

The Behavioral Logic of Collective Action: Partisans Cooperate and Punish More Than Non-Partisans

Online Appendix

I. R code.

```

#declare variables (non-parameters)
mutant=mutants=r=g=i=w=x=y=wt=0;

#Parameters:
#B-benefit form altruism, C-cost of altruism
#X-cost of punishment for sender, Y-cost of punishment for receiver
#Z-cost of group competition, V-total [party] value of victory
#N-total population size, MR-mutation rate, R-number of rounds

B=5;C=1;X=1;Y=3;Z=1;N=400;MR=0.005;R=1000;V=N*(B-C);

#9x9 payoff matrix
PM=t(array(c(B-C,-C,B-C,B-C,-C,B-C,B-C,-C,B-C,
B,0,B-Y,B,0,B-Y,B,0,B-Y,
B-C,-C-X,B-C,B-C,-C-X,B-C,B-C,-C-X,B-C,
B-C,-C,B-C,B-C,-C,B-C,B-C,-C,B-C,
B,0,B-Y,B,0,B-Y,B,0,B-Y,
B-C,-C-X,B-C,B-C,-C-X,B-C,B-C,-C-X,B-C,
B-C,-C,B-C,B-C,-C,B-C,B-C,-C,B-C,
B,0,B-Y,B,0,B-Y,B,0,B-Y,
B-C,-C-X,B-C,B-C,-C-X,B-C,B-C,-C-X,B-C),dim=c(9,9)))

#data array
data=array(0,dim=c(R,9))

#note on types:
#1 - partisan cooperators A
#2 - partisan defectors A
#3 - partisan reciprocators A
#4 - non-partisan cooperators
#5 - non-partisan defectors
#6 - non-partisan reciprocators
#7 - partisan cooperators B
#8 - partisan defectors B
#9 - partisan reciprocators B

#arrays for type operations
Lottery=array(0,dim=c(N,9));Tot=array(0,dim=c(9));P=array(0,dim=c(9));AF=array(0,dim=c(9))

#population array: fitness, type, partner
pop=array(0,dim=c(N,3))

#starting fitness (nonnegative)
pop[1:N,1]=C+X+Y+Z;

#starting population types: uniformly random
pop[1:N,2]=as.integer(1+9*runif(N));

#generations start here
for (r in 1:R) {

#first determine the strength of parties and the winning party

```

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#technically, calculate cooperators/reciprocators in each party
W=2;if (sum(pop[1:N,2]==1)+sum(pop[1:N,2]==3)>sum(pop[1:N,2]==7)+sum(pop[1:N,2]==9)) {W=1}

#everyone plays PD game
pop[1:N,3]=as.integer(1+N*runif(N))
for (x in 1:N) {pop[x,1]=pop[x,1]+PM[(pop[x,2]),(pop[(pop[x,3]),2])]}

#adding cost of competition to types 1-3, 6-9
pop[1:N,1]=pop[1:N,1]-Z*(pop[1:N,2]<4);
pop[1:N,1]=pop[1:N,1]-Z*(pop[1:N,2]>6);

#number of people (of all types) in the winning group
if (W==1) {wt=sum(pop[1:N,2]<4)}
if (W==2) {wt=sum(pop[1:N,2]>6)}

#adding the value of victory (per capita) to members of the winning group
if (W==1) {pop[1:N,1]=pop[1:N,1]+(V/wt)*(pop[1:N,2]<4)}
if (W==2) {pop[1:N,1]=pop[1:N,1]+(V/wt)*(pop[1:N,2]>6)}

#generational change
#average population fitness
AFP=sum(pop[1:N,1])/N

#replicator dynamics (aggregate level proportions)
for (i in 1:9) {
Tot[i]=sum(pop[1:N,2]==i)
P[i]=data[r,i]=Tot[i]/N
if (Tot[i]>0) AF[i]=sum(pop[pop[1:N,2]==i,1])/Tot[i]
#discrete RP
P[i]=P[i]*(AF[i]/AFP)}

#individual types given aggregate level proportions (probabilities)
#stochastic replicator dynamics via transposed multinomial random number generation
Lottery=t(rmultinom(N, size = 1, prob=c(P[1],P[2],P[3],P[4],P[5],P[6],P[7],P[8],P[9])));
pop[1:N,2]=max.col(Lottery);

#code for variation:
#1) find how many "mutants" in the population
#2) pick randomly and mutate
mutants=N*MR
if (mutants>1) {
for (i in 1:mutants+1) {
mutant=as.integer(1+N*runif(1))
pop[mutant,2]=as.integer(1+9*runif(1))}
}

#reset starting fitness
pop[1:N,1]=C+X+Y+Z;

#generations end
}

write.csv(data, file = "party_sim_data.txt")
matplot(1:R,cbind(data[1:R,1],data[1:R,2],data[1:R,3],data[1:R,4],
data[1:R,5],data[1:R,6],data[1:R,7],data[1:R,8],data[1:R,9]))
done=1

```

II. Replication Results Using a Four Category Measure for Partisan Strength Instead of a Dichotomous Variable for Partisan/Non-Partisan

<i>Dependent Variable: Amount Contributed to Public Good</i>						
	<u>Model A1.1</u>			<u>Model A1.2</u>		
	Coef	SE	p	Coef	SE	p
<i>Partisan Strength</i>	2.09	0.87	0.02	1.62	0.82	0.05
<i>Male</i>				-2.90	1.38	0.04
<i>Age</i>				0.02	0.30	0.94
<i>Republican</i>				-0.66	0.49	0.18
<i>Income</i>				-0.29	0.27	0.29
<i>Constant</i>	2.02	1.20	0.09	10.38	5.27	0.17
<i>Log scale</i>	2.21	0.08	0.00	2.18	0.09	0.00
<i>Log likelihood</i>		-1582			-1549	
<i>Null likelihood</i>		-1593			-1572	
<i>N (5 rounds * 120 subjects – missing data)</i>		595			590	

Table A-1. Effect of Partisan Strength on Contributions in the Public Goods Game

<i>Dependent Variable: Change in Amount Contributed to Pubic Good</i>						
	<u>Model A2.1</u>			<u>Model A2.2</u>		
	Coef	SE	p	Coef	SE	p
<i>Partisan Strength</i>	0.05	0.15	0.73	0.32	0.21	0.13
<i>Punishment Received in Previous Round</i>	0.40	0.10	0.00	0.83	0.19	0.00
<i>Partisan Strength*Punishment Received in Previous Round</i>				-0.28	0.12	0.02
<i>Constant</i>	-1.21	0.29	0.00	-1.63	0.36	0.00
<i>Log scale</i>	1.65	0.09	0.00	1.64	0.09	0.00
<i>Log likelihood</i>		-1445			-1443	
<i>Null likelihood</i>		-1452			-1452	
<i>N (4 changes * 120 subjects – missing data)</i>		476			476	

Table A-2. Effect of Punishment and Partisanship on Change in Public Goods Contributions

<i>Dependent Variable: Income Alteration in the Random Income Game</i>									
	<u>Model A3.1</u>			<u>Model A3.2</u>			<u>Model A3.3</u>		
	Coef	SE	p	Coef	SE	p	Coef	SE	p
<i>Partisan Strength</i>	0.46	0.30	0.13	0.63	0.37	0.09	0.57	0.29	0.05
<i>Target Income Deviance</i>	0.14	0.03	0.00	0.20	0.07	0.00	0.13	0.03	0.00
<i>Partisan Strength*Target Income Deviance</i>				-0.04	0.04	0.32			
<i>Male</i>							-0.82	0.47	0.08
<i>Age</i>							0.08	0.12	0.53
<i>Republican</i>							0.10	0.14	0.46
<i>Income</i>							-0.10	0.10	0.32
<i>Constant</i>	-1.72	0.51	0.00	-1.94	0.61	0.00	-1.90	2.88	0.51
<i>Log scale</i>	1.19	0.08	0.00	1.19	0.08	0.00	1.16	0.08	0.00
<i>Log likelihood</i>		-2638			-2637			-2570	
<i>Null likelihood</i>		-2658			-2658			-2607	
<i>N (120 subjects * 3 decisions per round * 5 rounds - missing data)</i>		1785			1785			1770	

Table A-3. Effect of Partisan Strength on Income Alteration in the Random Income Game

<i>Dependent Variable: Punishment in the Public Goods Game</i>									
	<u>Model A4.1</u>			<u>Model A4.2</u>			<u>Model A4.3</u>		
	Coef	SE	p	Coef	SE	p	Coef	SE	P
<i>Partisan Strength</i>	0.63	0.31	0.04	0.66	0.35	0.06	0.65	0.28	0.02
<i>Target Negative Contribution Deviance</i>	0.38	0.05	0.00	0.39	0.08	0.00	0.34	0.04	0.00
<i>Partisan Strength*Negative Contribution Deviance</i>				-0.01	0.04	0.83			
<i>Income Alteration From Random Income Game</i>							0.04	0.02	0.03
<i>Contributions From Public Goods Game</i>							0.00	0.00	0.80
<i>Male</i>							0.02	0.48	0.97
<i>Age</i>							0.03	0.13	0.83
<i>Republican</i>							0.17	0.14	0.22
<i>Income</i>							-0.01	0.09	0.92
<i>Constant</i>	-4.44	0.73	0.00	-4.48	0.80	0.00	-6.00	2.92	0.04
<i>Log scale</i>	1.10	0.10	0.00	1.10	0.10	0.00	1.02	0.10	0.00
<i>Log likelihood</i>		-1458			-1458			-1379	
<i>Null likelihood</i>		-1585			-1585			-1535	
<i>N</i>		1785			1785			1770	

Table A-4. Effect of Partisan Strength on Punishment in the Public Goods Game.

III. Text of the Instructions to Subjects

Random Income Game

These instructions are adapted from instructions used by Fehr and Gächter (2002) for «Altruistic Punishment in Humans.»

You are now taking part in an economic experiment which has been financed by various foundations for research. If you read the following instructions carefully, you can, depending on your decisions, earn a considerable amount of money. It is therefore very important that you read these instructions carefully.

The instructions which we have distributed to you are solely for your private information. **It is prohibited to communicate with the other participants during the experiment.** Should you have any questions please ask us.

During the experiment we will not speak of Dollars but rather of tokens. During the experiment your entire earnings will be calculated in tokens. At the end of the experiment the total amount of tokens you have earned will be converted to Dollars at the following rate:

1 token = 4 cents.

At the end of the experiment your entire earnings from the experiment and the 10 dollar show up fee will be immediately paid to you in cash.

The experiment is divided into periods. In total, the experiment has five periods. In each period the participants are divided into groups of four. That is, your group has three other participants in it aside from you. Group composition will change in each period. **In each of the five periods your group of four is composed of different people. Therefore, in each of the five periods you will form a group with three different people.**

First Stage

At the beginning of each period the computer will randomly choose a number of tokens to give to each person in your group. The income of each group member from the project is calculated in the same way. An *income screen* will show you how many tokens you have earned at the first stage.

After the first stage concludes, we will begin the second stage.

Do you have any questions?

Second stage

You will see how much the individual group members have earned in the first stage. Please note that who is in your group is randomly determined in each period; the individuals in your group are likely to change over the course of the experiment.

You will now have the opportunity to **change** or **leave unchanged** the income of each of the other group members. You can decrease their income by allocating negative tokens. The other group members can also reduce your income, if they so wish.

You must decide how many negative or positive tokens to give to each of the other three group members and then enter a number for each of them in the boxes labeled "positive tokens" and "negative tokens". If you do not want to change the income of a particular group member, you enter 0 in each box. If you do want to distribute negative tokens, enter the number you want to allocate into the box labeled "negative tokens". If you do want to distribute positive tokens, enter the number you want to allocate into the box labeled "positive tokens". You can move from one input field to the other by pressing the tab-key or by using the mouse.

If you distribute positive or negative tokens, you must pay a cost for each of the tokens you allocate. **Positive and negative tokens are integers between 0 and 10.** The more tokens you allocate, the higher your costs. The following formula indicates how much it costs to allocate tokens:

$$\text{Cost of tokens} = \text{Sum of allocated positive and negative tokens.}$$

Each token therefore costs you 1 token. If, for instance, you allocate 2 negative tokens to one group member, you must pay a cost of 2 tokens. If you allocate 9 positive tokens to another member, it will cost you an additional 9 tokens; if you allocate 0 negative and positive tokens to the last group member, there will be no additional cost. Therefore, you have allocated a total of 11 tokens and your **total costs** are 11 tokens (2+9+0).

Each negative token you allocate to a group member reduces his or her income by 3 tokens. If you allocate 0 tokens to a certain group member, you do not change the income of this group member. If, however, you allocate **one negative token** to a group member, you reduce his or her income by **3 tokens**. If you allocate **2 negative tokens** to a group member, you reduce his or her income by **6 tokens**. Similarly, if you allocate **one positive token** to a group member, you increase his or her income by **3 tokens**. If you allocate **2 positive tokens** to a group member, you increase his or her income by **6 tokens**.

Whether or by how much the income at the end of the period is in total increased or decreased depends on the total of the received tokens. If somebody receives a **total of 3 negative tokens** (from all other group members in this period), then his or her income would be decreased by **9 tokens**. If somebody receives a total of 4 **positive tokens**, his or her income is increased by **12 tokens**. Your total income from the two stages is therefore calculated as follows:

Total income (in tokens) at the end of the period = period income =

$$\begin{aligned}
 &= \text{income from first stage (1)} \\
 &\quad + 3 * (\text{sum of received } \textit{positive} \text{ tokens}) \text{ (2)} \\
 &\quad - 3 * (\text{sum of received } \textit{negative} \text{ tokens}) \text{ (3)} \\
 &\quad - \text{costs of your } \textit{allocated} \text{ tokens allocated to others (4)} \\
 &\quad \text{if } (1) + (2) + (3) + (4) \geq 0; \\
 &= \mathbf{0} - \text{costs of your distributed tokens} \\
 &\quad \text{if } (1) + (2) + (3) + (4) < 0
 \end{aligned}$$

Please note that your income in tokens at the end of the period can be negative, if the costs of your distributed tokens exceed your income in tokens minus the cost of received negative tokens plus the cost of received positive tokens. **You can however avoid such losses with certainty through your own decisions!** After all participants have made their decision, your income from the period will be displayed on the screen.

Do you have further questions?

Control questions: Please answer all questions and write down how you have calculated the result! If you have questions please ask us!

1. At the second stage you distribute the following negative tokens to your three other group members: 9, 5, 0. What are the total costs of your distributed tokens?.....
2. What are your costs if you distribute a total of 0 negative tokens?.....
3. By how many tokens will your income from the first stage be reduced, when you receive a total of 0 negative tokens from the other group members?.....
4. By how many tokens will your income from the first stage be decreased, when you receive a total of 4 negative tokens from the other group members?.....
5. By how many tokens will your income from the first stage be reduced, when you receive a total of 15 negative tokens from the other group members?.....

Public Goods Game

You are now taking part in an economic experiment which has been financed by various foundations for research. If you read the following instructions carefully, you can, depending on your decisions, earn a considerable amount of money. It is therefore very important that you read these instructions carefully.

The instructions which we have distributed to you are solely for your private information. **It is prohibited to communicate with the other participants during the experiment.** Should you have any questions please ask us.

During the experiment we will not speak of Dollars but rather of tokens. During the experiment your entire earnings will be calculated in tokens. At the end of the experiment the total amount of tokens you have earned will be converted to Dollars at the following rate:

1 token = 4 cents.

At the end of the experiment your entire earnings from the experiment and the 5 dollar show up fee will be immediately paid to you in cash.

The experiment is divided into periods. In total, the experiment has six periods. In each period the participants are divided into groups of four. That is, your group has three other participants in it aside from you. Group composition will change in each period. **In each of the six periods your group of four is composed of different people. Therefore, in each of the six periods you will form a group with three different people.**

At the beginning of each period each participant receives **20 tokens**. In the following pages we call this his or her endowment. Your task is to decide how to use your endowment. You have to decide how many of the 20 tokens you want to contribute to a **project** and how many of them to keep for yourself. The consequences of your decision are explained in detail below.

First Stage

At the beginning of each period an *input screen* for the first stage will appear. The **period number** appears in the top left corner of the screen. In the top right corner you can see how many more **seconds** remain for you to decide on the distribution of your tokens. Your decision must be made before the time displayed is 0 seconds.

Your **endowment in each period is 20 tokens**. You have to decide how many tokens you want to contribute to the project by typing a number between 0 and 20 in the input field. This field can be reached by clicking it with the mouse. Deciding how many tokens to contribute to the project means you have also decided how many tokens you keep for yourself: This is **(20 - your contribution)** tokens. After entering your contribution you have to press the **O.K. button** (either with the mouse, or by pressing the Enter - key). Once you have done this your decision can no longer be revised.

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

your contribution). Also this screen shows you how many tokens you have earned at the first stage.

Your income in the first stage consists of two parts:

- (1) the tokens which you have kept for yourself (“**Income from tokens kept**”).
- (2) the “**Income from the project**”.

This income is calculated as follows:

$$\text{Your income from the project} = 0.4 \text{ times the total contribution of all 4 group members to the project.}$$

Your **income in tokens** at the first stage of a period is therefore:

$$(20 - \text{your contribution to the project}) + 0.4 * (\text{total contributions to the project}).$$

The income of each group member from the project is calculated in the same way, this means that each group member receives the same income from the project. Suppose the sum of the contributions of all group members is 60 tokens. In this case each member of the group receives an income from the project of: $0.4 * 60 = 24$ tokens. If the total contribution to the project is 9 tokens, then each member of the group receives an income of $0.4 * 9 = 3.6$ tokens from the project.

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

After the first stage concludes, we will begin the second stage.

Do you have any questions?

Control questions: Please answer all questions and write down how you have calculated the result! If you have questions please ask us!

1. Each group member has an endowment of 20 tokens. Nobody (including yourself) contributes any token to the project at the first stage. What is:

Your income from the first stage?.....

The income of the other group members from the first stage?.....

2. Each group member has an endowment of 20 tokens. You contribute 20 tokens to the project at the first stage. All other group members each contribute 20 tokens to the project at the first stage. What is:

Your income from the first stage?.....

The income of the other group members from the first stage?.....

3. Each group member has an endowment of 20 tokens. The other three group members contribute together a total of 30 tokens to the project.

a) What is your income from the first stage if you contribute a further 0 tokens to the project?.....

b) What is your income from the first stage if you contribute a further 15 tokens to the project?.....

4. Each group member has an endowment of 20 tokens. You contribute 8 tokens to the project.

a) What is your income from the first stage if the other group members together contribute a further total of 7 tokens to the project?.....

b) What is your income from the stage if the other group members together contribute a further total of 22 tokens to the project?.....

Second stage

After the income screen an *information screen* appears which will inform you about the contribution and income of the individual group members.

You will see how much the individual group members have contributed to the project. Your contribution to the project is always written in the first row, while the contributions of the other three group members in each round are written in another row (according to a random order). Please note that who is in your group is randomly determined in each period; the individuals in your group are likely to change over the course of the experiment. In addition to the absolute contributions to the project the contribution in percentage is also displayed.

You will now have the opportunity to **change** or **leave unchanged** the income of each of the other group members by allocating **negative tokens**. The other group members can also reduce **your** income, if they so wish.

You must decide how many negative tokens to give to each of the other three group members and then enter a number for each of them. If you do not want to change the income of a particular group member, you enter 0. If you do want to distribute negative tokens, enter the number you want to allocate. You can move from one input field to the other by pressing the tab-key or by using the mouse.

If you distribute negative tokens, you must pay a cost for each of the negative tokens you allocate. **Negative tokens are integers between 0 and 10**. The more negative tokens you allocate, the higher your costs. The following formula indicates how much it costs to allocate negative tokens:

$$\text{Cost of negative tokens} = \text{Sum of allocated negative tokens.}$$

Each negative token therefore costs you 1 token. If, for instance, you allocate 2 negative tokens to one group member, you must pay a cost of 2 tokens. If you allocate 9 negative tokens to another member, it will cost you an additional 9 tokens; if you allocate 0 negative tokens to the last group member, there will be no additional cost. Therefore, you have allocated a total of 11 negative tokens and your **total costs** are 11 tokens (2+9+0).

Each negative token you allocate to a group member reduces his or her income by 3 tokens. If you allocate 0 tokens to a certain group member, you do not change the income of this group member. If, however, you allocate **one negative token** to a group member, you reduce his or her income by **3 tokens**. If you allocate **2 negative tokens** to a group member, you reduce his or her income by **6 tokens**.

Whether or by how much the income at the end of the period is in total increased or decreased depends on the total of the received positive or negative tokens. If somebody receives a **total of 3 negative tokens** (from all other group members in this period), then his or her income would be decreased by **9 tokens**. If somebody receives a total of **4 negative tokens**, his or her income is reduced by **12 tokens**. The income received in the first stage cannot be reduced below zero regardless of how many negative tokens are received. If anybody receives **10 or more** negative tokens their income from the first stage will be reduced to zero. Your total income from the two stages is therefore calculated as follows:

Total income (in tokens) at the end of the period = period income =

$$\begin{aligned}
 &= \text{income from first stage (1)} \\
 &\quad - 3 * (\text{sum of received } \textit{negative} \text{ tokens) (2)} \\
 &\quad - \text{costs of you're the negative tokens allocated to others} \\
 &\qquad\qquad\qquad \textit{if} (1) + (2) \geq 0;
 \end{aligned}$$

$$\begin{aligned}
 &= \mathbf{0} - \text{costs of your distributed tokens} \\
 &\qquad\qquad\qquad \textit{if} (1) + (2) < 0
 \end{aligned}$$

Please note that your income in tokens at the end of the period can be negative, if the costs of your distributed tokens exceed your income in positive tokens minus the cost of received negative tokens. **You can however avoid such losses with certainty through your own decisions!** After all participants have made their decision, your income from the period will be displayed on the screen.

Do you have further questions?

Control questions: Please answer all questions and write down how you have calculated the result! If you have questions please ask us!

1. At the second stage you distribute the following negative tokens to your three other group members: 9, 5, 0. What are the total costs of your distributed tokens?.....
2. What are your costs if you distribute a total of 0 negative tokens?.....
3. By how many tokens will your income from the first stage be reduced, when you receive a total of 0 negative tokens from the other group members?.....
4. By how many tokens will your income from the first stage be reduced, when you receive a total of 4 negative tokens from the other group members?.....
5. By how many tokens will your income from the first stage be reduced, when you receive a total of 15 negative tokens from the other group members?.....

Survey

1. Are you male or female? (Male / Female)

2. What is your AGE? (___ years)

3. Which of the following categories best describes you? (Asian / Black / Hispanic-Latino / Native-American / White / Other)

4. What is your citizenship status in the United States? (U.S. Citizen / Resident Alien / Non-Resident Alien / Other Status)

5. Please choose the category that describes the total amount of income earned in 2004 by your FAMILY. Consider all forms of income, including salaries, tips, interest and dividend payments, scholarship support, student loans, parental support, social security, alimony, and child support, and others. (\$15,000 or under / \$15,001 - \$25,000 / \$25,001 - \$35,000 / \$35,001 - \$50,000 / \$50,001 - \$65,000 / \$65,001 - \$80,000 / \$80,001 - \$100,000 / over \$100,000 / don't know)

6. We hear a lot of talk these days about liberals and conservatives. Here is a scale on which the political views that people might hold are arranged from extremely liberal to extremely conservative. Where would you place yourself on this scale?

very liberal
 liberal
 slightly liberal
 moderate
 slightly conservative
 conservative
 very conservative

7. Generally speaking, do you usually think of yourself as a REPUBLICAN, a DEMOCRAT, or what?

Strong Democrat
 Democrat
 Independent, But Closer to Democrats
 Independent
 Independent, But Closer to Republicans
 Republican
 Strong Republican