

## Online Appendix

### Letting off Steam! Experimental Evidence on Displaced Aggression

#### Appendix A: Instructions and control questions

English translation of the instructions and control questions for the players in the role of *Player C* in the *Chance* treatment.

General instructions for participant C

We are pleased to welcome you to this economic experiment.

If you read the following instructions carefully, you can earn money, depending on your decisions and those of the other participants. It is thus very important that you read these instructions carefully. If you have questions, please ask us.

**Communication with other participants during the experiment is strictly forbidden.** Not following this rule will result in exclusion from the experiment and any payments.

During the experiment, we will not speak of Euros, but points. Your entire income will first be calculated in points. The total number of points you earn during the experiment will be converted into Euros at the end of the experiment, where the following conversion rate applies:

**5 Points = 1 Euro.**

At the end of today's experiment, you will receive the number of points earned during the experiment in **cash**.

We will explain the exact experimental procedure on the next pages.

### The Experiment

**At the beginning of the experiment, three other participants in the experiment will be randomly assigned to you.** You will never learn of the identity of the three persons assigned to you before or after the experiment, nor will the persons assigned to you learn of your identity.

There are three types of participants in this experiment: participants A, B, and C. **You are a participant C.** The three other persons assigned to you are one participant A and one participant

B and one participant C. (There is thus one participant A, one participant B, and there are two participants C).

**In this experiment, 100 points will be distributed between the four participants according to Allocation 1 or Allocation 2.**

- **Allocation 1:** Participants A and B receive 45 points each and the two participants C receive 5 points each.
- **Allocation 2:** Participant A, participant B and both participants C receive 25 points each.

**Participant A can either choose Allocation 1 or delegate the decision to a computer that generates Allocation 1 in 50% of the cases and Allocation 2 in 50 % of the cases.**

The table below provides an additional summary of the possible outcomes:

	Participant A's points	Participant B's points	One participant C's points	The other participant
Participant A chooses Allocation 1	45	45	5	5
Participant A delegates and computer generates Allocation 1	45	45	5	5
Participant A delegates and computer generates Allocation 2	25	25	25	25
Participant A delegates and computer generates Allocation 1	25	25	25	25

Either you or the other participant C will be chosen randomly. Only the decision of the randomly chosen participant C will determine the payoff outcomes of the game. You will be informed about the random choice of participant C by the computer after you make all your decisions.

**As participant C, you have the possibility of giving up your points to deduct points from participant B and/or the other participant C. For each point that you give up, 5 points will be deducted from the corresponding participant(s) that you choose. In the case of both allocations 1 or 2, you may give up at most 5 of your points for deducting points from the other participants. However, a participant can never have more points deducted than he or she**

earned from Allocation 1 or 2.

**Participant A is impune, which means that no points can be deducted from participant**

**A. Participant B cannot make any decisions in this Experiment.**

Example 1: Participant A chooses Allocation 1 and the randomly chosen participant C gives up 2 points to deduct  $2 \times 5 = 10$  points from participant B. The following payments then result:

	Participant A	Participant B	The other participant C	The chosen participant C
Allocation	45	45	5	5
Deductions	-	<b>2x5</b>	<b>0x5</b>	2
Payments?	45	45-10=35	5-0=5	5-2=3

Example 2: Participant A delegates the decision and the computer generates Allocation 2 and the randomly chosen participant C gives up 2 points to deduct  $1 \times 5 = 5$  points from participant B and  $1 \times 5 = 5$  points from the other participant C. The following payments then result:

	Participant A	Participant B	The other participant C	The chosen participant C
Allocation	25	25	25	25
Deductions	-	<b>1x5</b>	<b>1x5</b>	2
Payments?	25	25-5=20	25-5=20	25-2=23

Example 3:

The randomly chosen participant C does not give up any points to deduct points from other participants. The points shown on the previous page will then result, depending on the respective allocation.

**Your decisions:**

Before you, as participant C, learn which allocation is chosen/generated, and before you know whether you or the other participant C were chosen randomly, we ask you to **make your decision for each of the following three cases:**

- Participant A decides for Allocation 1 (45 45 5 5)

- Participant A delegates the decision and the computer generates Allocation 1 (45 45 5 5)
- Participant A delegates the decision and the computer generates Allocation 2 (25 25 25 25)

Please decide if you would like to deduct points or not, and if yes, how many points would you like to give up to deduct points from the other participants.

Participant A makes his or her decision without knowing what you or the other participant C would do in the two cases.

**If you are randomly chosen, your decision for that case which arises from participant A's decision will be implemented.**

**Your decisions for each of the three cases can therefore be applicable for your payment.**

**Procedure on the Computer:**

If you are randomly chosen, the decision you make for the case stemming from the decisions of participant A will be implemented. Therefore, each of your three decisions can be relevant for your payment. Please enter your decisions on the following screen:

Periode 1 von 1

Sie sind Spieler C.

Fall: Teilnehmer A wählt die folgende Aufteilung:

A erhält 45  
B erhält 45  
C erhält 5

Wollen Sie Punkte abziehen?  JA  
 NEIN

OK

The example above shows the possible case “**participant A decides for the allocations 45 45 5 5**”.

The screens for the other two outcomes, in which participant A delegates the decision, appear correspondingly. Thus, please take exact note of which case you are making your decisions for!

If you click "YES", the following screen appears:

Periode 1 von 1

Sie sind Spieler C.

Fall: Teilnehmer A wählt die folgende Aufteilung:

A erhält 45  
B erhält 45  
C erhält 5

Wollen Sie Punkte abziehen?  JA  NEIN

**Für jeden Punkt, den Sie ausgeben, werden dem entsprechenden Mitspieler 5 Punkte abgezogen.**  
Spieler A ist immun; das heißt, dass keine Punkte von Spieler A abgezogen werden können.

Wie viele Ihrer Punkte möchten Sie ausgeben, um ...

Punkte von Spieler B abzuziehen?

Punkte von Spieler C abzuziehen?

OK

**If you click "YES", you can enter the desired amount of point(s) you would like to give up for making five-fold deductions from the other player(s)' earnings in the corresponding two fields. Hence, five points will be deducted from the corresponding participant for every point that you give up.**

**If you click "NO", the field with the black edge will not appear (or it will disappear again) and you cannot deduct any points.**

Once you have made your decision, please click the "OK" button in the lower right corner. You can change your decisions as long as you have not clicked this button.

An example follows on the next page.

Periode 1 von 1

Sie sind Spieler C.

Fall: Teilnehmer A wählt die folgende Aufteilung:

A erhält 45  
B erhält 45  
C erhält 5

Wollen Sie Punkte abziehen?  JA  
 NEIN

**Für jeden Punkt, den Sie ausgeben, werden dem entsprechenden Mitspieler 5 Punkte abgezogen.**  
Spieler A ist immun; das heißt, dass keine Punkte von Spieler A abgezogen werden können.

Wie viele Ihrer Punkte möchten Sie ausgeben, um ...

Punkte von Spieler B abzuziehen?

Punkte von Spieler C abzuziehen?

OK

In this example, participant C would like to deduct points. He or she has thus clicked on "YES" and the field with the black edge appears. Participant C deducts  $2 \times 5 = 10$  points from participant B and  $1 \times 5 = 5$  points from the other participant C. (This is only an example, and neither a suggestion nor a hint about how you should act.)

After you click the "OK" button, you will get to the next case. You can change your decision as long as you have not yet clicked this button.

**Afterward, we will ask you hypothetical questions on how many points you would have liked to give up to deduct five-fold of those points from each of the participants if participant A would not have been impune. If you click "YES", you would be able to enter the desired amount of point(s) you would like to give up for deductions in three fields that correspond to each of your co-players.**

**Moreover, we would like to know your expected estimates regarding the decisions made by the other participants.**

**At the very end, we kindly ask you to fill in a questionnaire. All information collected will most certainly be handled with full confidentiality. Do you have any remaining questions?**

## Practice Questions

Please answer the following practice questions. They only serve to make you more acquainted with the experiment. **The decisions and numerical values in the practice questions are chosen on a purely random basis and are not to be considered as a hint or suggestion as to how you could decide.** Your answers to the practice questions will not affect your payment at the end of the experiment.

1. Whose decisions are relevant for the payment at the end of the experiment?
  
2. Participant A chooses Allocation 1. One participant C is randomly chosen and decides to deduct the point values (written in bold). Please determine the payments which result.

	Participant A	Participant B	The other participant C	The chosen participant C
Allocation	45	45	5	5
Deduction	-	<b>3x5</b>	<b>1x5</b>	
Payments?				

3. Participant A delegates the decision and the computer generates Allocation 1. One participant C is randomly chosen and decides to deduct the point values (written in bold). Please determine the payments which result.

	Participant A	Participant B	The other participant C	The chosen participant C
Allocation	45	45	5	5
Deduction	-	<b>3x5</b>	<b>0</b>	
Payments?				

**We would again like to emphasize that the decisions and numerical values in the practice questions are chosen on a purely random basis and are not to be considered as a hint or suggestion as to how you could decide.**

Please raise your hand after you have solved all the practice questions. We will come to your



seat and check your answers.

Once we have checked your answers, it is advisable to seriously consider your decisions in the experiment.

## Appendix B: Correction for multiple hypotheses testing using the Benjamini and Hochberg (1995) correction procedure

### Summary of adjusted significance levels of two-sided Fisher's exact tests

#### (Part I): Comparisons of punishment behavior for each of the subject pools separately

1) Intentional unfair distributions in Baseline vs. Chance treatments, 2) Intentional vs. chance-generated unfair distributions in the Chance treatment, 3) Intentional fair distribution in Baseline treatment vs. chance-generated fair distribution in the Chance treatment

	Unfair Intentional		Unfair Chance	Fair Intentional / Chance	
	Baseline	Chance	Chance	Baseline	Chance
Students	-			-	
		-			
Soldiers	-			-	
		-			
Frisbee players	-			-	
		-			

#### (Part II): Comparison for punishment behavior between subject pools

	Unfair Intentional			Unfair Chance			Fair Intentional / Chance			
	Basel.	Chance		Chance			Basel.	Chance		
Students		*	-			-				-
Soldiers	-			-			-	-		
Frisbee players			*		-				-	

*Note:* Adjusted levels of significance are denoted by \*\*\*:  $p < 0.001$ , \*\*  $< 0.01$ , and \*:  $p < 0.05$ . Levels of adjusted significance refer to p-values that are corrected for multiple hypotheses testing using the Benjamini and Hochberg (1995) correction procedure with 18 comparisons of punishment behavior.

## Appendix C: Theoretical Predictions

In its most general form, utility, according to the Fehr-Schmidt (FS) model, is:

$$u_i(x) = x_i - \alpha_i \frac{1}{n-1} \sum_{j \neq i} \max \{x_j - x_i, 0\} - \beta_i \frac{1}{n-1} \sum_{j \neq i} \max \{x_i - x_j, 0\}$$

where  $x$ -s represent the material payoffs for the different players and  $n$  is the number of players in the group. According to the FS model, subjects experience disutility from feelings of envy towards co-players that have higher payoffs than them. Subjects also experience disutility from feelings of guilt towards co-players who have lower payoffs than them. The strengths of these feelings for an individual are represented by the parameters  $\alpha_i$  and  $\beta_i$ , respectively.

Let's assume Player A has directly chosen the unfair distribution, Player C could then, for example:

- i) choose not to punish anyone. In this case, Player A and Player B have 45 points each and the 2 Player Cs have 5 points each.
- ii) choose to punish passive Player B by 1 point. In this case, Player A would still have 45 points, player B would have 40 points (= 45 - 5), the other Player C would still have 5 points, and the chosen and punishing Player C would have 4 points (= 5 - 1);

The utility equations for these two scenarios would be:

- i)  $u_C(45, 45, 5, 5) = 5 - \alpha_C \frac{2}{3} (45 - 5)$ , since there are then 2 players who are better off than the chosen Player C (by 40 points) and no player that is worse off than the chosen player C.  
 $u_C(45, 45, 5, 5) = 5 - \frac{80}{3} \alpha_C$ .
- ii)  $u_C(45, 40, 5, 4) = 4 - \alpha_C \frac{1}{3} (45 - 4) - \alpha_C \frac{1}{3} (40 - 4) - \alpha_C \frac{1}{3} (5 - 4)$ . In this case, the chosen Player C has given up one point to punish Player B by 5 points. Therefore, there are now 3 co-players that are better off (in different amounts) than Player C.  $u_C(45, 40, 5, 4) = 4 - \frac{78}{3} \alpha_C$ .

Given these calculations, the chosen Player C should choose to punish Player B by one point if  $u_C(45, 40, 5, 4) > u_C(45, 45, 5, 5)$ . This expression holds, when  $\alpha$  is sufficiently high:  $\alpha_C > 3/2$ .

- *Between-subject (treatment) comparison (Research Question 2)*

Since the dictator's direct choice for unfairness results in the same distribution in both treatments, the FS model in both treatments predicts the same punishment behavior on the part of Player C.

- *Within-subject comparison (Research Question 3)*

According to the FS model, it should not matter if the unfair distribution has been caused by A's bad intentions or bad luck randomly generated by either the computer or the coin flip (depending on the session). If subjects have inequity-averse preferences, these two scenarios of Chance treatment have the same payoff structure, and therefore must result in the same punishment behavior, which depends on the individual's envy parameter  $\alpha$ . Subjects with a sufficiently high  $\alpha$  ( $>1.5$ ) should punish Player B in both scenarios. For these sufficiently envious player Cs, this punishment pattern would bring their payoff closer to the payoff of Player B and would thereby boost their utility.

- *Who should get punished in unfair distributions?*

A Player C with FS preferences should never punish the co-playing Player C. Since unfair distribution leaves the two Player Cs with equal endowments, the punishment of the other Player C could only cause disutility to the punishing Player C.

- *Should subjects punish in fair distributions?*

In the case of fair distribution, all four co-players have an equal endowment. Punishment in this case can only create disutility. Therefore, according to the FS model, no punishment should be observed in the case of fair distribution.