Not for Publication

Online Supplementary Materials for,

"Teams do inflict costly third party punishment as individuals do: experimental evidence"

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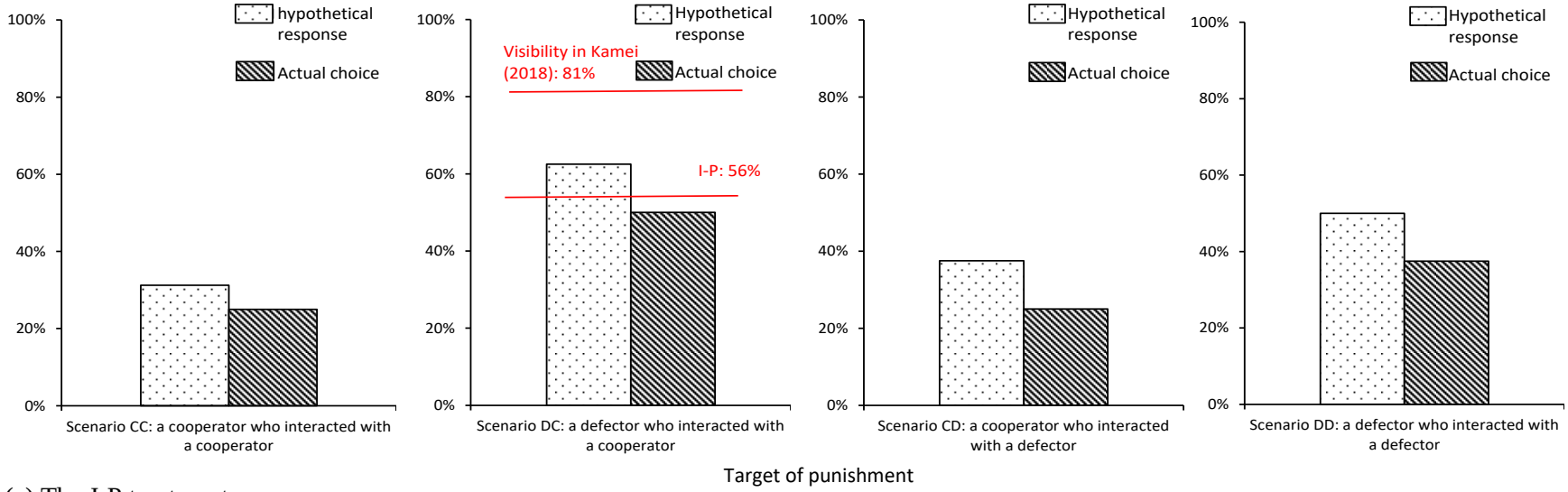
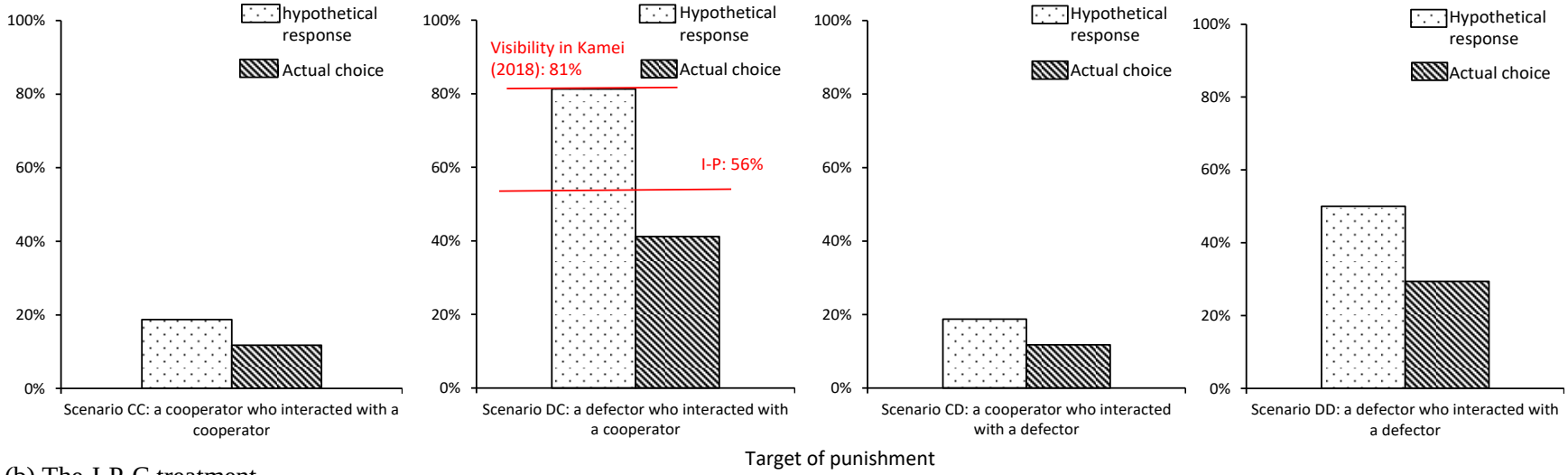
Appendix A: Additional Figures and Tables

Figure S1: *Percentages of Third Party Players who Engage in Punishment in the J-P and J-P-C treatments*



(a) The J-P treatment



(b) The J-P-C treatment

Table S1: *PD Players' Sending Rates and Third Party Punishers' Beliefs on the Number of Cooperators*

(1) Test Results for the Differences in the PD Players' Sending Rate between the Treatments

	I-P	J-P	J-P-C
I-P	---	.2107	1.000
J-P	---	---	.2235
J-P-C	---	---	---

Notes: Two-sided Fisher's exact tests. The numbers in this table are *p*-values.

*, **, and *** indicate significance at the 10 percent level, at the 5 percent level and at the 1 percent level, respectively.

(2) Test Results for the Differences in Third Party Punishers' Beliefs between the Treatments

	I-P	J-P	J-P-C
I-P	---	.8878	.7059
J-P	---	---	.7566
J-P-C	---	---	---

Notes: Two-sided Mann-Whitney tests. The numbers in this table are *p*-values.

*, **, and *** indicate significance at the 10 percent level, at the 5 percent level and at the 1 percent level, respectively.

Table S2: *The Differences in the Frequency of Third party Punishment between Scenarios in the Two Joint-Decision Treatments (supplementing Figure 1(a) of the paper)*

(I) The J-P Treatment

	Scenario CC	Scenario DC	Scenario CD	Scenario DD
Scenario CC	---	.4982	1.0000	.7225
Scenario DC	---	---	.4982	.7539
Scenario CD	---	---	---	.7225
Scenario DD	---	---	---	---

(II) The J-P-C Treatment

	Scenario CC	Scenario DC	Scenario CD	Scenario DD
Scenario CC	---	.2575	1.0000	.4192
Scenario DC	---	---	.2575	.7419
Scenario CD	---	---	---	.4192
Scenario DD	---	---	---	---

Remark: The following table shows the comparison results for the I-P Treatment:

	Scenario CC	Scenario DC	Scenario CD	Scenario DD
Scenario CC	---	.3603	1.0000	.5322
Scenario DC	---	---	.5487	.7773
Scenario CD	---	---	---	.7572
Scenario DD	---	---	---	

Notes: Two-sided Fisher's exact tests. The numbers in these tables are two-sided *p*-values.
*, **, and *** indicate significance at the 10 percent level, at the 5 percent level and at the 1 percent level, respectively.

Table S3: *The Differences in Average Punishment Points between Scenarios in the Two Joint-Decision Treatments (supplementing Figure 1(b) of the paper)*

(I) The J-P Treatment

	Scenario CC	Scenario DC	Scenario CD	Scenario DD
Scenario CC	---	.0084***	.1573	.0608*
Scenario DC	---	---	.0006***	.0158**
Scenario CD	---	---	---	.0048***
Scenario DD	---	---	---	---

(II) The J-P-C Treatment

	Scenario CC	Scenario DC	Scenario CD	Scenario DD
Scenario CC	---	.0010***	.9832	.0530*
Scenario DC	---	---	.0016***	.1874
Scenario CD	---	---	---	.0530*
Scenario DD	---	---	---	---

Remark: The following table shows the comparison results for the I-P Treatment:

	Scenario CC	Scenario DC	Scenario CD	Scenario DD
Scenario CC	---	.0394**	.6045	.1716
Scenario DC	---	---	.0367**	.4188
Scenario CD	---	---	---	.0481**
Scenario DD	---	---	---	

Notes: Two-sided Wilcoxon signed ranks tests. The numbers in these tables are two-sided *p*-values.
*, **, and *** indicate significance at the 10 percent level, at the 5 percent level and at the 1 percent level, respectively.

Table S4: *Pre-Communication Willingness to Punish in the J-P and J-P-C Treatments versus Punishment Intensity in the I-P Treatment and in the Visibility Treatment of Kamei (2018) [21] in Scenario DC (supplementing Figure 2 of the paper)*

(1) Test Results for the Null Hypothesis under Scenario DC: Pre-communication punishment points in the joint-decision treatment = Actual punishment points observed in the I-P treatment

	J-P treatment versus I-P treatment	J-P-C treatment versus I-P treatment
p-value (two-sided)	.0303**	.0562*

Notes: Mann-Whitney test results. *, **, and *** indicate significance at the 10 percent level, at the 5 percent level and at the 1 percent level, respectively.

(2) Test Results for the Null Hypothesis: Pre-communication punishment points in the joint-decision treatment = Actual punishment points in the Visibility treatment

	J-P treatment versus Visibility treatment	J-P-C treatment versus Visibility treatment
p-value (two-sided)	.5961	.3058

Notes: Mann-Whitney test results. *, **, and *** indicate significance at the 10 percent level, at the 5 percent level and at the 1 percent level, respectively.

Result: *Members in the pairs in the J-P (J-P-C) treatment exhibit significantly (weakly significantly) stronger willingness to punish in Scenario DC before communication, compared with individuals in the I-P treatment. The levels of pre-communication willingness to punish in the J-P and J-P-C treatment are at similar levels to the Visibility treatment of Kamei (2018) [21].*

Table S5: *Decreases in the Willingness to Punish through Communication in the J-P and J-P-C Treatments (supplementing Figure 2 of the paper)*

	Scenario CC	Scenario DC	Scenario CD	Scenario DD
J-P treatment				
Actual punishment points *minus* Pre-communication punishment points	–0.28 points	–2.89 points	–0.33 points	–1.31 points
p-value (two-sided)[#1]	.9515	.0171**	.1888	.0995*
J-P-C treatment				
Actual punishment points *minus* Pre-communication punishment points	0.03 points	–2.74 points	–0.50 points	–0.56 points
p-value (two-sided) [#1]	1.0000	.0107**	.6350	.0873*

Notes: [#1] *p*-values for Wilcoxon signed ranks tests. *, **, and *** indicate significance at the 10 percent level, at the 5 percent level and at the 1 percent level, respectively.

Result: *Third parties in the J-P and J-P-C treatments decreased willingness to punish in Scenario DC significantly through communication. They also decreased willingness to punish in Scenario DD weakly significantly through communication.*

Appendix B: Instructions used in the Experiment

B.1. The J-P treatment

[The following are the instructions used in the J-P treatment:]

At the beginning of this experiment, you will be randomly assigned to a group of 4. All members in your group are then randomly assigned identification numbers 1, 2, 3 and 4. That is, each member is assigned either number with a probability of 1/4 (= 25.0%). The same numbers will not be assigned to 2 members in a group. We call a subject who is assigned number k "player k." In each group, 4 members are named as player 1, player 2, player 3 and player 4. The experiment consists of 2 phases.

Phase 1

In this phase, each of player 1 and player 2 is assigned an endowment of 25 points, and simultaneously decides whether or not to send 10 points to each other. If player 1 sends 10 points to player 2, the 10 points will be tripled and becomes earnings of player 2. Likewise, if player 2 sends 10 points to player 1, the 10 points will be tripled and becomes earnings of player 1.

There are 4 possible situations.

(a) Both player 1 and player 2 send 10 points to their counterparts. In this situation, each player obtains $25 - 10 + 3 \times 10 = 45$ points.

(b) Player 1 sends 10 points to player 2, but player 2 does not send 10 points to player 1. In this situation, the earnings of player 1 are $25 - 10 = 15$ points. The earnings of player 2 are $25 - 0 + 3 \times 10 = 55$ points.

(c) Player 2 sends 10 points to player 1, but player 1 does not send 10 points to player 2. In this situation, the earnings of player 1 are $25 - 0 + 3 \times 10 = 55$ points. The earnings of player 2 are $25 - 10 = 15$ points.

(d) Neither player 1 nor player 2 sends 10 points to her counterpart. In this situation, player 1 and player 2 each obtain earnings of $25 - 0 = 25$ points.

You are not allowed to communicate with anyone during this decision stage. As indicated in the calculations above, your own earnings will be maximized when you do not send 10 points but your counterpart sends 10 points. However, if both player 1 and player 2 send 10 points to each other, the total earnings of the 2 players will be maximized and will be 45×2 points = 90 points; and each player obtains 45 points as earnings. Your earnings will be minimized if you send 10 points to your counterpart but your counterpart does not send 10 points to you.

While players 1 and 2 decide whether or not to send 10 points, players 3 and 4 are asked to answer how many persons among players 1 and 2 in their group (= 0, 1, 2) they think will send 10 points to their counterparts. The responses of players 3 and 4 to this question will not affect their earnings in the experiment.

Any questions?

Instructions for Phase 2:

In this phase, player 3 and player 4 form a pair in each group and are given an opportunity to jointly reduce earnings of players 1 and 2. In this phase, each pair is assigned an endowment of 40 points.

Each reduction point a pair allocates to reduce someone's earnings **reduces the pair's earnings by 1 point** and **reduces that individual's earnings by 3 points**.

Each pair will be asked to jointly make decisions for the following **four scenarios**:

(a) how many reduction points the pair would like to assign to a player that sent 10 points to his or her counterpart when the counterpart also sent 10 points to that player

(b) how many reduction points the pair would like to assign to a player that did not send 10 points to his or her counterpart when the counterpart sent 10 points to that player

(c) how many reduction points the pair would like to assign to a player that sent 10 points to his or her counterpart when the counterpart did not send 10 points to that player

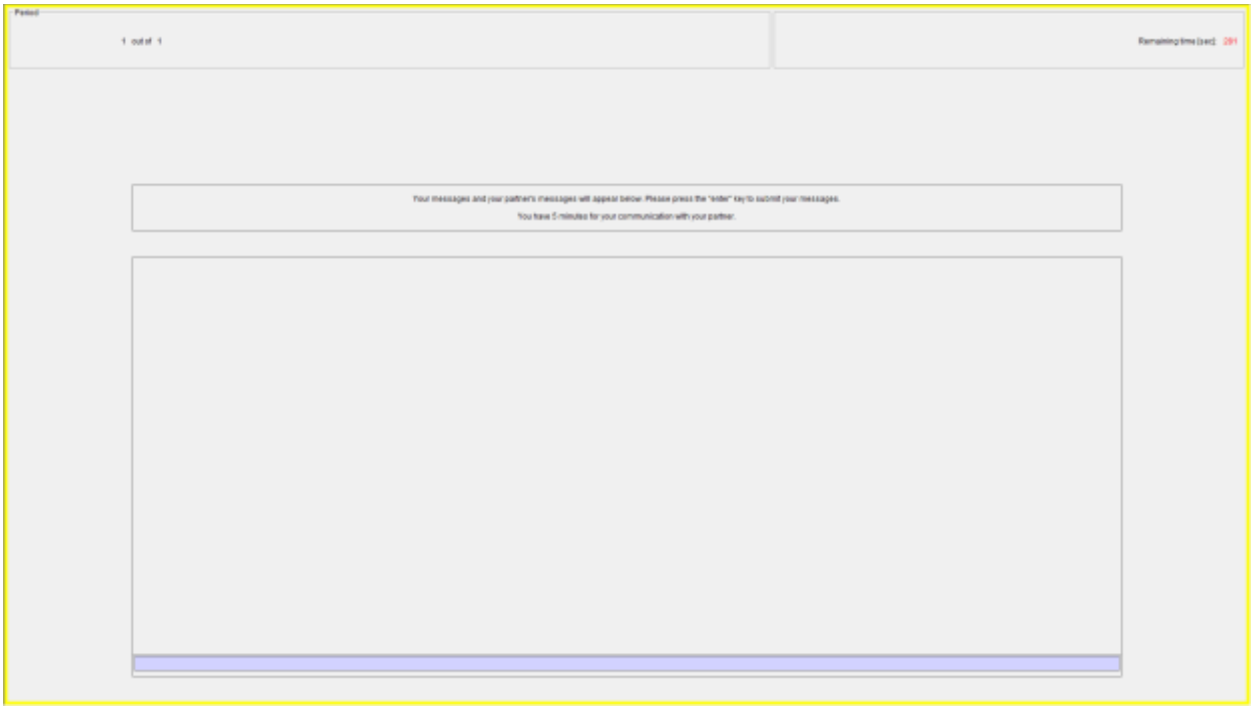
(d) how many reduction points the pair would like to assign to a player that did not send 10 points to his or her counterpart when the counterpart also did not send 10 points to that player

The reduction points to each player must be an integer. They must also be less than or equal to 20. One of the four decisions will be applied for player 1 and player 2 based on the two players' actual sending decisions. Player 3 and player 4 will be informed of the actual sending decisions of player 1 and player 2 in Phase 1 at the end of the experiment.

How to decide joint reduction decision in each pair:

Once phase 1 is over, player 3 and player 4 have five minutes to communicate using the computer to jointly decide reduction amounts for each of player 1 and player 2. Specifically, you can send any messages via a chat window as illustrated below. In this stage, you are not allowed to communicate verbally.

An example of the computer screen:



In the communication stage, any kind of offensive language is prohibited. Also, you are not allowed to convey any personal information nor information that can identify you including which seat you are sitting. With a clear violation of this rule you will be deducted 10 pounds from your today's payment. Once the communication stage is over, player 3 and player 4 each submit an agreed joint reduction amount targeted for **each of** player 1 and player 2 on their computer screens. Note that you need to decide joint reduction points contingent on each of the four scenarios mentioned above. Thus, you submit four reduction points in this stage. In case that you do not agree what you assign as a pair, you can submit whatever amount you prefer to reduce as a pair. If both you and your partner submit the same (agreed) amount, then the amount becomes your pair's joint reduction decision to a member in this period. If you and your partner submit different amounts, then one of the two is randomly selected by the computer as your pair's joint reduction amount. Once both players 3 and 4 press the "OK" button to submit their pair's reduction amounts, they will be informed of what reduction points their partner submitted in a scenario realized, at the end of the experiment.

How to calculate earnings:

Earnings of player 1 are calculated as:

Player 1's earnings in Phase 1

minus

Reduction amounts received from the pair consisting of players 3 and 4

If the earnings are negative, then the earnings will be 0. Earnings of player 2 are calculated with the same formula.

Earnings of player 3 and player 4 are the same between each other in each pair. That is, player 3 and player 4 each obtain earnings of:

40 – joint reduction points assigned to player 1 – joint reduction points assigned to player 2.

Comprehension Questions:

1. At the beginning of the experiment, you are assigned either players 1, 2, 3 or 4. Answer the following questions.

(a) What is the probability that you are assigned a role of player 1?

[ ]

(b) What is the probability that you are assigned a role of player 3 or player 4?

[ ]

2. Suppose that player 1 in a group sends 10 points to player 2, and player 2 does not send 10 points to player 1. What are the interim earnings of player 1? What are the interim earnings of player 2?

[ ]

3. Suppose that a pair jointly decides to impose 3 reduction points to a member. How many points are deducted from the earnings of the target? How many points are deducted from the earnings of each member of the pair?

Any questions? Once all questions are answered, we will start the experiment.

[Subjects were asked to answer the comprehension questions. After that, the experimenter explained the answers to make sure that the subjects understood the experiments fully.]

B.2. The J-P-C treatment

[The following are the instructions used in the J-P-C treatment:]

At the beginning of this experiment, you will be randomly assigned to a group of 4. All members in your group are then randomly assigned identification numbers 1, 2, 3 and 4. That is, each member is assigned either number with a probability of 1/4 (= 25.0%). The same numbers will not be assigned to 2 members in a group. We call a subject who is assigned number k "player k." In each group, 4 members are named as player 1, player 2, player 3 and player 4. The experiment consists of 2 phases.

Phase 1

In this phase, each of player 1 and player 2 is assigned an endowment of 25 points, and simultaneously decides whether or not to send 10 points to each other. If player 1 sends 10 points to player 2, the 10 points will be tripled and becomes earnings of player 2. Likewise, if player 2 sends 10 points to player 1, the 10 points will be tripled and becomes earnings of player 1.

There are 4 possible situations.

(a) Both player 1 and player 2 send 10 points to their counterparts. In this situation, each player obtains $25 - 10 + 3 \times 10 = 45$ points.

(b) Player 1 sends 10 points to player 2, but player 2 does not send 10 points to player 1. In this situation, the earnings of player 1 are $25 - 10 = 15$ points. The earnings of player 2 are $25 - 0 + 3 \times 10 = 55$ points.

(c) Player 2 sends 10 points to player 1, but player 1 does not send 10 points to player 2. In this situation, the earnings of player 1 are $25 - 0 + 3 \times 10 = 55$ points. The earnings of player 2 are $25 - 10 = 15$ points.

(d) Neither player 1 nor player 2 sends 10 points to her counterpart. In this situation, player 1 and player 2 each obtain earnings of $25 - 0 = 25$ points.

You are not allowed to communicate with anyone during this decision stage. None of the participants are informed of who interacts with whom as player 1 and player 2. As indicated in the calculations above, your own earnings will be maximized when you do not send 10 points but your counterpart sends 10 points. However, if both player 1 and player 2 send 10 points to each other, the total earnings of the 2 players will be maximized and will be 45×2 points = 90 points; and each player obtains 45 points as earnings. Your earnings will be minimized if you send 10 points to your counterpart but your counterpart does not send 10 points to you.

While players 1 and 2 decide whether or not to send 10 points, players 3 and 4 are asked to answer how many persons among players 1 and 2 in their group (= 0, 1, 2) they think will send

10 points to their counterparts. The responses of players 3 and 4 to this question will not affect their earnings in the experiment.

Any questions?

Instructions for Phase 2:

In this phase, player 3 and player 4 form a pair in each group and are given an opportunity to jointly reduce earnings of players 1 and 2. Players 3 and 4 will be informed of the seat numbers of the matched pair partners. Before players 3 and 4 decide joint reduction decisions, each pair is given 2 minutes to introduce themselves to their partner using a chat window.

In this phase, each pair is assigned an endowment of 40 points.

Each reduction point a pair allocates to reduce someone's earnings **reduces the pair's earnings by 1 point** and **reduces that individual's earnings by 3 points**.

Each pair will be asked to jointly make decisions for the following **four scenarios**:

(a) how many reduction points the pair would like to assign to a player that sent 10 points to his or her counterpart when the counterpart also sent 10 points to that player

(b) how many reduction points the pair would like to assign to a player that did not send 10 points to his or her counterpart when the counterpart sent 10 points to that player

(c) how many reduction points the pair would like to assign to a player that sent 10 points to his or her counterpart when the counterpart did not send 10 points to that player

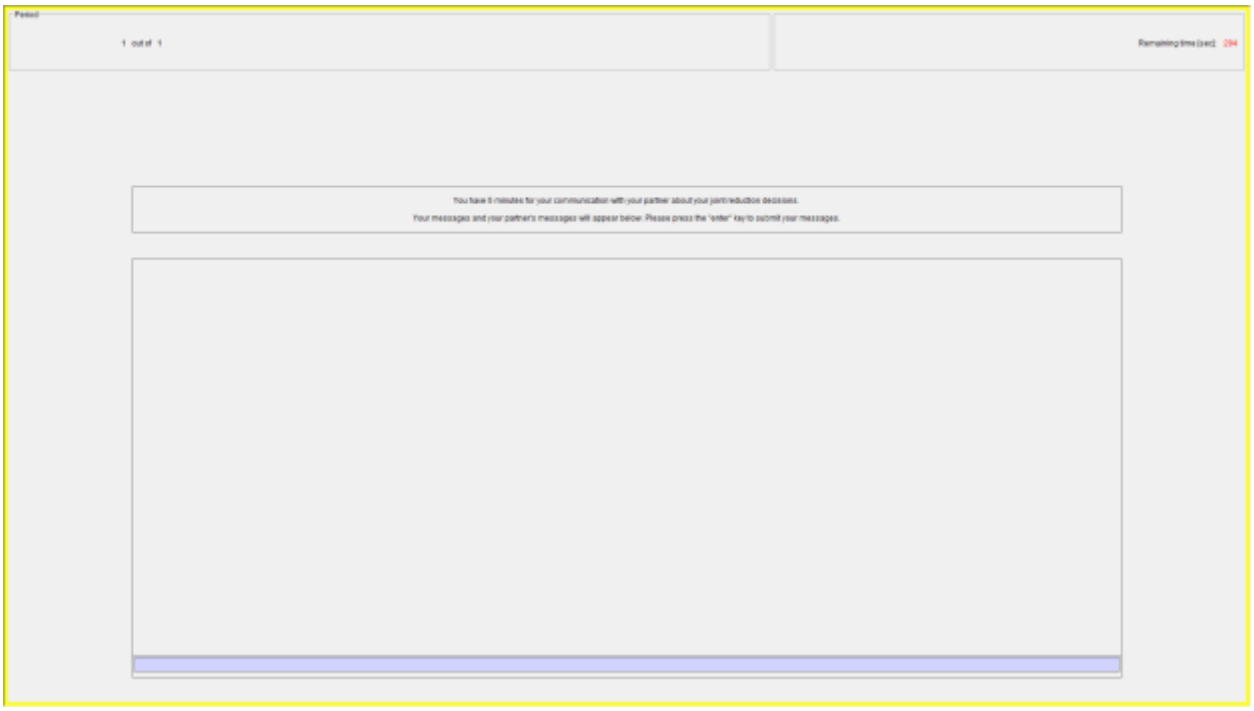
(d) how many reduction points the pair would like to assign to a player that did not send 10 points to his or her counterpart when the counterpart also did not send 10 points to that player

The reduction points to each player must be an integer. They must also be less than or equal to 20. One of the four decisions will be applied for player 1 and player 2 based on the two players' actual sending decisions. Player 3 and player 4 will be informed of the actual sending decisions of player 1 and player 2 in Phase 1 at the end of the experiment.

How to decide joint reduction decision in each pair:

After the two minutes for player 3 and player 4 to introduce themselves to each other is over, player 3 and player 4 have five minutes to communicate using the computer to jointly decide reduction amounts for each of player 1 and player 2. Specifically, you can send any messages via a chat window as illustrated below. In this stage, you are not allowed to communicate verbally.

An example of the computer screen:



In the communication stage, any kind of offensive language is prohibited. Once the communication stage is over, player 3 and player 4 each submit an agreed joint reduction amount targeted for **each of** player 1 and player 2 on their computer screens. Note that you need to decide joint reduction points contingent on each of the four scenarios mentioned above. Thus, you submit four reduction points in this stage. In case that you do not agree what you assign as a pair, you can submit whatever amount you prefer to reduce as a pair. If both you and your partner submit the same (agreed) amount, then the amount becomes your pair's joint reduction decision to a member in this period. If you and your partner submit different amounts, then one of the two is randomly selected by the computer as your pair's joint reduction amount. Once both players 3 and 4 press the "OK" button to submit their pair's reduction amounts, they will be informed of what reduction points their partner submitted in a scenario realized, at the end of the experiment.

How to calculate earnings:

Earnings of player 1 are calculated as:

Player 1's earnings in Phase 1

minus

Reduction amounts received from the pair consisting of players 3 and 4

If the earnings are negative, then the earnings will be 0. Earnings of player 2 are calculated with the same formula.

Earnings of player 3 and player 4 are the same between each other in each pair. That is, player 3 and player 4 each obtain earnings of:

40 – joint reduction points assigned to player 1 – joint reduction points assigned to player 2.

Comprehension Questions:

1. At the beginning of the experiment, you are assigned either players 1, 2, 3 or 4. Answer the following questions.

(a) What is the probability that you are assigned the role of player 1?

[ ]

(b) What is the probability that you are assigned the role of player 3 or player 4?

[ ]

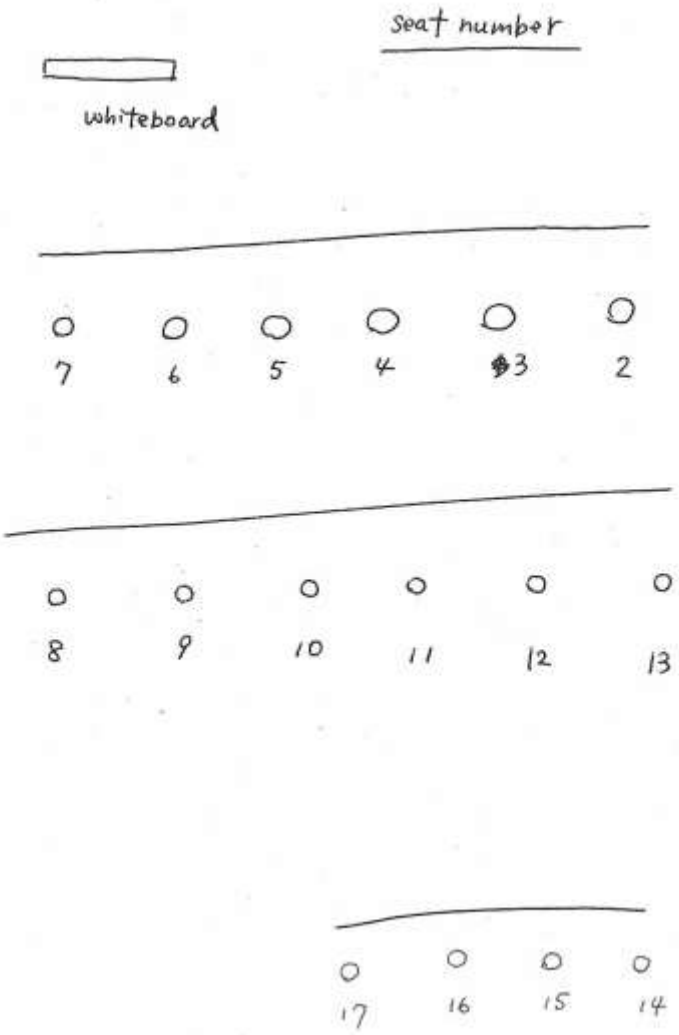
2. Suppose that player 1 in a group sends 10 points to player 2, and player 2 does not send 10 points to player 1. What are the interim earnings of player 1? What are the interim earnings of player 2?

[ ]

3. Suppose that a pair jointly decides to impose 3 reduction points to a member. How many points are deducted from the earnings of the target? How many points are deducted from the earnings of each member of the pair?

Any questions? Once all questions are answered, we will start the experiment.

[Subjects were asked to answer the comprehension questions. After that, the experimenter explained the answers to make sure that the subjects understood the experiments fully.]


seat number
whiteboard
7
6
5
4
3
2
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17
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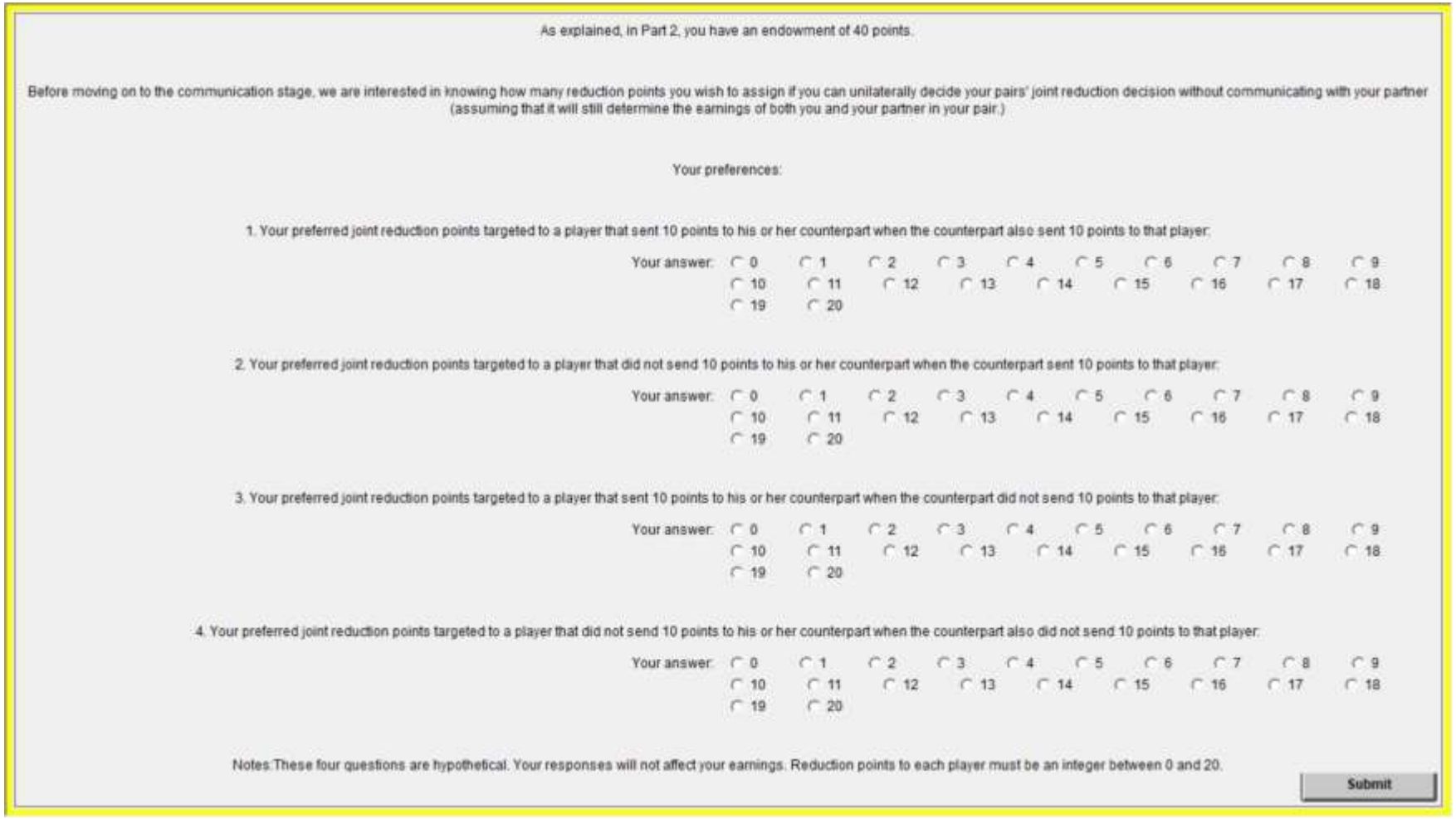
14

B.3. A Screen Shot in Eliciting Third Parties' Pre-communication Willingness to Punish



B.4. The I-P treatment

[The instructions used in the I-P treatment are also included in this Appendix – see also Kamei (2018):]

At the beginning of this experiment, all members in your group are randomly assigned identification numbers 1, 2 and 3. That is, each member is assigned either number with a probability of 1/3 (= 33.3%). The same numbers will not be assigned to 2 members in a group. We call a subject who is assigned number k "player k." In each group, 3 members are named as player 1, player 2 and player 3. This experiment consists of 2 phases.

Phase 1

In this phase, each of player 1 and player 2 is assigned an endowment of 25 points, and simultaneously decides whether or not to send 10 points to each other. If player 1 sends 10 points to player 2, the 10 points will be tripled and becomes earnings of player 2. Likewise, if player 2 sends 10 points to player 1, the 10 points will be tripled and becomes earnings of player 1.

There are 4 possible situations.

(a) Both player 1 and player 2 send 10 points to their counterparts. In this situation, each player obtains $25 – 10 + 3 \times 10 = 45$ points.

(b) Player 1 sends 10 points to player 2, but player 2 does not send 10 points to player 1. In this situation, the earnings of player 1 are $25 – 10 = 15$ points. The earnings of player 2 are $25 – 0 + 3 \times 10 = 55$ points.

(c) Player 2 sends 10 points to player 1, but player 1 does not send 10 points to player 2. In this situation, the earnings of player 1 are $25 – 0 + 3 \times 10 = 55$ points. The earnings of player 2 are $25 – 10 = 15$ points.

(d) Neither player 1 nor player 2 sends 10 points to her counterpart. In this situation, player 1 and player 2 each obtain earnings of $25 – 0 = 25$ points.

You are not allowed to communicate with anyone during the decision stage. As indicated in the calculations above, your own earnings will be maximized when you do not send 10 points but your counterpart sends 10 points. However, if both player 1 and player 2 send 10 points to each other, the total earnings of the 2 players will be maximized and will be 45×2 points = 90 points; and each player obtains 45 points as earnings. Your earnings will be minimized if you send 10 points to your counterpart but your counterpart does not send 10 points to you.

While players 1 and 2 decide whether or not to send 10 points, player 3 is asked to answer how many persons among players 1 and 2 in his/her group (= 0, 1, 2) he or she thinks will send 10

points to their counterparts. The response of player 3 to this question will not affect his or her earnings in the experiment.

Any questions?

Instructions for Phase 2:

In this phase, player 3 is given an opportunity to reduce earnings of players 1 and 2. In this phase, player 3 is assigned an endowment of 40 points.

Each reduction point player 3 allocates to reduce someone's earnings **reduces player 3's earnings by 1 point** and **reduces that individual's earnings by 3 points**. The reduction points to each player (player 1 or player 2) must be an integer. They must also be less than or equal to 20.

Player 3 will be asked to make decisions for the following four scenarios:

(a) how many reduction points player 3 would like to assign to a player that sent 10 points to his or her counterpart when the counterpart also sent 10 points to that player

(b) how many reduction points player 3 would like to assign to a player that did not send 10 points to his or her counterpart when the counterpart sent 10 points to that player

(c) how many reduction points player 3 would like to assign to a player that sent 10 points to his or her counterpart when the counterpart did not send 10 points to that player

(d) how many reduction points player 3 would like to assign to a player that did not send 10 points to his or her counterpart when the counterpart also did not send 10 points to that player

The reduction points to a player must be an integer. They must also be less than or equal to 20. One of the four decisions will be applied for player 1 and player 2 based on the two players' actual sending decisions. Player 3 will be informed of the actual sending decisions of player 1 and player 2 in Phase 1 at the end of the experiment.

How to calculate earnings:

Earnings of player 1 are calculated as:

Player 1's earnings in Phase 1

minus

Reduction amounts received from player 3

If the earnings are negative, then, the earnings will be 0. Earnings of player 2 are calculated with the same formula.

Player 3 obtains earnings of:

40 – reduction points assigned to player 1 – reduction points assigned to player 2.

Comprehension Questions:

1. At the beginning of the experiment, you are assigned either players 1, 2 or 3. Answer the following questions.

(a) What is the probability that you are assigned a role of player 1?

[ ]

(b) What is the probability that you are assigned a role of player 3?

[ ]

2. Suppose that player 1 in a group sends 10 points to player 2, and player 2 does not send 10 points to player 1. What are the interim earnings of player 1? What are the interim earnings of player 2?

[ ]

3. Suppose that player 3 decides to impose 3 reduction points to a member. How many points are deducted from the earnings of the target? How many points are deducted from the earnings of player 3?

Any questions? Once all questions are answered, we will start the experiment.

[Subjects were asked to answer the comprehension questions. After that, the experimenter explained the answers to make sure that the subjects understood the experiments fully.]