\beta + \delta_h)[2\beta + \delta_l + n(\delta_l - \delta_h)]^2}{[4\beta^2 + (1 + 2n)\delta_h\delta_l + 2(1 + n)\beta(\delta_h + \delta_l)]^2}, \tag{A.1b}$$

and

$$u_{bj}(x^e_{bj}) = \frac{(\alpha - \gamma)^2(\beta + \delta)}{[2\beta + (2n + 1)\delta]^2}. \tag{A.1c}$$

In the social optimum we get the following payoffs:

$$u_{lj}(x_{lj}^{o}) = \frac{(\alpha-\gamma)^2(\beta+n\delta_h)[\kappa - n\delta_l(\beta+n\delta_l)]}{[2\beta^2+3n\beta(\delta_h+\delta_l)+n^2(\delta_h+\delta_l)^2]^2}, \tag{A.2a}$$

and

$$u_{hj}(x_{hj}^{o}) = \frac{(\alpha-\gamma)^2(\beta+n\delta_l)[\kappa - n\delta_h(\beta+n\delta_h)]}{[2\beta^2+3n\beta(\delta_h+\delta_l)+n^2(\delta_h+\delta_l)^2]^2}, \tag{A.2b}$$

$$u_{bj}(x_{bj}^{o}) = \frac{(\alpha-\gamma)^2}{4(\beta+2n\delta)}, \tag{A.2c}$$

where $\kappa = \beta^2 + 2n\beta(\delta_h+\delta_l) + n^2(\delta_h^2+\delta_h\delta_l+\delta_l^2)$ and $\kappa > n\delta_h(\beta+n\delta_h)$.

A2. EFFICIENCY LEVELS

Payoffs from above yield the following individual efficiency levels (with social efficiency being the average efficiency level in the group):

$$E(x_{lj}^{e}) = \frac{[(\beta+\delta_l)(2\beta+\delta_h+n\delta_h-n\delta_l)^2\mu^2]}{(\beta+n\delta_h)[4\beta^2+(1+2n)\delta_l\delta_h+2(1+n)\beta(\delta_h+\delta_l)]^2\eta}, \tag{A.3a}$$

$$E(x_{hj}^{e}) = \frac{[(\beta+\delta_h)(2\beta+\delta_l+n\delta_l-n\delta_h)^2\mu^2]}{(\beta+n\delta_l)[4\beta^2+(1+2n)\delta_l\delta_h+2(1+n)\beta(\delta_h+\delta_l)]^2\eta}, \tag{A.3b}$$

with $\mu = [2\beta^2 + 3n\beta(\delta_h+\delta_l) + n^2(\delta_h+\delta_l)^2]$
and

$$\eta = [\beta^2 + 2n\beta(\delta_l+\delta_h) - n\delta_l(\beta+n\delta_l) + n^2(\delta_h^2+\delta_l\delta_l+\delta_l^2)].$$

$$E(x_{bj}^{e}) = \frac{4(\beta+\delta)(\beta+2n\delta)}{[2\beta+(2n+1)\delta)]^2}. \tag{A.3c}$$

In the following, we show that the proposal $\mathbf{x}^{\mathrm{MBC}}$, which allocates the amount $x_{ij} = x_{ij}^{e}$ to $n + 1$ members of a minimum-winning-coalition, but $x_{ij} = 0$ to $n - 1$ non-coalition members, increases total payoff of the group relative to the group payoff in case all group members choose the Nash equilibrium.

A2.1. HOMOGENEOUS GROUPS

Total payoff in case all group members play the Nash equilibrium is given by

$$\sum_{j=1}^{n} u_{bj} = \frac{2n(\alpha-\gamma)^2(\beta+\delta)}{(2\beta+\delta+2n\delta)^2}. \tag{A.4}$$

Payoff of $n + 1$ coalition-members in $\mathbf{x}^{\mathrm{MWC}}$ is given by

$$u_{bj} = \frac{(\alpha-\gamma)^2(\beta+n\delta)}{(2\beta+\delta+2n\delta)^2},$$

which is always larger than $u_{bj}(\mathbf{x}^e)$, given in equation (6c) in Section 2, due to the term $n\delta$ in the numerator. Hence, individual rationality is satisfied.
The total sum of group payoff from $\mathbf{x}^{MWC}$ can then be calculated as follows:

$$\sum_{j\in MWC} u_{bj} = \frac{(1+n)(\alpha-\gamma)^2(\beta+n\delta)}{(2\beta+\delta+2n\delta)^2}. \tag{A.5}$$

Subtracting (A.4) from (A.5), we arrive at the following condition to satisfy (A.5) > (A.4):

$$(n-1)\delta > \frac{(n-1)\beta}{n} \tag{A.6}$$

Given that we choose choose $\beta = \delta$ in the experiment, condition (A.6) is always satisfied for $n > 1$, as is the case in the experiment.

A.2.2. HETEROGENEOUS GROUPS

Group payoff in case of the Nash equilibrium is given by

$$\sum_{i=l,h}\sum_{j=1}^{n} u_{ij} = \frac{n(\alpha-\gamma)^2[(\beta+\delta_l)(2\beta+\delta_h+n\delta_h-n\delta_l)^2+(\beta+\delta_h)(2\beta+\delta_l+n\delta_l-n\delta_h)^2]}{[4\beta^2+(1+2n)\delta_h\delta_l+2(n+1)\beta(\delta_h+\delta_l)]^2} \tag{A.7}$$

The minimum winning coalition shall comprise 1 low-cost-type and n high-cost types. This combination yields the lowest total group payoff of all combinations of minimum winning coalitions.

Payoff for the low-cost-type coalition member from $\mathbf{x}^{MWC}$:

$$u_{l1} = \frac{(\alpha-\gamma)^2(2\beta+\delta_h+n\delta_h-n\delta_l)^2(\beta+n\delta_l)}{[4\beta^2+(1+2n)\delta_h\delta_l+2(1+n)\beta(\delta_h+\delta_l)]^2},$$

which is always larger than $u_{lj}(\mathbf{x}^e)$, given in equation (6a) in Section 2, due to the term $(\beta+n\delta_1)$ in the numerator of u_{l1}.

Payoff for each of the n high-cost-types coalition members from $\mathbf{x}^{MWC}$ is calculated as

$$u_{hj} = \frac{(\alpha-\gamma)^2(2\beta+\delta_l+n\delta_l-n\delta_h)\psi}{[4\beta^2+(1+2n)\delta_h\delta_l+2(1+n)\beta(\delta_h+\delta_l)]^2},$$

where $\psi = 2\beta^2+\delta_h((n^2-n-1)\delta_h+\delta_l+2n\delta_l-n^2\delta_l)+\beta(\delta_l+n(\delta_h+\delta_l))$.
The term $u_{hj}(\mathbf{x}^{MWC})$ is larger than u_{hj} ($\mathbf{x}^e$), given in Equation (6b) in Section 2, if the following condition is satisfied: $\frac{2\beta+(n+1)\delta_l}{n} > \delta_h$. Given the parameters of Table I this inequality is satisfied.
The sum of total group payoff from proposal $\mathbf{x}^{MWC}$ is then given by

$$\sum_{ij\in \mathrm{MWC}} u_{ij} = \frac{(\alpha-\gamma)^2[(2\beta+\delta_h+n\delta_h-n\delta_l)^2(\beta+n\delta_l)+n2\beta+\delta_l+n(\delta_l-n\delta_h)\psi]}{[4\beta^2+(1+2n)\delta_h\delta_l+2(1+n)\beta(\delta_h+\delta_l)]^2}. \quad \text{(A.8)}$$

For the parameters used in the experiment (see Table I), total payoff (A.7) is 130 when all group members play the Nash equilibrium, and 156 if the proposal $\mathbf{x}^{\mathrm{MWC}}$ is implemented (A.8).

Appendix B

Instructions for the experiment were originally written in German. We provide a translation of the instructions for a high-cost-type in heterogeneous groups. Instructions for low-cost-types and for homogeneous groups are analogous and available upon request from the authors.

Instructions

Welcome to our experiment! Please read the instructions carefully! If you have any questions, give notice. We will answer your questions privately.

This is an experiment in decision making. The instructions are designed to inform you of the types of decisions you will be making and the consequences of those decisions. All profits earned during the experiment will be summed up and paid to you privately in cash at the end of the experiment. Additionally, you will receive ATS 50.- for your participation.

$$\textit{Payment will be as follows}: 10\ \textit{Talers} = 4\ \textit{ATS}$$

In the experiment there will be groups of 6 participants each. In every group there are 3 participants of type A (ID 1 to 3) and 3 participants of type B (ID 4 to 6). The groups will remain unchanged during the whole experiment. *You are participant of type A*.

The experiment has **ten** rounds. In each round you are asked to place an order for tokens. Tokens ordered in one round cannot be carried over to other rounds.

Why would you want to order tokens? Because you can earn money from those tokens. Tokens you order each round will earn you a cash benefit. But, any tokens you order will also cost you money. Benefits and costs are described below.

Cash Benefits From Tokens you Order

Each token you order earns you a cash return. The cash benefits you earn for various token orders will be displayed to you as the "Token benefits Table" (see Table VII). This table is the same for every participant and the same for each round.

For example, you order 10 tokens in a given round. That token order will earn you Benefits of 69.1 Taler.

Ordering "tokens" earns you a cash benefit. But you must pay for all tokens you order.

Costs for Tokens you Order

There are two types participants (A + B). They are different in their average cost for every single token ordered. Your average costs depend on how many tokens you order, as well as how many tokens the other individuals in your group order. Your average costs are depicted in the **"COSTTABLE"** as well as the average costs for the other cost type.

In every round, what you pay equals the number of tokens you order times the Average Token Cost for that round. Further, the average token cost for that round depends on how many tokens you order, as well as how many tokens the other individuals order.

Example

If your group had ordered 30 tokens, the costs for participants of type **A** would be **2.45 Taler per token**. Let us now assume you ordered six of this thirty tokens. Your token costs would thus be $6 \times 2.45 = 14.7$ Taler.

Cost Table (see Table VIII)

The cost table informs you how the costs for the tokens you order change, depending on how many tokens you and the other group members order. Token costs are different for type A-players and type B-players.

Cost Calculation

The costs of the tokens you order are easy to compute:

[AVERAGE COSTS OF ALL TOKENS ORDERED BY THE GROUP] times [THE AMOUNT OF TOKENS YOU ORDERED]

Final Comments

- Benefits of token orders are identical for all participants (A + B).
- The costs for the participants are different for the two types. The costs are identical for members of the same type.
- In every group there are three members of type A and time members of type B each.
- The earnings in the experiment may differ even between participants of the same type because they may place different orders for tokens.

Table VII. Benefits from tokens
This table displays total benefits for various token orders (identical for all group members)

Tokens	Benefit	Tokens	Benefit	Tokens	Benefit	Tokens	Benefit
1	7.54	2	14.94	3	22.20	4	29.32
5	36.30	6	43.14	7	49.84	8	56.40
9	62.82	10	69.10	11	75.24	12	81.24
13	87.10	14	92.82	15	98.40	16	103.84
17	109.14	18	114.30	19	119.32	20	124.20
21	128.94	22	133.54	23	138.00	24	142.32
25	146.50	26	150.54	27	154.44	28	158.20
29	161.82	30	165.30	31	168.64	32	171.84
33	174.90	34	177.82	35	180.60	36	183.24
37	185.74	38	188.10	39	190.32	40	192.40
41	194.34	42	196.14	43	197.80	44	199.32
45	200.70	46	201.94	47	203.04	48	204.00
49	204.82	50	205.50	51	206.04	52	206.44
53	206.70	54	206.82	55	206.80	56	206.64
57	206.34	58	205.90	59	205.32	60	204.60
61	203.74	62	202.74	63	201.60	64	200.32
65	198.90	66	197.34	67	195.64	68	193.80
69	191.82	70	189.70	71	187.44	72	185.04
73	182.50	74	179.82	75	177.00	76	174.04
77	170.94	78	167.70	79	164.32	80	160.80

- The experiment will last 10 rounds. Prior to the experiment there will be three trial rounds in order to get used to the computer. Profits from the trial rounds will not be paid. Please note that group composition will change in each of the trial rounds and that you will not interact with anyone from the trial rounds in the 10 rounds which will be paid.
- At the beginning of each round, you will be asked to enter a "TOKEN ORDER" on the computer. After all participants have placed an order, the computer will tabulate the orders,
- compute token benefits and token costs, and then inform you of

(1) the total number of tokens ordered by the group,
(2) the average token cost for that round for you (type A) as well as for type B,
(3) your total benefits for that round,
(4) your total costs for that round,
(5) your total profit for that round,
(6) your total profit over all rounds.

Rules for the Experiment – Conclusion

(1) At the beginning of each individual will place a token order. The more tokens an round, each individual orders the greater the Average Token Cost to that individual and to All Other Individuals.
(2) Tokens cannot be carried over to future rounds.
(3) The computer will sum up all token orders, compute the "average token cost", and then compute the "total token cost" for each individual.
(4) The computer will then display: (1) the group's total token order for that round, (2) each individual's own average and total token costs for that round, (3) each individual's own total benefits, total costs, and total profits for that round, and (4) each individual's own profits totaled over all rounds.

Instructions for Part 2

The experiment is repeated. However, there are some changes to the rules of the experiment:

(1) Prior to each round, you will be asked to make a proposal for token orders for the entire group.
(2) More specifically, you will fill out a form on the computer where you propose a token order for each person in the group.
(3) Every person in the group will privately fill out a "proposal form". The computer will inform you about the proposals of the other group members by their ID-Number.
(4) After the proposals are displayed to the group, each person will privately vote on a proposal. Every participant has one vote.
(5) If a proposal receives a majority of the votes (it receives 4 or more), that proposal will be adopted and implemented for that round. That is, the computer will place a token order for each person. The token orders made for each person will correspond to the approved proposal.
(6) If no proposal receives a majority of the votes, each person will make her own token order for that round – like in the first part of the experiment.

Special considerations:

(1) You are allowed to make a proposal that has the same token order for each person or you can propose different orders for different persons.

Table VIII. Token costs

We provide in this table the costs for both high- and low-cost types in the heterogeneous groups and the costs in the homogeneous groups (control). Of course, in the heterogeneous treatment subjects were not informed about costs in the control treatment and *vice versa*. In the experiment, high-cost (low-cost) types were called type A (B).

Costs per given total token orders in the group (with No denoting the sum of token orders in the group)

No	High	Low	Control	No	High	Low	Control	No	High	Low	Control	No	High	Low	Control	N°	High	Low	Control
1	0.13	0.11	0.12	**2**	0.21	0.17	0.19	**3**	0.29	0.23	0.26	**4**	0.37	0.29	0.33	**5**	0.45	0.35	0.40
6	0.53	0.41	0.47	**7**	0.61	0.47	0.54	**8**	0.69	0.53	0.61	**9**	0.77	0.59	0.68	**10**	0.85	0.65	0.75
11	0.93	0.71	0.82	**12**	1.01	0.77	0.89	**13**	1.09	0.83	0.96	**14**	1.17	0.89	1.03	**15**	1.25	0.95	1.10
16	1.33	1.01	1.17	**17**	1.41	1.07	1.24	**18**	1.49	1.13	1.31	**19**	1.57	1.19	1.38	**20**	1.65	1.25	1.45
21	1.73	1.31	1.52	**22**	1.81	1.37	1.59	**23**	1.89	1.43	1.66	**24**	1.97	1.49	1.73	**25**	2.05	1.55	1.80
26	2.13	1.61	1.87	**27**	2.21	1.67	1.94	**28**	2.29	1.73	2.01	**29**	2.37	1.79	2.08	**30**	2.45	1.85	2.15
31	2.53	1.91	2.22	**32**	2.61	1.97	2.29	**33**	2.69	2.03	2.36	**34**	2.77	2.09	2.43	**35**	2.85	2.15	2.50
36	2.93	2.21	2.57	**37**	3.01	2.27	2.64	**38**	3.09	2.33	2.71	**39**	3.17	2.39	2.78	**40**	3.25	2.45	2.85
41	3.33	2.51	2.92	**42**	3.41	2.57	2.99	**43**	3.49	2.63	3.06	**44**	3.57	2.69	3.13	**45**	3.65	2.75	3.20
46	3.73	2.81	3.27	**47**	3.81	2.87	3.34	**48**	3.89	2.93	3.41	**49**	3.97	2.99	3.48	**50**	4.05	3.05	3.55
51	4.13	3.11	3.62	**52**	4.21	3.17	3.69	**53**	4.29	3.23	3.76	**54**	4.37	3.29	3.83	**55**	4.45	3.35	3.90
56	4.53	3.41	3.97	**57**	4.61	3.47	4.04	**58**	4.69	3.53	4.11	**59**	4.77	3.59	4.18	**60**	4.85	3.65	4.25
61	4.93	3.71	4.32	**62**	5.01	3.77	4.39	**63**	5.09	3.83	4.46	**64**	5.17	3.89	4.53	**65**	5.25	3.95	4.60
66	5.33	4.01	4.67	**67**	5.41	4.07	4.74	**68**	5.49	4.13	4.81	**69**	5.57	4.19	4.88	**70**	5.65	4.25	4.95
71	5.73	4.31	5.02	**72**	5.81	4.37	5.09	**73**	5.89	4.43	5.16	**74**	5.97	4.49	5.23	**75**	6.05	4.55	530
76	6.13	4.61	5.37	**77**	6.21	4.67	5.44	**78**	6.29	4.73	5.51	**79**	6.37	4.79	5.58	**80**	6.45	4.85	5.65
81	6.53	4.91	5.72	**82**	6.61	4.97	5.79	**83**	6.69	5.03	5.86	**84**	6.77	5.09	5.93	**85**	6.85	5.15	6.00
86	6.93	5.21	6.07	**87**	7.01	5.27	6.14	**88**	7.09	5.33	6.21	**89**	7.17	5.39	6.28	**90**	7.25	5.45	6.35
91	7.33	5.51	6.42	**92**	7.41	5.57	6.49	**93**	7.49	5.63	6.56	**94**	7.57	5.69	6.63	**95**	7.65	5.75	6.70
96	7.73	5.81	6.77	**97**	7.81	5.87	6.84	**98**	7.89	5.93	6.91	**99**	7.97	5.99	6.98	**100**	8.05	6.05	7.05
101	8.13	6.11	7.12	**102**	8.21	6.17	7.19	**103**	8.29	6.23	7.26	**104**	8.37	6.29	7.33	**105**	8.45	6.35	7.40
106	8.53	6.41	7.47	**107**	8.61	6.47	7.54	**108**	8.69	6.53	7.61	**109**	8.77	6.59	7.68	**110**	8.85	6.65	7.75
111	8.93	6.71	7.82	**112**	9.01	6.77	7.89	**113**	9.09	6.83	7.96	**114**	9.17	6.89	8.03	**115**	9.25	6.95	8.10

Table VIII. (Continued)

No	High	Low	Control	No	High	Low	Control	No	High	Low	Control	No	High	Low	Control	N°	High	Low	Control
116	9.33	7.01	8.17	**117**	9.41	7.07	8.24	**118**	9.49	7.13	8.31	**119**	9.57	7.19	8.38	**120**	9.65	7.25	8.45
121	9.73	7.31	8.52	**122**	9.81	7.37	8.59	**123**	9.89	7.43	8.66	**124**	9.97	7.49	8.73	**125**	10.05	7.55	8.80
126	10.13	7.61	8.87	**127**	10.21	7.67	8.94	**128**	10.29	7.73	9.01	**129**	10.37	7.79	9.08	**130**	10.45	7.85	9.15
131	10.53	7.91	9.22	**132**	10.61	7.97	9.29	**133**	10.69	8.03	9.36	**134**	10.77	8.09	9.43	**135**	10.85	8.15	9.50
136	10.93	8.21	9.57	**137**	11.01	8.27	9.64	**138**	11.09	8.33	9.71	**139**	11.17	8.39	9.78	**140**	11.25	8.45	9.85
141	11.33	8.51	9.92	**142**	11.41	8.57	9.99	**143**	11.49	8.63	10.06	**144**	11.57	8.69	10.13	**145**	11.65	8.75	10.20
146	11.73	8.81	10.27	**147**	11.81	8.87	10.34	**148**	11.89	8.93	10.41	**149**	11.97	8.99	10.48	**150**	12.05	9.05	10.55
151	12.13	9.11	10.62	**152**	12.21	9.17	10.69	**153**	12.29	9.23	10.76	**154**	12.37	9.29	10.83	**155**	12.45	9.35	10.90
156	12.53	9.41	10.97	**157**	12.61	9.47	11.04	**158**	12.69	9.53	11.11	**159**	12.77	9.59	11.18	**160**	12.85	9.65	11.25
161	12.93	9.71	11.32	**162**	13.01	9.77	11.39	**163**	13.09	9.83	11.46	**164**	13.17	9.89	11.53	**165**	13.25	9.95	11.60
166	13.33	10.01	11.67	**167**	13.41	10.07	11.74	**168**	13.49	10.13	11.81	**169**	13.57	10.19	11.88	**170**	13.65	10.25	11.95
171	13.73	10.31	12.02	**172**	13.81	10.37	12.09	**173**	13.89	10.43	12.16	**174**	13.97	10.49	12.23	**175**	14.05	10.55	12.30
176	14.13	10.61	12.37	**177**	14.21	10.67	12.44	**178**	14.29	10.73	12.51	**179**	14.37	10.79	12.58	**180**	14.45	10.85	12.65
181	14.53	10.91	12.72	**182**	14.61	10.97	12.79	**183**	14.69	11.03	12.86	**184**	14.77	11.09	12.93	**185**	14.85	11.15	13.00
186	14.93	11.21	13.07	**187**	15.01	11.27	13.14	**188**	15.09	11.33	13.21	**189**	15.17	11.39	13.28	**190**	15.25	11.45	13.35
191	15.33	11.51	13.42	**192**	15.41	11.57	13.49	**193**	15.49	11.63	13.56	**194**	15.57	11.69	13.63	**195**	15.65	11.75	13.70
196	15.73	11.81	13.77	**197**	15.81	11.87	13.84	**198**	15.89	11.93	13.91	**199**	15.97	11.99	13.98	**200**	16.05	12.05	14.05
201	16.13	12.11	14.12	**202**	16.21	12.17	14.19	**203**	16.29	12.23	14.26	**204**	16.37	12.29	14.33	**205**	16.45	12.35	14.40
206	16.53	12.41	14.47	**207**	16.61	12.47	14.54	**208**	16.69	12.53	14.61	**209**	16.77	12.59	14.68	**210**	16.85	12.65	14.75
211	16.93	12.71	14.82	**212**	17.01	12.77	14.89	**213**	17.09	12.83	14.96	**214**	17.17	12.89	15.03	**215**	17.25	12.95	15.10
216	17.33	13.01	15.17	**217**	17.41	13.07	15.24	**218**	17.49	13.13	15.31	**219**	17.57	13.19	15.38	**220**	17.65	13.25	15.45
221	17.73	13.31	15.52	**222**	17.81	13.37	15.59	**223**	17.89	13.43	15.66	**224**	17.97	13.49	15.73	**225**	18.05	13.55	15.80
226	18.13	13.61	15.87	**227**	18.21	13.67	15.94	**228**	18.29	13.73	16.01	**229**	18.37	13.79	16.08	**230**	18.45	13.85	16.15
231	18.53	13.91	16.22	**232**	18.61	13.97	16.29	**233**	18.69	14.03	16.36	**234**	18.77	14.09	16.43	**235**	18.85	14.15	16.50
236	18.93	14.21	16.57	**237**	19.01	14.27	16.64	**238**	19.09	14.33	16.71	**239**	19.17	14.39	16.78	**240**	19.25	14.45	16.85
241	19.33	14.51	16.92	**242**	19.41	14.57	16.99	**243**	19.49	14.63	17.06	**244**	19.57	14.69	17.13	**245**	19.65	14.75	17.20
246	19.73	14.81	17.27	**247**	19.81	14.87	17.34	**248**	19.89	14.93	17.41	**249**	19.97	14.99	17.48	**250**	20.05	15.05	17.55

Table VIII. (Continued)

251	20.13	15.11	17.62	**252**	20.21	15.17	17.69	**253**	20.29	15.23	17.76	**254**	20.37	15.29	17.83	**255**	20.45	15.35	17.90
256	20.53	15.41	17.97	**257**	20.61	15.47	18.04	**258**	20.69	15.53	18.11	**259**	20.77	15.59	18.18	**260**	20.85	15.65	18.25
261	20.93	15.71	18.32	**262**	21.01	15.77	18.39	**263**	21.09	15.83	18.46	**264**	21.17	15.89	18.53	**265**	21.25	15.95	18.60
266	21.33	16.01	18.67	**267**	21.41	16.07	18.74	**268**	21.49	16.13	18.81	**269**	21.57	16.19	18.88	**270**	21.65	16.25	18.95
271	21.73	16.31	19.02	**272**	21.81	16.37	19.09	**273**	21.89	16.43	19.16	**274**	21.97	16.49	19.23	**275**	22.05	16.55	19.30
276	22.13	16.61	19.37	**277**	22.21	16.67	19.44	**278**	22.29	16.73	19.51	**279**	22.37	16.79	19.58	**280**	22.45	16.85	19.65
281	22.53	16.91	19.72	**282**	22.61	16.97	19.79	**283**	22.69	17.03	19.86	**284**	22.77	17.09	19.93	**285**	22.85	17.15	20.00
286	22.93	17.21	20.07	**287**	23.01	17.27	20.14	**288**	23.09	17.33	20.21	**289**	23.17	17.39	20.28	**290**	23.25	17.45	20.35
291	23.33	17.51	20.42	**292**	23.41	17.57	20.49	**293**	23.49	17.63	20.56	**294**	23.57	17.69	20.63	**295**	23.65	17.75	20.70
296	23.73	17.81	20.77	**297**	23.81	17.87	20.84	**298**	23.89	17.93	20.91	**299**	23.97	17.99	20.98	**300**	24.05	18.05	21.05
301	24.13	18.11	21.12	**302**	24.21	18.17	21.19	**303**	24.29	18.23	21.26	**304**	24.37	18.29	21.33	**305**	24.45	18.35	21.40
306	24.53	18.41	21.47	**307**	24.61	18.47	21.54	**308**	24.69	18.53	21.61	**309**	24.77	18.59	21.68	**310**	24.85	18.65	21.75
311	24.93	18.71	21.82	**312**	25.01	18.77	21.89	**313**	25.09	18.83	21.96	**314**	25.17	18.89	22.03	**315**	25.25	18.95	22.10
316	25.33	19.01	22.17	**317**	25.41	19.07	22.24	**318**	25.49	19.13	22.31	**319**	25.57	19.19	22.38	**320**	25.65	19.25	22.45
321	25.73	19.31	22.52	**322**	25.81	19.37	22.59	**323**	25.89	19.43	22.66	**324**	25.97	19.49	22.73	**325**	26.05	19.55	22.80
326	26.13	19.61	22.87	**327**	26.21	19.67	22.94	**328**	26.29	19.73	23.01	**329**	26.37	19.79	23.08	**330**	26.45	19.85	23.15
331	26.53	19.91	23.22	**332**	26.61	19.97	23.29	**333**	26.69	20.03	23.36	**334**	26.77	20.09	23.43	**335**	26.85	20.15	23.50
336	26.93	20.21	23.57	**337**	27.01	20.27	23.64	**338**	27.09	20.33	23.71	**339**	27.17	20.39	23.78	**340**	27.25	20.45	23.85
341	27.33	20.51	23.92	**342**	27.41	20.57	23.99	**343**	27.49	20.63	24.06	**344**	27.57	20.69	24.13	**345**	27.65	20.75	24.20
346	27.73	20.81	24.27	**347**	27.81	20.87	24.34	**348**	27.89	20.93	24.41	**349**	27.97	20.99	24.48	**350**	28.05	21.05	24.55
351	28.13	21.11	24.62	**352**	28.21	21.17	24.69	**353**	28.29	21.23	24.76	**354**	28.37	21.29	24.83	**355**	28.45	21.35	24.90
356	28.53	21.41	24.97	**357**	28.61	21.47	25.04	**358**	28.69	21.53	25.11	**359**	28.77	21.59	25.18	**360**	28.85	21.65	25.25
361	28.93	21.71	25.32	**362**	29.01	21.77	25.39	**363**	29.09	21.83	25.46	**364**	29.17	21.89	25.53	**365**	29.25	21.95	25.60
366	29.33	22.01	25.67	**367**	29.41	22.07	25.74	**368**	29.49	22.13	25.81	**369**	29.57	22.19	25.88	**370**	29.65	22.25	25.95
371	29.73	22.31	26.02	**372**	29.81	22.37	26.09	**373**	29.89	22.43	26.16	**374**	29.97	22.49	26.23	**375**	30.05	22.55	26.30
376	30.13	22.61	26.37	**377**	30.21	22.67	26.44	**378**	30.29	22.73	26.51	**379**	30.37	22.79	26.58	**380**	30.45	22.85	26.65
381	30.53	22.91	26.72	**382**	30.61	22.97	26.79	**383**	30.69	23.03	26.86	**384**	30.77	23.09	26.93	**385**	30.85	23.15	27.00
386	30.93	23.21	27.07	**387**	31.01	23.27	27.14	**388**	31.09	23.33	27.21	**389**	31.17	23.39	27.28	**390**	31.25	23.45	27.35

Table VIII. (Continued)

No	High	Low	Control	No	High	Low	Control	No	High	Low	Control	No	High	Low	Control	N°	High	Low	Control
391	31.33	23.51	27.42	**392**	31.41	23.57	27.49	**393**	31.49	23.63	27.56	**394**	31.57	23.69	27.63	**395**	31.65	23.75	27.70
396	31.73	23.81	27.77	**397**	31.81	23.87	27.84	**398**	31.89	23.93	27.91	**399**	31.97	23.99	27.98	**400**	32.05	24.05	28.05
401	32.13	24.11	28.12	**402**	32.21	24.17	28.19	**403**	32.29	24.23	28.26	**404**	32.37	24.29	28.33	**405**	32.45	24.35	28.40
406	32.53	24.41	28.47	**407**	32.61	24.47	28.54	**408**	32.69	24.53	28.61	**409**	32.77	24.59	28.68	**410**	32.85	24.65	28.75
411	32.93	24.71	28.82	**412**	33.01	24.77	28.89	**413**	33.09	24.83	28.96	**414**	33.17	24.89	29.03	**415**	33.25	24.95	29.10
416	33.33	25.01	29.17	**417**	33.41	25.07	29.24	**418**	33.49	25.13	29.31	**419**	33.57	25.19	29.38	**420**	33.65	25.25	29.45
421	33.73	25.31	29.52	**422**	33.81	25.37	29.59	**423**	33.89	25.43	29.66	**424**	33.97	25.49	29.73	**425**	34.05	25.55	29.80
426	34.13	25.61	29.87	**427**	34.21	25.67	29.94	**428**	34.29	25.73	30.01	**429**	34.37	25.79	30.08	**430**	34.45	25.85	30.15
431	34.53	25.91	30.22	**432**	34.61	25.97	30.29	**433**	34.69	26.03	30.36	**434**	34.77	26.09	30.43	**435**	34.85	26.15	30.50
436	34.93	26.21	30.57	**437**	35.01	26.27	30.64	**438**	35.09	26.33	30.71	**439**	35.17	26.39	30.78	**440**	35.25	26.45	30.85
441	35.33	26.51	30.92	**442**	35.41	26.57	30.99	**443**	35.49	26.63	31.06	**444**	35.57	26.69	31.13	**445**	35.65	26.75	31.20
446	35.73	26.81	31.27	**447**	35.81	26.87	31.34	**448**	35.89	26.93	31.41	**449**	35.97	26.99	31.48	**450**	36.05	27.05	31.55
451	36.13	27.11	31.62	**452**	36.21	27.17	31.69	**453**	36.29	27.23	31.76	**454**	36.37	27.29	31.83	**455**	36.45	27.35	31.90
456	36.53	27.41	31.97	**457**	36.61	27.47	32.04	**458**	36.69	27.53	32.11	**459**	36.77	27.59	32.18	**460**	36.85	27.65	32.25
461	36.93	27.71	32.32	**462**	37.01	27.77	32.39	**463**	37.09	27.83	32.46	**464**	37.17	27.89	32.53	**465**	37.25	27.95	32.60
466	37.33	28.01	32.67	**467**	37.41	28.07	32.74	**468**	37.49	28.13	32.81	**469**	37.57	28.19	32.88	**470**	37.65	28.25	32.95
471	37.73	28.31	33.02	**472**	37.81	28.37	33.09	**473**	37.89	28.43	33.16	**474**	37.97	28.49	33.23	**475**	38.05	28.55	33.30
476	38.13	28.61	33.37	**477**	38.21	28.67	33.44	**478**	38.29	28.73	33.51	**479**	38.37	28.79	33.58	**480**	38.45	28.85	33.65

(2) The proposals are ranked by their IDs (ID 1–3 for members of type A, ID 4–6 for members of type B)
(3) If 2 or more individuals make exactly the same proposal, the computer will count that proposal as one proposal.
(4) There will be a new proposal and new vote before each round.
(5) The second part of the experiment will start with one trial round. After that, there will be another 10 rounds for which you get paid. After these 10 rounds the experiment is finished.