The Revolution Game – A Behavioral Puzzle *

Gerrit Zauke & Isabel Wagner
University of Passau

15.09.2016

Abstract

In this paper a unique experiment is presented to figure out whether an actively redistributing state prevents a costly revolution of the poor in case of high inequality in the society. The experiment was designed as a modified ultimate game with a control group and a treatment group consisting of three different players. At the University of Passau observations were collected in computer-based experiment sessions. The analysis of the data showed indeed evidence for a shift of responsibility and that the intervention of a state lowers the probability of a "Revolution".

* The Experiment was conducted in the Experimental Economics Seminar in the summer term 2016 at the University of Passau.

List of Content

List of Tables

List of Figures

1 Introduction

Inequality is getting more and more visible not only between countries but also within countries. This inequality regarding income is even expected to rise the next years. Income inequality can lead to tensions between the citizens of a state as the poor people perceive the unequal distribution of income and wealth as unfair. One could assume that the state should be interested in lowering these tensions between its poor and rich citizens to prevent a revolution of the dissatisfied people of the population. A revolution is associated with a degradation of income and wealth in the whole society – this could be described as revolution costs. Through redistribution of income the state could obtain a more equal society where tensions and a possible revolution are less likely to happen as in an unequal society. In countries with a weak state it is often observed that the wealthier people tend to distribute more of their money – for example in the form of donations – to the poor. These phenomena lead to the idea for the design of the experiment presented in this paper.

In this paper a unique experiment is presented which tries to test whether the existence of an actively redistributing state leads to a more equal distribution of income and therefore a decreased probability of a revolution of the poor. The state intervenes as a controlling institution and prevents through its redistributions between the rich and poor people the happening of a costly "revolution" – this is what one would assume. The experiment introduced in this paper wasn't designed based on experiments already existing in the literature.

2 Experimental Design

The experiment was designed as a modified ultimate game. It consists of a control group and a treatment group. Both groups include Player A, Player B and Player C. All three players receive an initial credit with each round: Player A gets 50 units, Player B gets 10 units and Player C gets 30 units. The game lasts over six rounds.

Player A can distribute some of his units to Player B – it is also possible to distribute zero units to Player B. Afterwards Player C can decide if an additional amount should be distributed from Player A to Player B – it is also possible to not distribute more units. In the treatment group Player C is able to actively redistributing units from Player A to Player C whereas in the control group the decision is only hypothetical. If Player C increases the amount sent of Player A he has to pay transaction costs of 20 percent of the additional amount sent in the treatment group. After the decision of Player C Player B receives the total amount sent which is composed out of the amount sent of Player A and the additional amount sent of Player C – Player B is informed in every round how much of the total amount sent was distributed from Player A and Player C. Figure 1 outlines the game design graphically for the first round of the experiment.

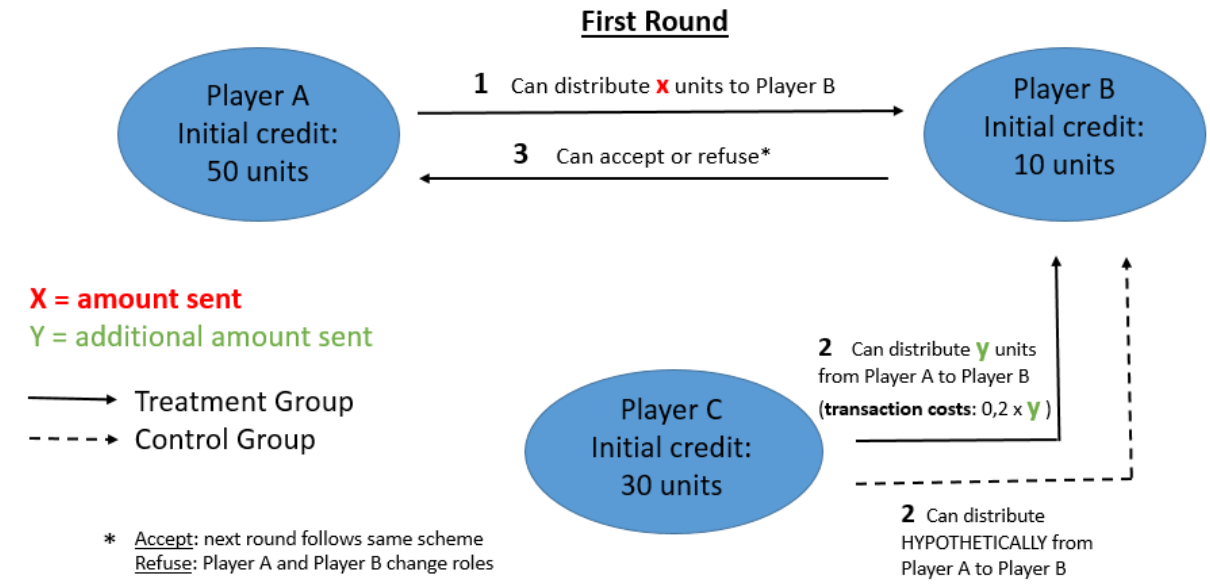


Figure 1: Game Design - Round 1

If Player B decides to refuse, Player A and Player B change roles in the next round. In that case the initial credit for the respective Player A decreases about 10 units and for Player C about 5 units. Player B still gets 10 units as initial credit. Figure 2 depicts the following round if Player B decided to change the roles with Player A.

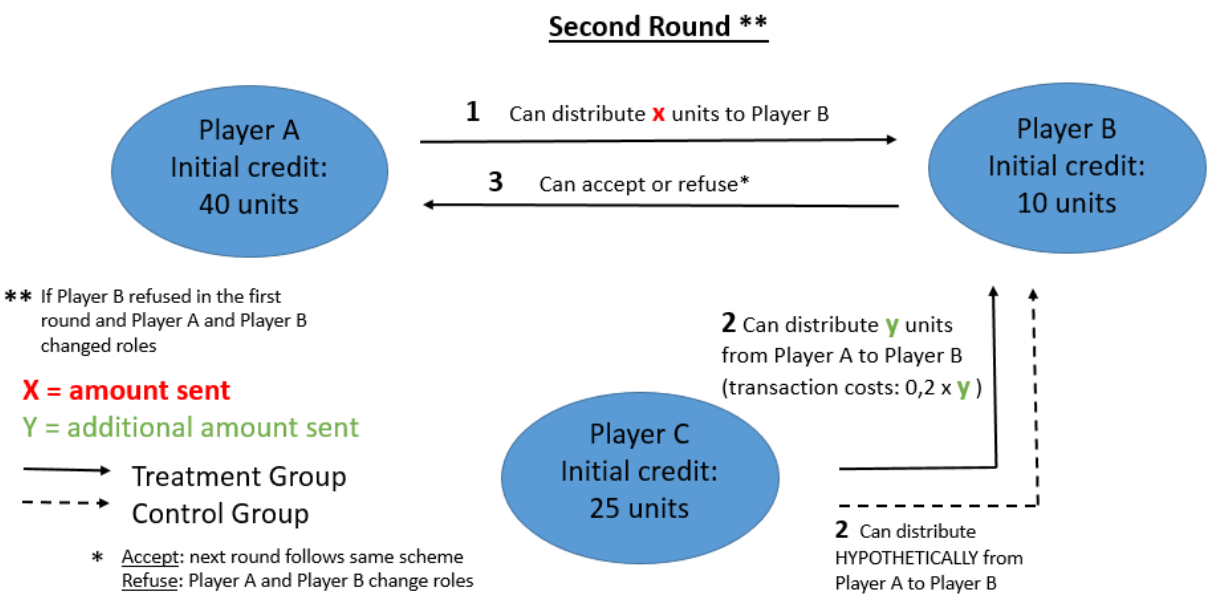


Figure 2: Game Design - Round 2 (Refuse)

If Player B decides to accept the following round follows the same scheme as the first round – the initial credit stays 50 units for Player A, 10 units for Player B and 30 units for Player C. This procedure continues over the whole six rounds of the experiment. In figure 3 the game design without a role change is illustrated.

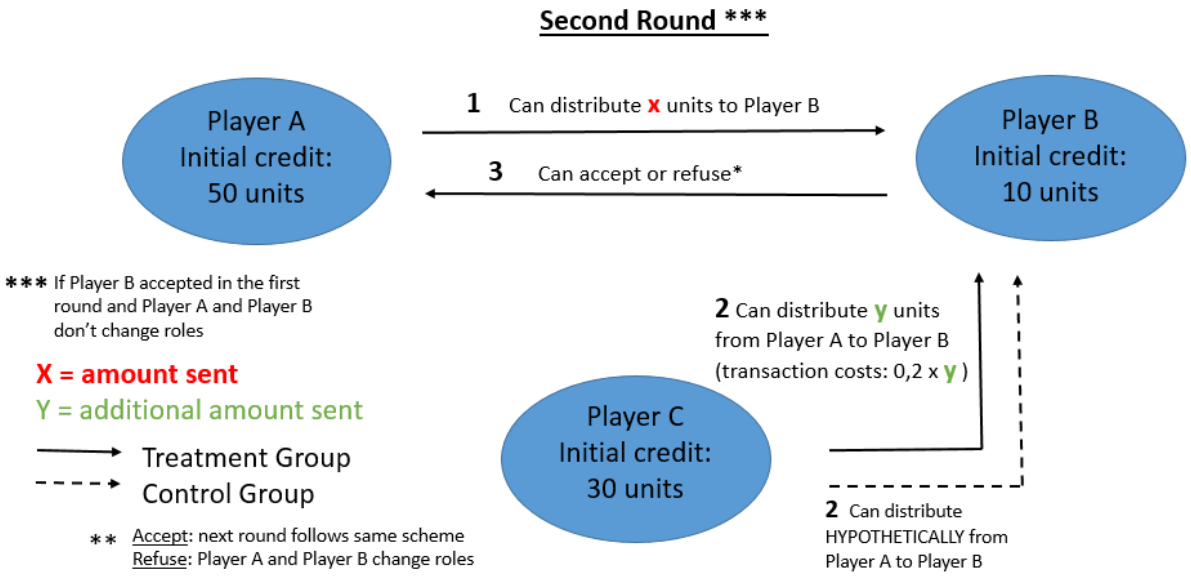


Figure 3: Game Design - Round 2 (Accept)

3 Hypotheses

After having designed the experiment hypotheses can be formulated. These hypotheses will be worked through in the results and analysis part after having gained the observations and the data.

H1: Shift of Responsibility

The first hypotheses we expect to verify with the data is that an additional Player C in the treatment group will lead to a shift of responsibility of Player A to Player C. This would imply a lower amount sent of Player A in the treatment group compared to the amount sent of Player A in the control group where the additional amount sent of Player C is only hypothetical.

H2: Acceptance higher in Treatment Group

The second hypotheses we would like to analyze with the data is that with a third Player C Player B is less likely to refuse and therefore less likely to change roles compared to the control group where Player C is not actively redistributing. Player C acts as a controlling institution in the treatment group and we expect less revolution.

4 Setting and Data

The experiment was conducted in one of the computer pools at the University of Passau in June 2016. The room was prepared accurately to ensure a professional setting and make the outcomes as realistic as possible. Between the 21 computers partition walls were set up so that the participants could run through the experiment anonymously and unobserved. The computer of the experiment leader was also set up in a separate corner to run the experiment without disturbing the participants. To run the experiment on the computer we used the program ztree, the Zurich Toolbox for Readymade Economic Experiments (Fischbacher, 2007).

The first stage of the experiment was the welcoming screen after which the experiment was explained on the second stage. If everything was clear to the participant the following stage matched the roles – either Player A, Player B or Player C. Player A was the first to decide if units should be distributed to Player B. The next stage was Player Cs' decision to additionally distribute units from Player A to Player B. Player B was asked on the next screen to decide whether to accept or refuse – and therefore change roles with Player A in the next round. The last screen of every round was the information about the respective round payoffs – all players were informed of every players' payoff. Some of the most important screenshots of the experiment can be found in the Appendix (A. Screenshots). After the experiment was finished we added a questionnaire to find out something about the participants' socio-demographic characteristics. Additionally, we appended questions about the participants' attitude towards inequality. The detailed questionnaire is also listed as a screenshot in the Appendix (B. Questionnaire).

The players were matched randomly and nobody knew with whom they were playing. As room capacity and time was restricted another experiment was placed after this experiment in the same sessions. The participants took part in the experiment voluntarily. We recruited most of the participants at the Faculty of Business Administration and Economics at the University of Passau where the computer pool was located. There were also some announcements in several lectures and seminars to recruit more participants. The experiment was supervised by instructors who were other members of the Experimental Economics seminar. They placed the participants at the computers by distributing seat numbers and took care of them or prepared the computers between the different sessions. The experiment leader was placed at the server station to start the experiment. In the beginning of each session the same instructions were read out loud by members of the Experimental Economics seminar to ensure the general elucidations were understood by all participants.

Altogether 198 observations could be obtained[1]. Over two days 12 sessions were conducted. As indicated in figure 1 below 32% of the participants were male and 68% were female. In all sessions 44% participated in the treatment group and 56% were part of the control group.

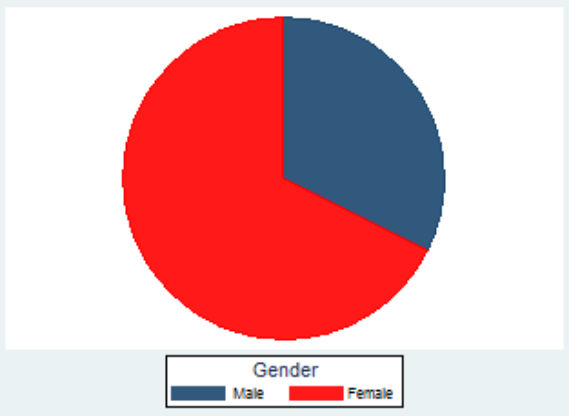


Figure 4: Male and Female Participants in the Experiment

There are limitations to the experiment which we would like to mention before presenting and analyzing the results. As the experiment was part of a seminar course and the participants of this seminar are all students we decided not to use monetary incentives. The participants were requested to act as if they were playing with real money. After the experiment they were offered coffee and sweets. Due to this lack of a monetary incentive we can assume a distortion of the results as people tend to play more morally when the payoff is only hypothesized.

5 Results & Analysis

5.1 Amount Sent and Additional Amount Sent

In our unique experiment, we find indeed evidence for a shift of responsibility in our treatment group – which coincides with the first Hypothesis (H1). With an active Player C who can intervene and send an additional amount to Player B, Player A distributes on average significantly less in the treatment group than in the control group (p-value Mann-Whitney .00)[2]. In the treatment group, an average amount of 12.93 was sent from Player A to Player B, while in the control group the average amount was 14.18. This is in line with our assumption that with the certainty of the existence of another Player C who can split the endowment in a fair way, one ´s tempted to send less to the other Player. Another explanation of the lower amount sent in the treatment group could be the fear of an overcompensation in the transfer

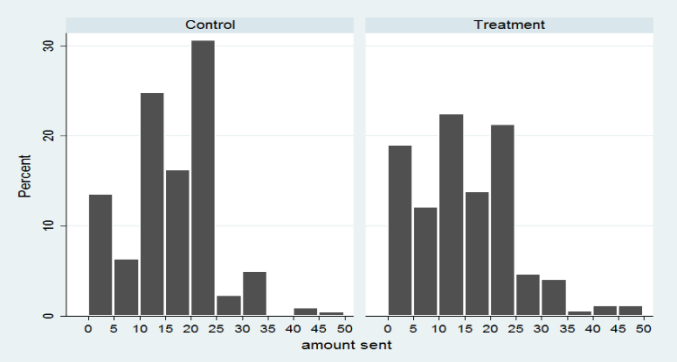


Figure 5: Amount Sent in Control and Treatment Group

[1] Overall 201 persons took part in the experiment. Three observations needed to be dropped as they were unusual.

[2] Since our dataset is not normally distributed, we will use a Mann-Whitney-Test in the following

by Player C, meaning that an amount sent by Player A judged as unfair could be punished by Player C with an extra high additional transfer of Player C (see figure 7).

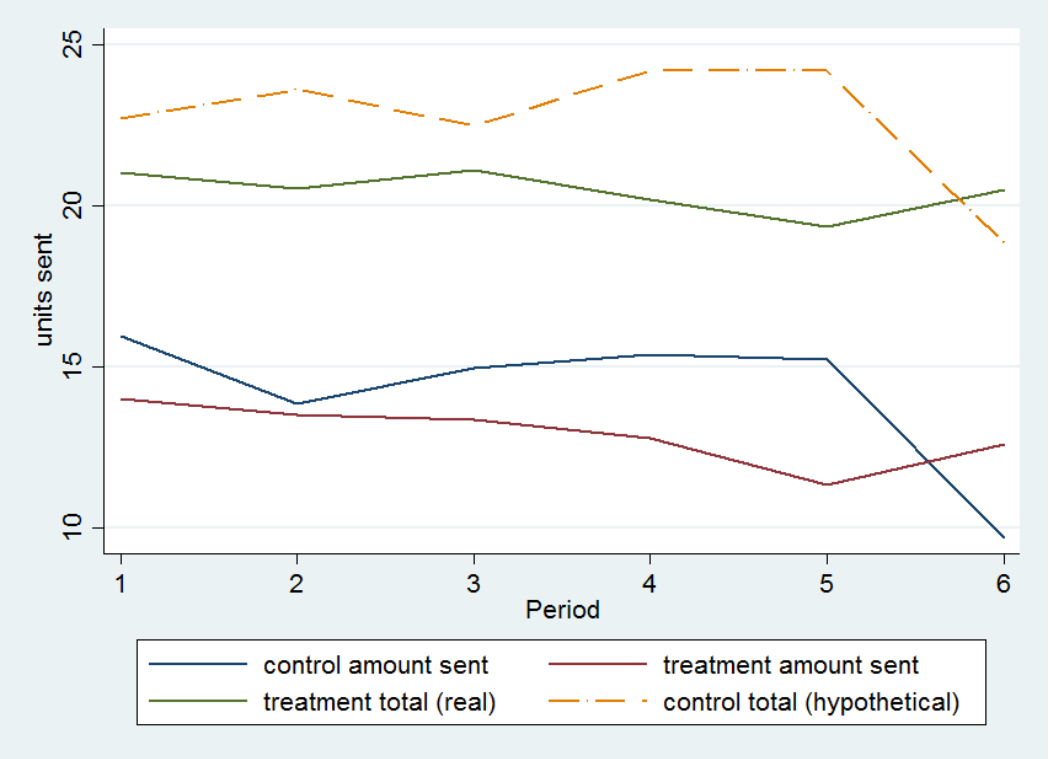


Figure 6: Amounts Sent in Treatment and Control Group over the Progress of the Game

If we run a regression with the amount sent as dependent variable and treatment as explaining variable with period and number of role changes as controls, we can see that the existence of a third active redistributing player in the treatment group affects negatively the amount sent by Player A. Moreover, we can observe that the period has no significant influence on the amount sent by Player A.

Table 1: Regression Output – Amount Sent in Control and Treatment Group

amount_sent		control	treatment
treatment	-2.268		
	(0.589)***		
period	0.292	0.367	0.211
	(0.211)	(0.239)	(0.355)
change	-4.326	-4.410	-4.245
	(0.472)***	(0.573)***	(0.733)***
_cons	15.595	15.378	13.584
	(0.716)***	(0.839)***	(1.126)***
R^2	0.10	0.14	0.06
N	1,188	666	522

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

In comparison to that, in both control and treatment group, Player C tends to redistribute more with advanced time. Also, which seems quite clear, Player C reacts with his redistribution to the transfer of Player A, and finally, the additional amount sent is in this regression model lower in the treatment than in the control group.

Table 2: Regression Output - Additional Amount Sent in Control and Treatment Group

Additional_amount_sent		control	treatment
amount_sent	-0.435	-0.624	-0.269
	(0.049)***	(0.082)***	(0.042)***
treatment	-2.649		
	(0.915)***		
period	0.997	1.406	0.599
	(0.179)***	(0.274)***	(0.235)**
change	-4.820	-6.145	-3.500
	(0.620)***	(0.927)***	(0.728)***
_cons	13.890	15.890	10.053
	(1.196)***	(1.624)***	(0.760)***
R^2	0.18	0.24	0.13
N	1,188	666	522

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

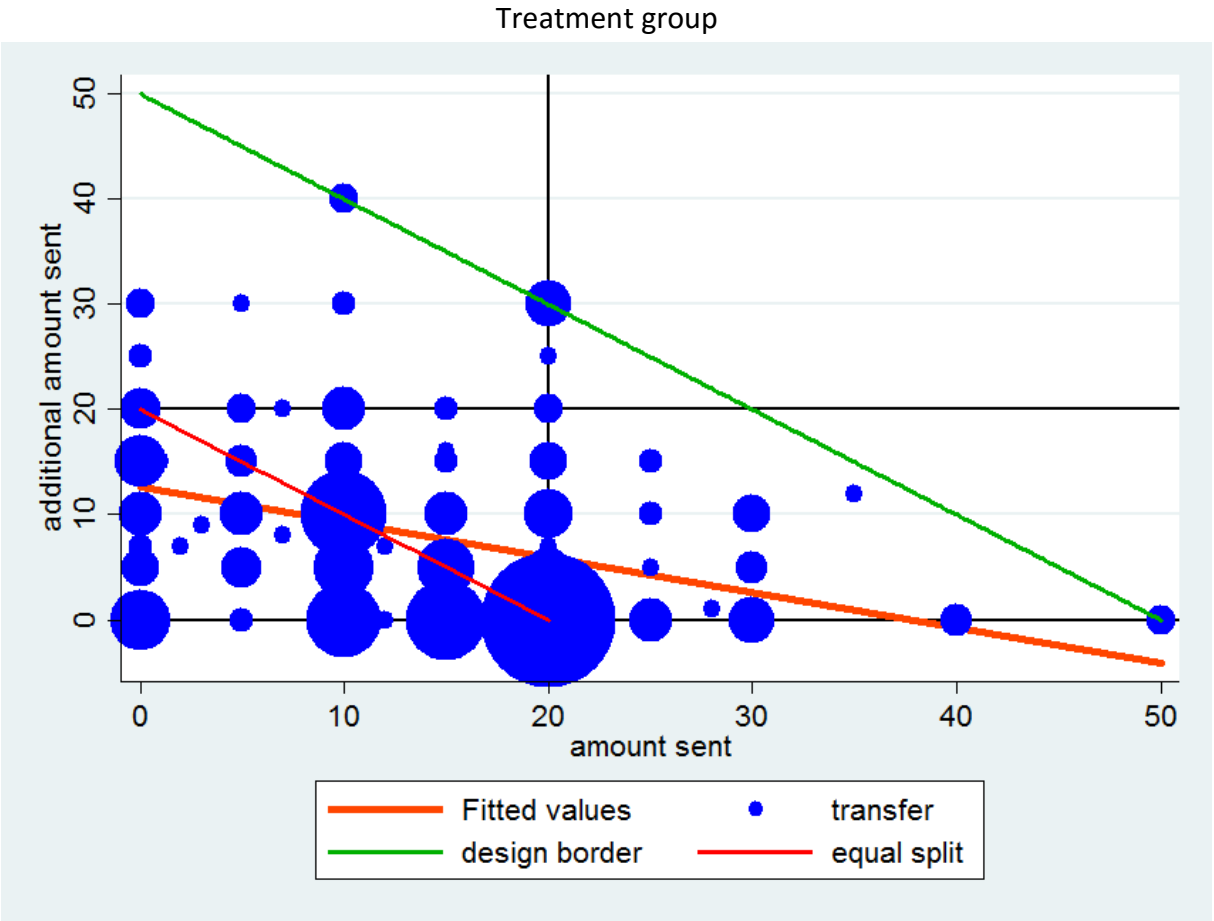


Figure 7: Additional Amount Sent plotted on the Amount Sent - Treatment Group

In figure 7 we can see the additional amount sent plotted on the amount sent. The dots show the different combinations of the amount sent by Player A and the additional amount sent by Player C in the treatment group. The larger the number of compositions of the absolute transfer we can observe at one point, the larger the dot. The green line marks the maximum possible composition, given by the design of the treatment, namely 50 units in the first round. All combinations on this line would transfer the whole amount of Player A in one round to Player B. The red line marks compositions that describe an equal split, in the first round this would be the line 20 - amount sent. Example: if Player A transfers 10 units to Player B, and Player C transfers an additional amount of 10 units to Player B, both Player A and Player B get an amount of 30 units in this round. The orange line indicates the fitted values which shows that the amount sent by Player A makes a larger share in the composition of the total transfer than the additional amount sent by Player B. The area on the left top, above the y=20-line and left of the x=20-line, can be interpreted in that way that Player C "punishes" Player A for an unfair transfer with an extra high additional transfer. The area right of the x=20-line and above the green line can be seen as altruistic behavior of Player A. Figure 8 shows the results for our control group. The results are similar to those in our treatment group, showing some small differences in the composition of the transfer, but the additional amount is just hypothetical in this case.

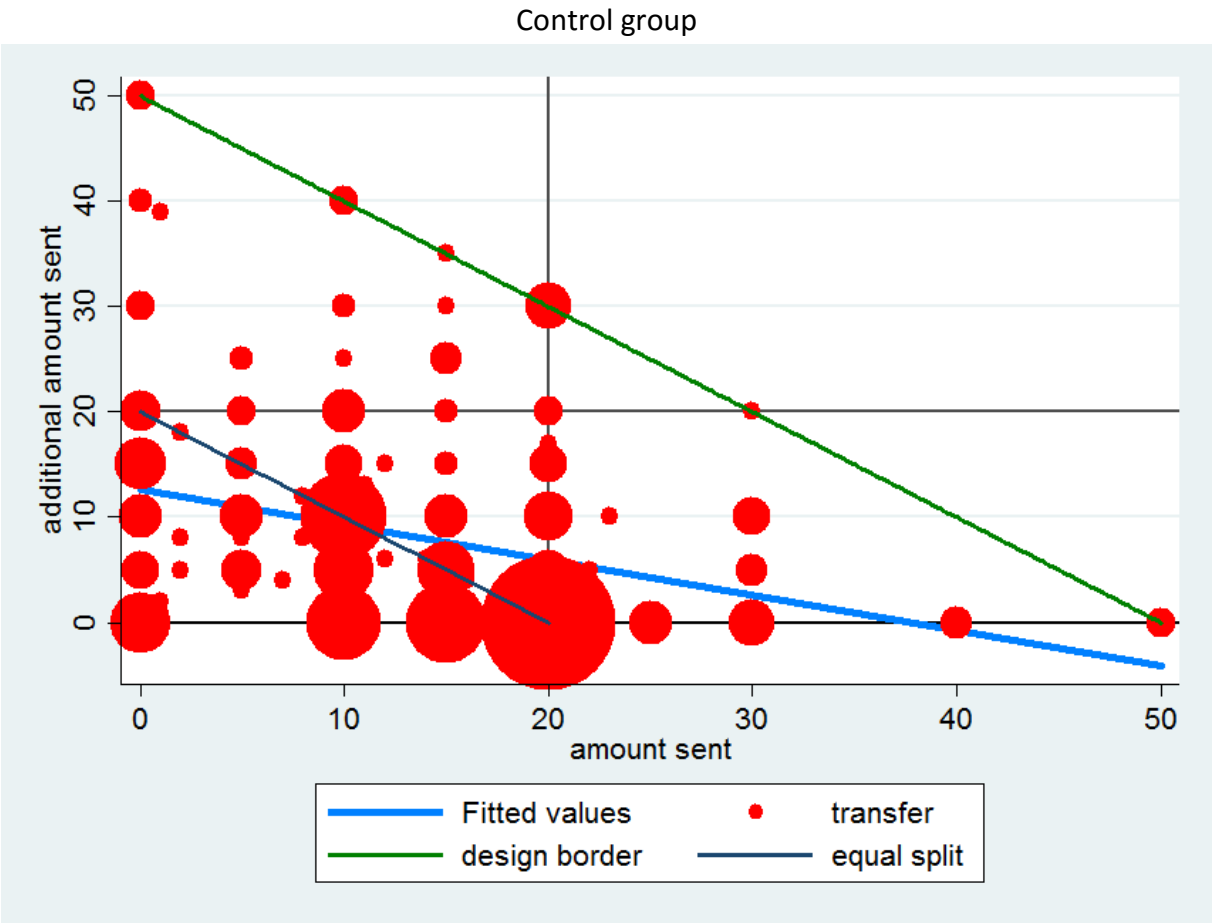


Figure 8: Additional Amount Sent plotted on the Amount Sent - Control Group

In the additional amount sent by Player C, we cannot find significant differences between our treatment, 7.52 units and the control group, 8.50 (p-value Mann-Whitney .42). One could assume that in the treatment group, the additional transfer of Player C should be higher to compensate a lower amount sent by Player A, but should take into account the evolving costs for Player C in the treatment group for an additional transfer, which could balance this expected behavior. What is surprising, that the sum of both transfers (amount sent + additional amount sent) is on average higher than 20, which would be the equal split in the beginning if no penalty for changing roles was given yet. The overall average of the sum is 20.70, the sum of both transfers in one round of Player A and Player C in the treatment group is 20.46, which is as well the average amount that was really transferred from Player A to Player B per round. Since the additional amount sent in the control group is just hypothetical, the hypothetical sum of 22.68 is reduced to the transfer of Player A, 14.18, that reaches Player B at the end of the round. Those results seem to be quite high, but coincide with the results of a simple Ultimatum Game in the existent literature, where proposer offer on average 30-40% of their endowment to the responder, which can be explained by altruism, inequality aversion and reciprocity. The latter two effects are reinforced in our experiment, which makes it outstanding. Since the game runs over 6 rounds and roles can be switched, participants have to anticipate that unfair behavior will be punished by the other two players in the next rounds and in addition would harm all players in a group because of the evolving costs for a role change if Player B is not satisfied with the offer. Moreover, not only the inequality aversion of the player who´s in the role of the proposer influences the outcome, but also the inequality aversion of Player C. Despite the fact that Player C has to carry costs in the treatment for an additional transfer to Player B, most of the participants are willing to pay these costs to keep the equilibrium (see Figure 9).

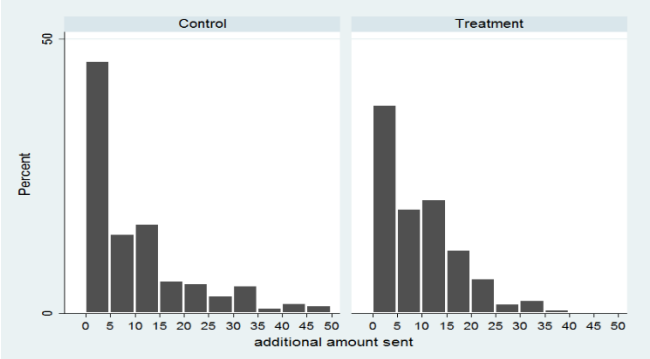


Figure 9: Additional Amount Sent in Control and Treatment Group

5.2 Acceptance

In total, 396 offers have been place to Player B, of which 267 (67%) have been accepted and 129 (33%) have been refused (see Table 3), which lead to a role change. In the control group, this role change was attached to costs of 10 units for a group due to a 10 units lowered endowment for the new Player A in the next round, in the treatment group one has to account for additional costs of 5 units, meaning costs of 15 units for the whole group per role change. If we sum up the costs for a “revolution”, meaning that Player B doesn´t accept the offer and wants to change roles, we get costs for the control group of 830 units (for a group of 111 player) and for the treatment group of 690 units (for a group of 87 player).

Table 3: Acceptance / Refusal in Control and Treatment Group

	overall		control	treatment
accept	267 (67%)		139 (74%)	128 (63%)
refuse	129 (33%)		83 (26%)	46 (37%)
sum	396 (100%)		222 (100%)	174 (100%)

For estimating the effect of the treatment, an active Player C, on the acceptance of an offer we use a probit model:

$$\Pr(\text{accept}=1 \mid X) = \Phi(X^T\beta)$$

where Pr denotes probability, and Φ is the Cumulative Distribution Function (CDF) of the standard normal distribution, X^T the independent variables and β the parameter (see Table 4).

Table 4: Regression Output - Accept in Control and Treatment Group (Probit Model)

accept			control	treatment
	treatment	0.479		
		(0.083)***		
	period	-0.396	-0.464	-0.413
		(0.025)***	(0.042)***	(0.034)***
	amount_sent	0.042	0.097	0.014
		(0.007)***	(0.011)***	(0.008)*
	additional_amount_sent	0.007	0.009	0.031
		(0.005)	(0.006)	(0.009)***
	change	0.085	0.325	0.052
		(0.057)	(0.088)***	(0.100)
	_cons	1.072	0.426	1.792
		(0.166)***	(0.261)	(0.229)***
N		1,188	666	522

* $p<0.1$; ** $p<0.05$; *** $p<0.01$

We can observe that the treatment group is less likely to reject an offer and therefore change roles (p-value Mann-Whitney .00). Furthermore, the later the point in the game, the more likely is Player B to reject the offer and to initiate a role change (see Table 4). This is significant for both treatment and control group. This fits perfectly with the Hypothesis (H2) for a higher acceptance level in the treatment group.

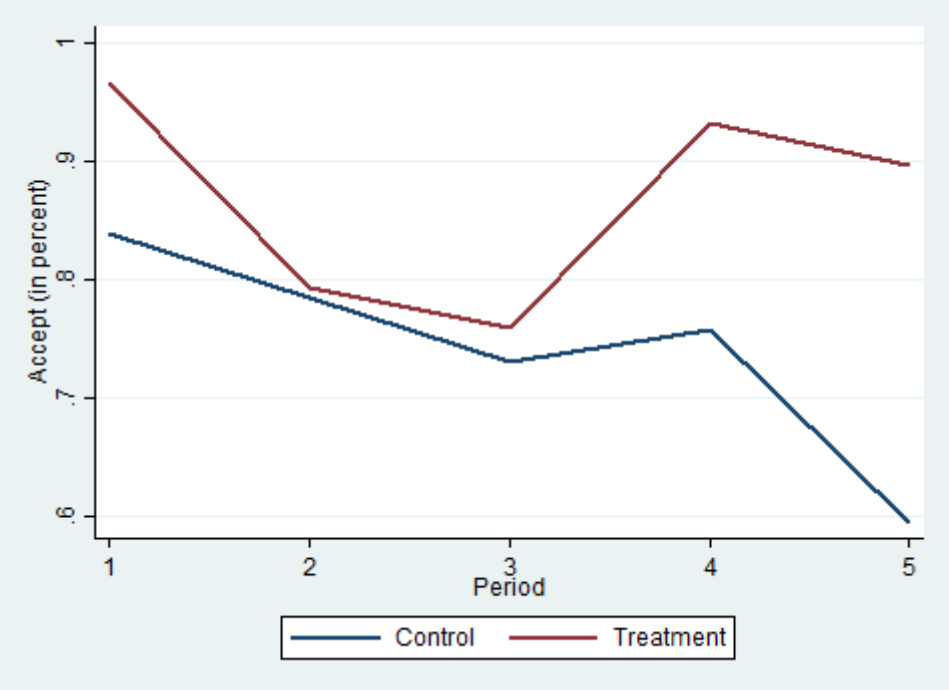


Figure 10: Acceptance over the Progress of the Game

In figure 10 we can see that there´s a decline in the acceptance of the offer. If we compare it to figure 6, this effect cannot be explained by a reduced offered amount, so other factors have to be taken into account. Other explanatory behaviors could be impatience or an evolving discontent with the growing inequality.

If we regard the total payoff after the last round both in the treatment and the control group, we see that the average payoff in the treatment group is with 167.12 units higher than in the control group (163.11 units), but has a higher standard deviation with 30.84 in the treatment against 19.06 in the control.

6 Conclusion

There are several factors that drive the behavior of the participants in our experiment which makes it quite complex. First of all, the involvement of a third player leads to a shift of responsibility from Player A to Player C. Moreover, we can observe a sense for equality in both respective Player A and especially Player C. Finally, participants expect negative reciprocity if they send unfair amounts to their counterparts. All those influences drive our participating groups to a relatively equal distribution of their endowments. Regarding our comparison with the state, the rich and the poor people, we could assume that according to our results a more passive state leads to a higher redistribution initiated by the citizens, whereas an intervening state leads to less “Revolution” and a higher overall payoff but also higher inequality.

Our study gives room for more research. Since our experiment was only theoretical, it´s not predicted how people would act in reality with real payoffs. Moreover, it could be interesting to examine the behavior of people with different cultural and financial backgrounds, our sample was mostly restricted to students of the University of Passau aged between 18 and 30.

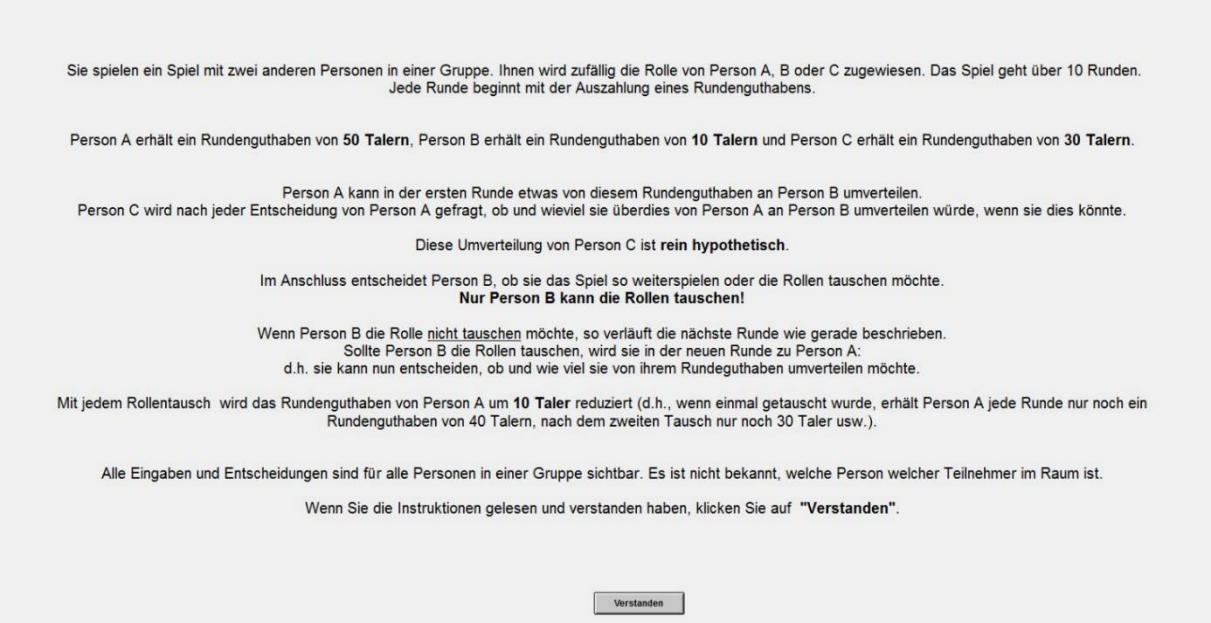
7 References

Fischbacher, U. (2007), "z-Tree: Zurich toolbox for readymade economic experiments", Experimental Economics, Vol. 10 (2): 171-178.

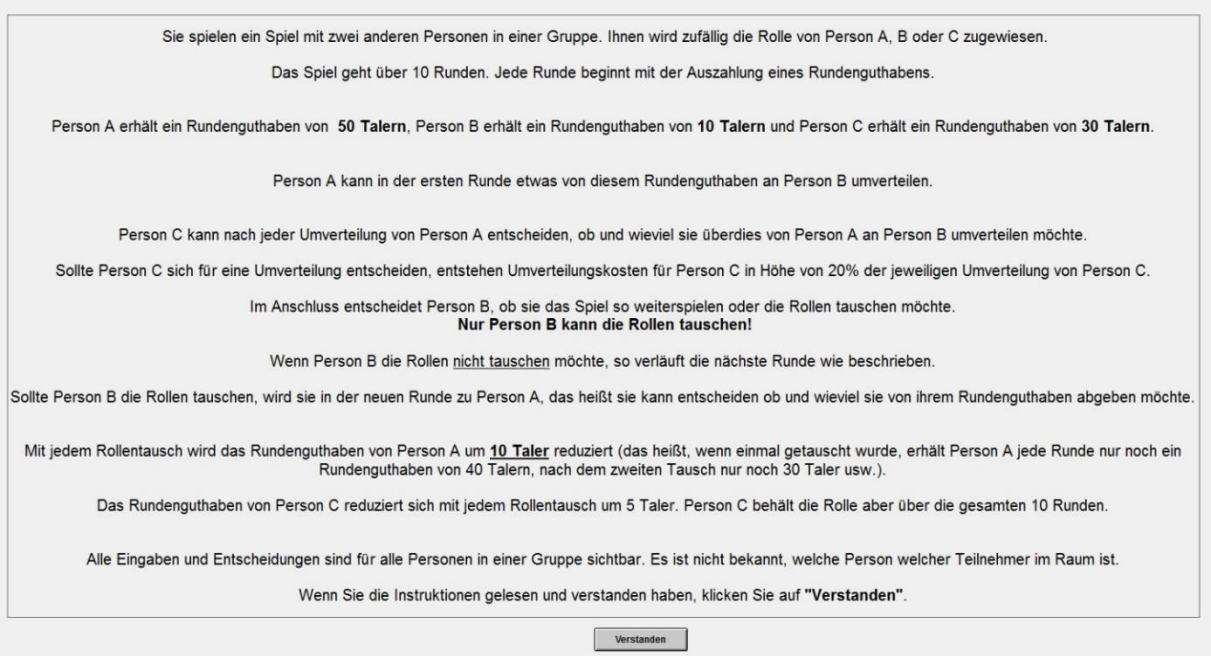
Appendix

A. Screenshots

Screenshot 1: Welcoming Stage

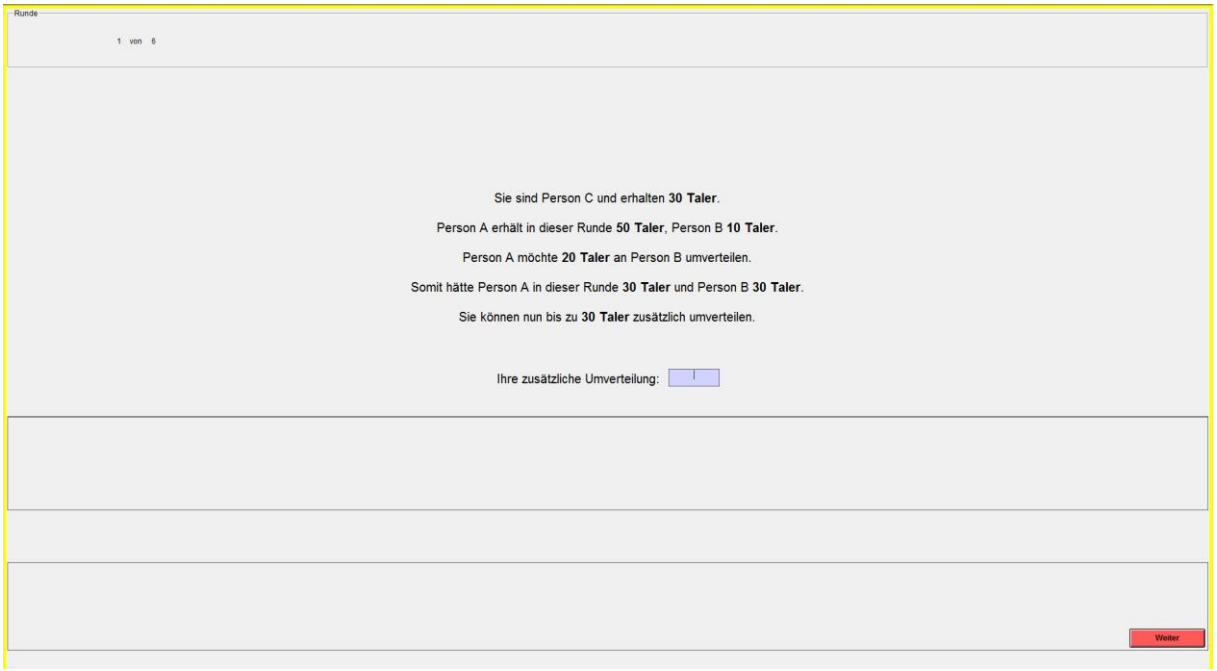


Screenshot 2: Game Instructions - Control Group

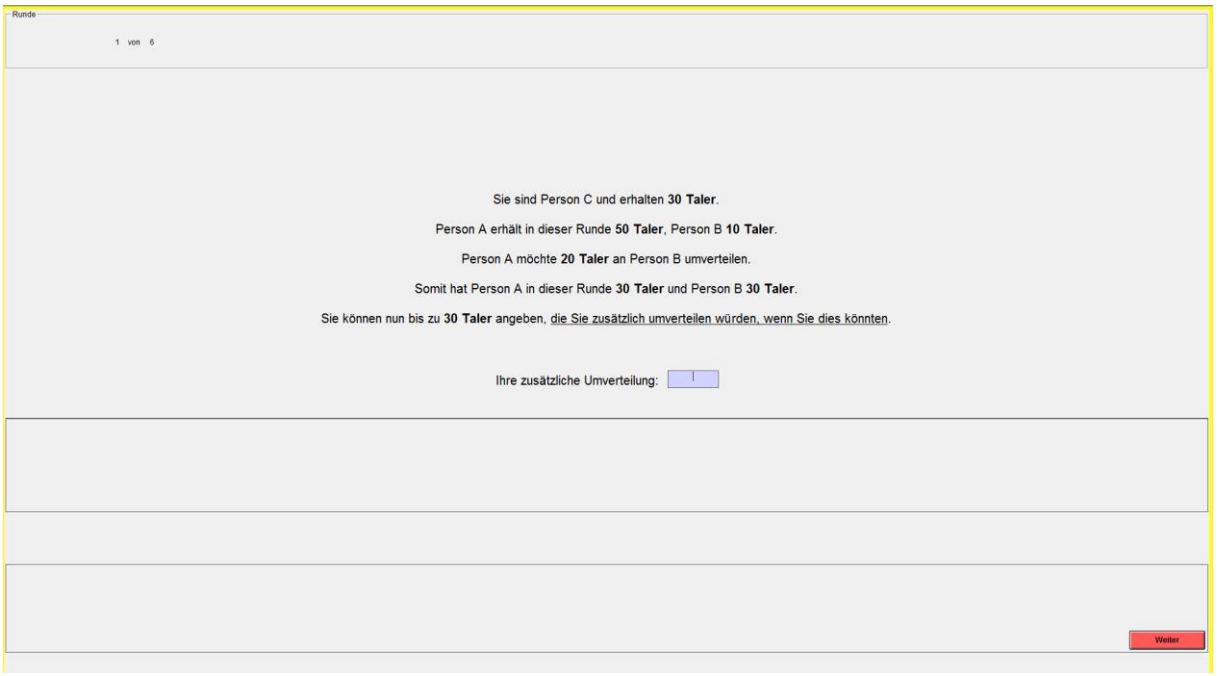


Screenshot 3: Game Instructions - Treatment Group

Screenshot 4: Player A - First Round - Treatment Group



Screenshot 5: Player C - First Round - Treatment Group



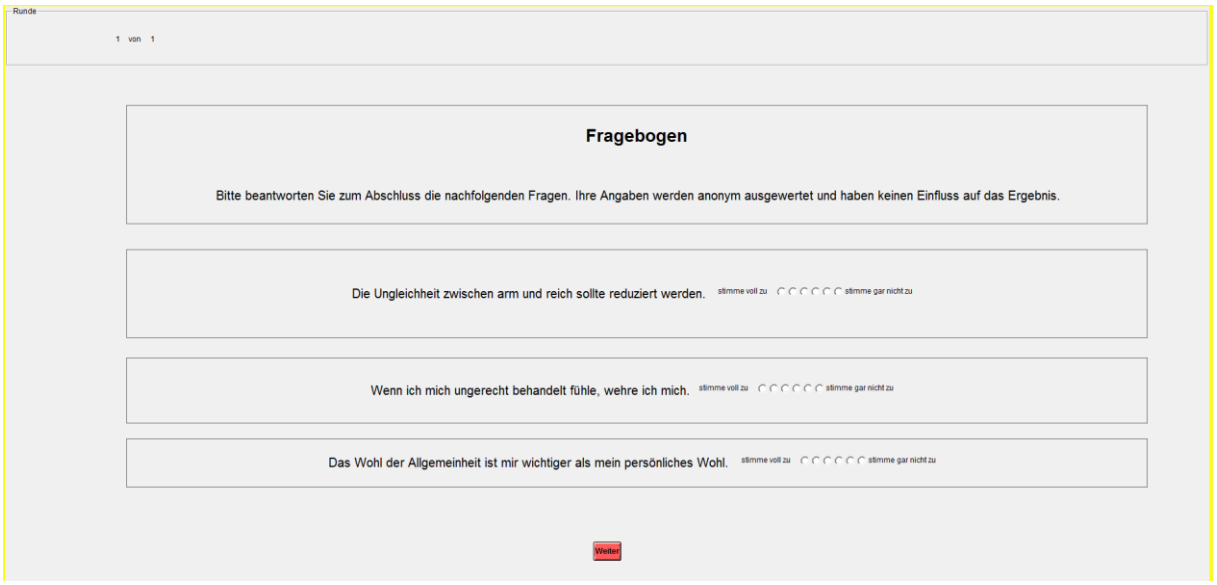
Screenshot 6: Player C - First Round - Control Group

Screenshot 7: Player B - First Round - Treatment Group

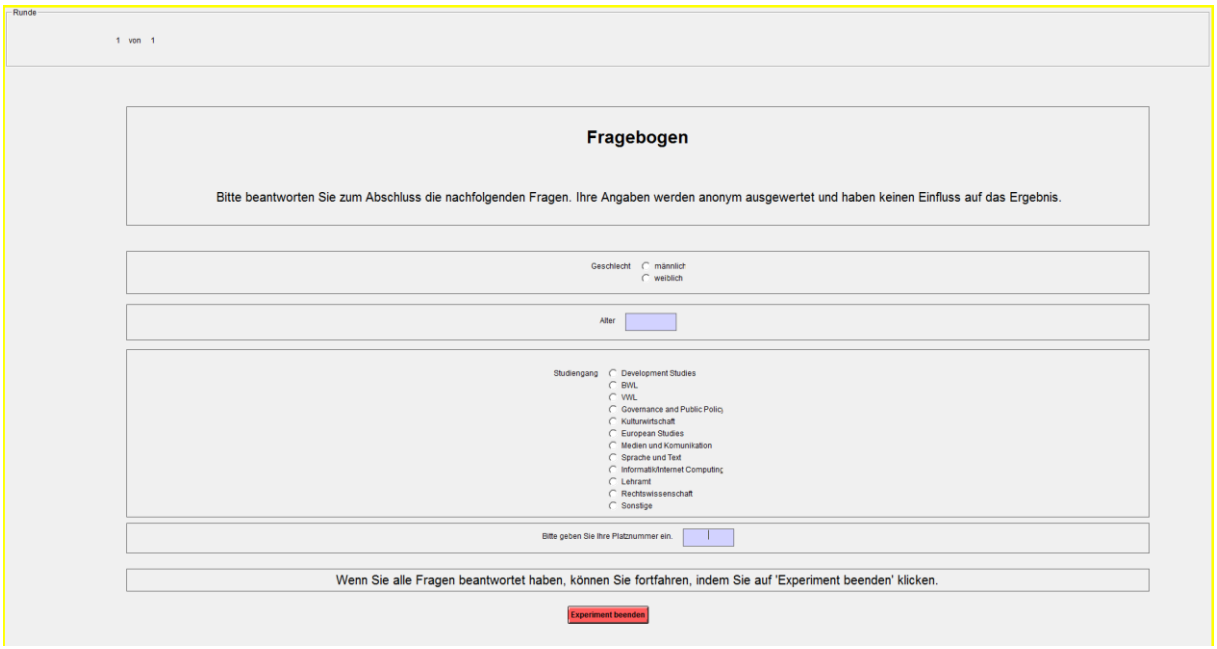
Screenshot 8: Player B - End of Round 1 - Control Group

Screenshot 9: Player A - Second Round - Role Change (with History Box)

B. Questionnaire



Screenshot 10: Questionnaire - Page 1



Screenshot 11: Questionnaire - Page 2