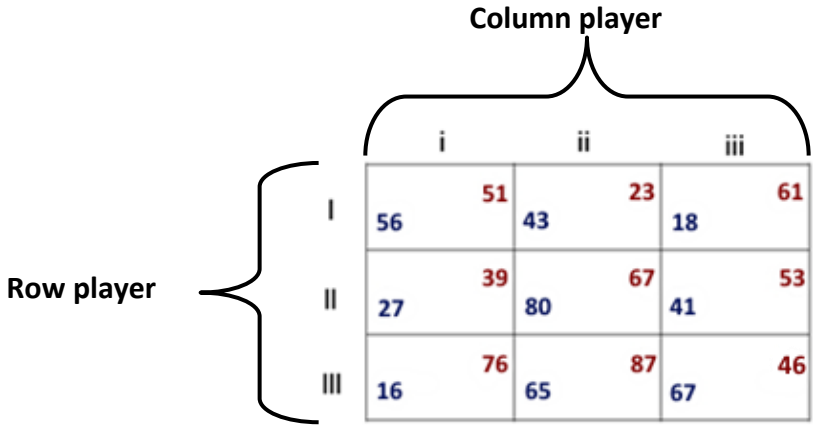
Supplementary Appendices

Appendix A: Experimental Instructions

The following is a translation of the original instructions (in Italian) provided to the *row-player* participants in treatment *AB*. The role description was adapted in the instructions provided to the *column-player participants*. The experimenter read the instructions aloud to the participant while he/she followed along on his/her own copy. Original instructions are available upon request.

Instructions
Dear student, you are about to participate in an interactive decision making experiment. Your privacy is guaranteed; results will be used and published anonymously. The experiment is divided into two parts. Each part of the experiment will be described in detail below. In total, you can earn between €1.00 and €19.90 in addition to a €4 show-up fee.

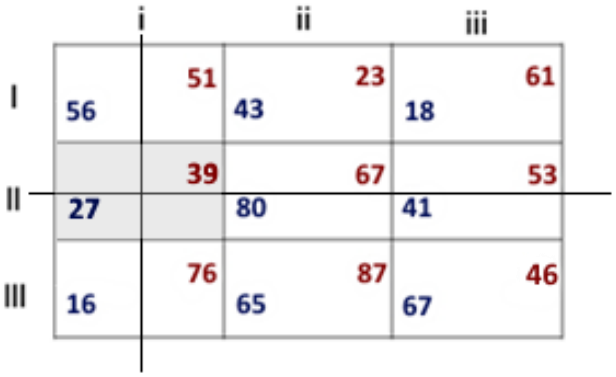
Part one: choice task
In this part of the experiment, you can earn between €1.00 and €9.90.
The task consists of 18 rounds. In each round you will face an interactive decision-making situation. In each round you will have to choose one **of three options**: the word "*interactive*" indicates that the outcome of your decision will be determined by your choice and the choice of another randomly chosen participant.
The structure of each interactive decision problem, henceforth **game**, will be represented by a matrix like the one shown below.



Each number in the matrix indicates an amount in euros (e.g. 56 indicate 5 euros and 60 cents). Throughout the experiment, you and the participant with whom you will be paired will play the roles, respectively, of **ROW PLAYER** and **COLUMN PLAYER**. The available choices of the **ROW PLAYER** (for you) are represented by the **rows** of the matrix (the row on top "**I**", the row in the middle "**II**" and the row at the bottom "**III**"). The available choices of the **COLUMN PLAYER** are represented by the **columns** of the matrix (the column on the left "**i**", the column on the center "**ii**" and the column on the right "**iii**").
Each possible combination of choices of the row and column player (i.e., each possible combination of rows and columns) identifies one cell in the matrix. Each cell reports two numerical values. These values indicate the earnings (in EUROS) of each participant associated with that combination

of choices. Conventionally, the blue number on the bottom-left corner of the cell represents the earnings of the **ROW PLAYER** (your earning), while the red number on the top-right corner represents the earnings of the **COLUMN PLAYER**.

For example: in the table below, if **YOU** choose the second row (II) and the **OTHER PLAYER** chooses the first column (i), then your earnings will be those in the cell at the intersection of the selected row and column. In this example, **YOU** earn 2.70 EUROS and the **OTHER PLAYER** 3.90 EUROS.



Bear in mind that you cannot directly choose the cell of the matrix, but only one of the rows (the other participant with whom you will be matched will choose one column). Only the combination of both choices will select one and only one cell.

The choices that you and the other participant will make, and the corresponding results, will not be communicated to you at the end of each period, but only at the end of the whole data collection.

Information

You will face 18 matrices, corresponding to 18 different interactive situations. Each game is independent of all other games and there is no time limit on responses. To help you with your choice, the row-player payoffs (your payoffs) will be located in the bottom-left corner of each cell and will be in blue, while the payoffs of the column player (the counterpart) will be located in the top-right corner of the cell and will be in red.

To select your choice you will have to press key 1 for the row I (the row on the top), key 2 for the row II (the row in the middle) and key 3 for the row III (the row on the bottom).

Payments

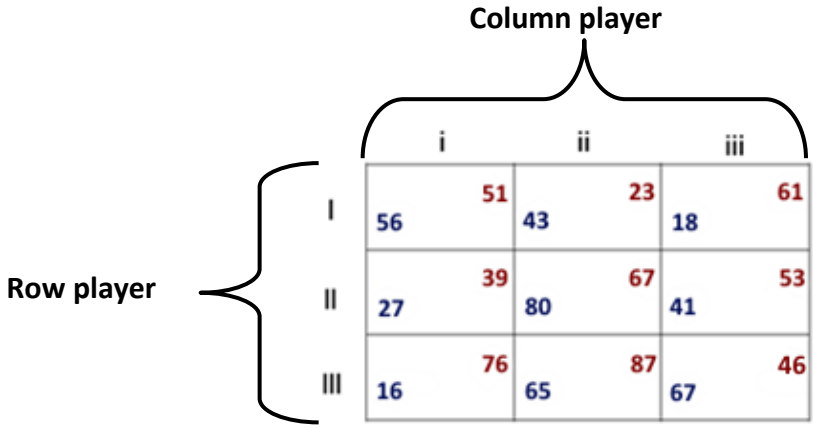
Your earnings will be determined at the end of the data collection through the following procedure: Each game is identified by a code. Some tags will be placed in a box, each showing the code of one of the matrices. The experimenter will ask you to pick one of these tags from the box. You will be paid according to the earnings obtained in the game corresponding to the extracted code. Your earnings will be determined by your choice and the choice of the column player that was randomly associated with you, in the game you have drawn. The earning of all other participants will be determined using the same procedure.

Since each of the 18 matrices has the same positive probability of being selected for payment, we ask you to devote the same attention to all of them.
Before the experiment starts, we will ask you to answer a simple anonymous questionnaire, in order to test whether instructions have been clearly understood or whether clarifications are needed. If there are incorrect answers, instructions will be repeated. The first part of the experiment will start after the questionnaire phase is completed.

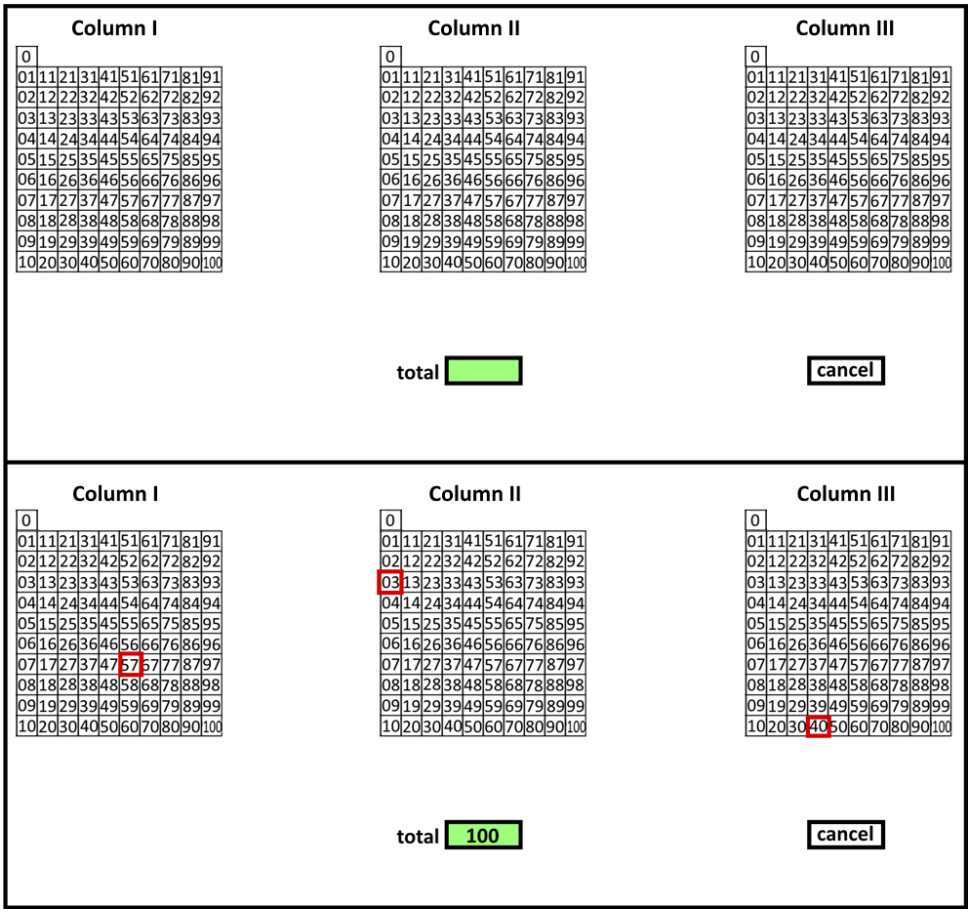
Part 2: Belief elicitation task

In this part of the experiment, you can earn between €0 and €10. The task consists of 18 rounds, in each round you will face the same interactive decision-making situations you played before, but this time you are not asked to make a decision, but rather we ask you **what your estimate is of the behavior of the participant with whom you were matched in Part 1**. That is, in each round we ask you to think about the participant with whom you were matched in the specific round of part I in which the same table of points was used, and to answer the following question: How many out of 100 times would this participant choose each of her/his possible action? Of course she/he had to make her/his decision only once in each decision situation in part 1 (just as you had), not 100 times. However, you can think of this question as a way to ask how likely it is that each one of the three possible actions (**i, ii, iii**) was chosen by her/him.
For example, suppose you are sure that she/he would always choose the action **ii**, in a given decision situation, and that she/he would never choose the action **i** or the action **iii**. Then, you would respond to our question by selecting the numbers 0, 100, 0, for the actions **i**, **ii** and **iii**, respectively.
Or, suppose that you expect her/him not always to choose **ii**. For example, you still think that she/he probably chooses **ii**, but that there is also some chance that she/he chooses **i**, and a smaller chance that she/he chooses **iii** in this decision situation. Then, you may respond by selecting the number 20 for the action **i**, the number 70 for the action **ii**, and the number 10 for the action **iii**.
If you think that it is even less likely that your counterpart choose **ii**, you may select 24 for the action **i**, 60 for the action **ii** and 16 for the action **iii**.
If you think that even though she/he would choose **ii** more often than each of the other two possible actions, it is likely that most of the time either **i** or **iii** would be chosen, you could select the numbers 34, 41 and 25. Finally, if you think that each action is equally likely to be chosen by your counterpart, then you would, say, respond by selecting the numbers 33, 34 and 33 for **i**, **ii** and **iii**, respectively.
Please, be aware that the three numbers you select always need to add up to 100. Also, please be aware that the order in which the tables appear in part 2 may not be the same as the order in which the tables appeared in part 1. **Importantly: the numbers used in these examples were selected arbitrarily. They are not intended to suggest how anyone might respond in any situation.**
In the figure below you can see the response screen with which you will interact to make your estimate of the counterpart's choices. We ask you to think about the numbers to assign to the three actions of the counterpart while observing the game matrix. Then, once you have decided the three numbers, you have to press the spacebar to move to the response screen. In the response screen, you just have to click with the mouse on three numbers (the selected value will be highlighted in red) and confirm your response by clicking the total button in the center of the screen. If you want to

change a selected value it is sufficient to click on the new value. If you want to delete all the selected values you just have to click on the cancel button.



Response screen



Payments

Only one of the 18 rounds will be selected at random to determine your payment for the beliefs elicitation task. For this round, you will be paid an amount of money according to the difference between your estimate of the action frequencies and her/his actual choice. Your payment will be higher if you estimated that she/he would choose the ***true*** action (which she/he actually choose in part 1) many times out of 100, as compared to the case that you estimated that she would choose

this ***true*** action only a few times. Likewise, your payment will depend on how well you predict which actions **are not chosen** by her/him, in the sense that you will earn less if you estimated that she/he would choose a certain action many times (out of 100), but she/he, in fact, do not choose it. The exact payment calculation will proceed as follows:
For each of her/his three possible actions, we will calculate a number which reflects how well you estimated whether or not she/he would choose this action. Using these three numbers we will calculate your payment.
To illustrate what your payments could be in this part of the experiment, we will consider four examples. Suppose that the counterpart choose **ii** and that your estimates for **i**, **ii** and **iii**, respectively are

option i: 0 **option ii: 100** **option iii: 0**

your earnings are:
$(10 - 0.0005(0 - 0)^2 - 0.0005(100 - 100)^2 - 0.0005(0 - 0)^2 = (10 - 0 - 0 - 0) = 10€$

Suppose that the counterpart choose **ii** and that your estimates for **i**, **ii** and **iii**, respectively are
option i: 20 **option ii: 60** **option iii: 20**

your earnings are:
$(10 - 0.0005(0 - 20)^2 - 0.0005(100 - 60)^2 - 0.0005(0 - 20)^2 = (10 - 0.20 - 0.80 - 0.20) = 8.80€$

Suppose that the counterpart choose **ii** and that your estimates for **i**, **ii** and **iii**, respectively are
option i: 60 **option ii: 30** **option iii: 10**

your earnings are:
$10 - 0.0005(0 - 60)^2 - 0.0005(100 - 30)^2 - 0.0005(0 - 10)^2 = (10 - 1.80 - 2.45 - 0.05) = 5.70€$

Finally, suppose that the counterpart choose **ii** and that your estimates for **i**, **ii** and **iii**, respectively are
option i: 100 **option ii: 0** **option iii: 0**

your earnings are:
$(10 - 0.0005(0 - 100)^2 - 0.0005(100 - 0)^2 - 0.0005(0 - 0)^2 = (10 - 5 - 5 - 0) = 0€$

Your earnings will be determined at the end of the data collection through the following procedure: Each game is identified by a code. Some tags will be placed in a box, each showing the code of one of the matrices. The experimenter will ask you to pick one of these tags from the box.
You will be paid based on your estimate according to the scoring rule described above. The earnings of all other participants will be determined using the same procedure.
Since each of the 18 games has the same positive probability of being selected for payment, we ask you to devote the same attention to all of them. Before the experiment starts, we will ask you to answer a simple anonymous questionnaire, in order to test whether instructions have been clearly understood or whether clarifications are needed. If there are incorrect answers, instructions will be repeated. The second part of the experiment will start after the questionnaire phase is completed.

Appendix B: Questionnaires

Questionnaire for the choice task

Dear Participant,

the following questionnaire has the sole purpose of verifying your understanding of the rules of the choice task. We ask you to answer the following questions. If you are uncertain about how to respond, please consult the instructions sheet. Your answers to these questions will not affect your earnings in the experiment.

Thank you for your cooperation!

	i	ii	iii
I	3 **2**	2 **4**	1 **9**
II	4 **6**	4 **5**	7 **6**
III	2 **3**	1 **2**	2 **8**

<u>Suppose you are assigned to the role of Row Player:</u>

- If the column player chooses the column ii and you choose the row I, how many euros will you earn? …… and how many will the other player earn? …….
- If you choose the row II and column player chooses the column iii, how many euros will the column player earn? …… and how may euros will you earn? …….
- If the other player chooses the column i, your earning will be:
  if you choose the row **I**: ……..
  if you choose the row **II**: ……..
  if you choose the row **III**: ……..

<u>Suppose you are assigned to the role of Column Player:</u>

- If the row player chooses the row ii and you choose the column I, how many euros will you earn? …… and how many will the other player earn? …….
- If the other player chooses the row i, your earning will be:
  if you choose the column **i**: ……..
  if you choose the column **ii:** ……..
  if you choose the column **iii**: ……..

- Your role (as ROW or COLUMN PLAYER) in the rounds of the experiment will change:

  TRUE or FALSE

- The participant with whom you are paired will be determined randomly in each round, and you will never be matched more than once with the same participant.

  TRUE or FALSE

- After you have taken your decision on a table, you will be able to observe the choice of the participant with whom you were paired.

  TRUE or FALSE

Questionnaire for the belief statements task

Dear Participant,

the following questionnaire has the sole purpose of verifying your understanding of the rules of the belief statement task. We ask you to answer the following questions. If you are uncertain about how to respond, please consult the instructions sheet. Your answers to these questions will not affect your earnings in the experiment.

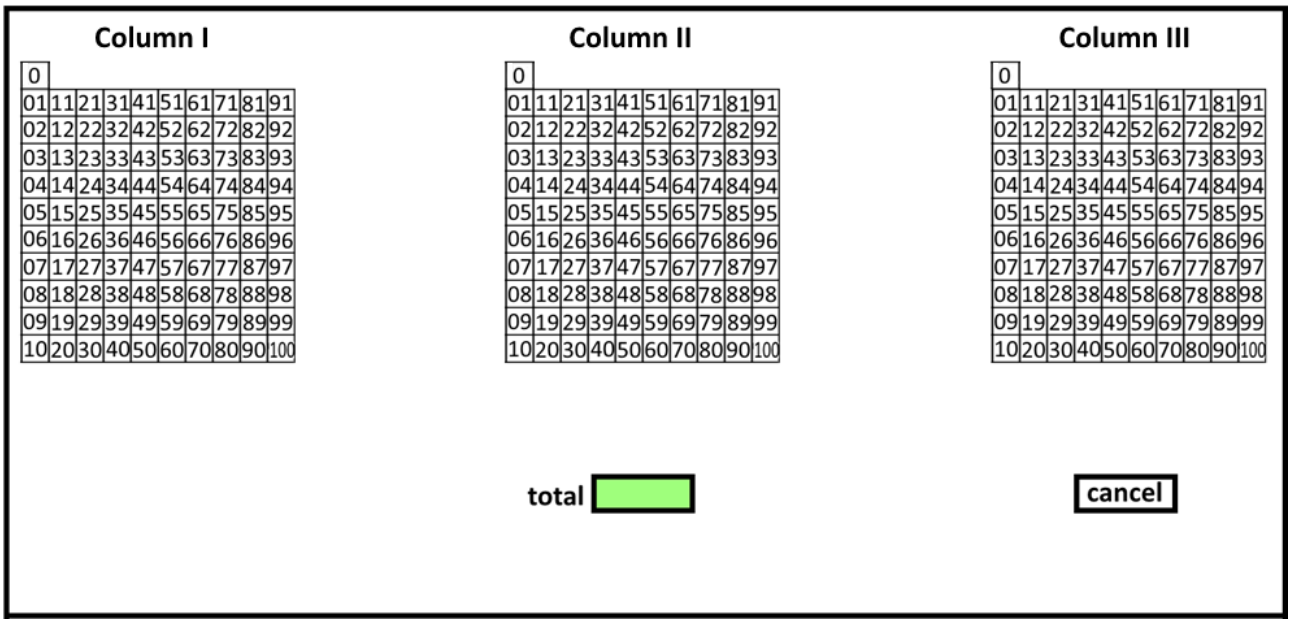
Thank you for your cooperation!

	i	ii	iii
I	3 2	2 4	1 9
II	4 6	4 5	7 6
III	2 3	1 2	2 8

<u>Suppose you are assigned to the role of Row Player:</u>

- What do you have to do?
  ……..Play with the other participant by choosing one of the three rows.
  ……..Give your estimate on the action taken by the other participant.
  ……..Play with the other participant by choosing one of the three columns.

- Suppose that you estimate that your counterpart will choose the option **i** 55 times out of 100, the option **ii** 25 times out of 100 and the option **iii** 20 times out of 100. Which values do you select in the response screen?



- To confirm your estimates you have to click on the:

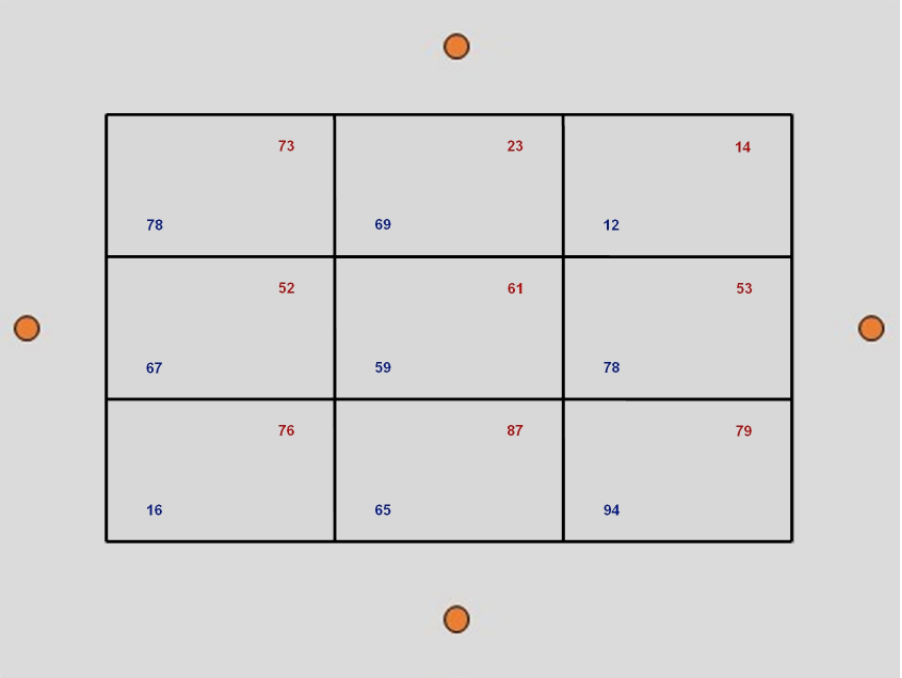
…….Cancel button

……..Total button

- the three selected numbers always need to add up to ….

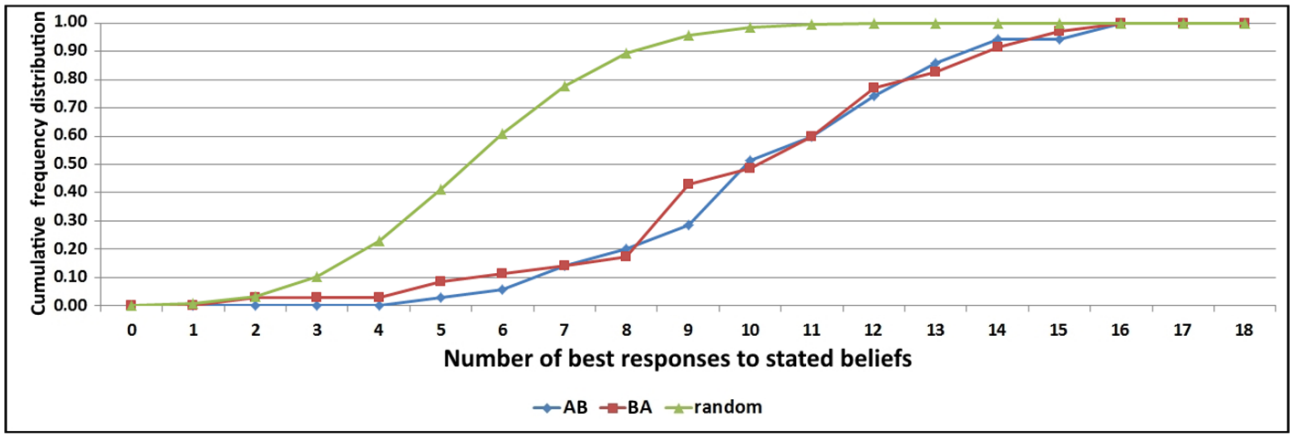
Appendix C: Eye-tracking procedure

Participants were seated in a chair with a soft head restraint to ensure a viewing distance of 60 cm from the monitor. Eye movements were monitored and recorded using a tower mounted Eyelink 2000 system (SR. Research Ontario Canada) with a sampling rate of 2000 Hz. A fixation was defined as an interval in which gaze was focused within 1 degree of visual angle for at least 80 ms. A 13 point calibration was performed at the beginning of each block. The calibration phase was repeated until the difference between the positions of the points on the screen and the corresponding eye locations was less than 1 degree of visual angle. After the calibration phase, a 13 points validation phase was performed (similar to the calibration phase) to make sure that the calibration was accurate. Recalibrations were performed if necessary, and eye-tracking interrupted if these were unsuccessful. Before the beginning of each trial, a drift correction was performed (except for the first trial of each block). After the drift correction, a fixation point was presented. To minimize possible biases related to the location of the fixation point we randomized its position among four alternative locations. All of them were located outside the area covered by the matrix (Supplementary Fig. 1). The game matrix was presented after the fixation point was fixated for 300 milliseconds and remained on the screen until a response was made. Eye movements were recorded during the game matrix display. To minimize noise, information displayed on the monitor was limited to payoffs and participants' action labels. In addition, the payoffs were positioned at an optimal distance from each other (calibrated in a pilot study) to distinguish fixations and saccades between them with row and column player payoffs at different latitudes and in different colors.

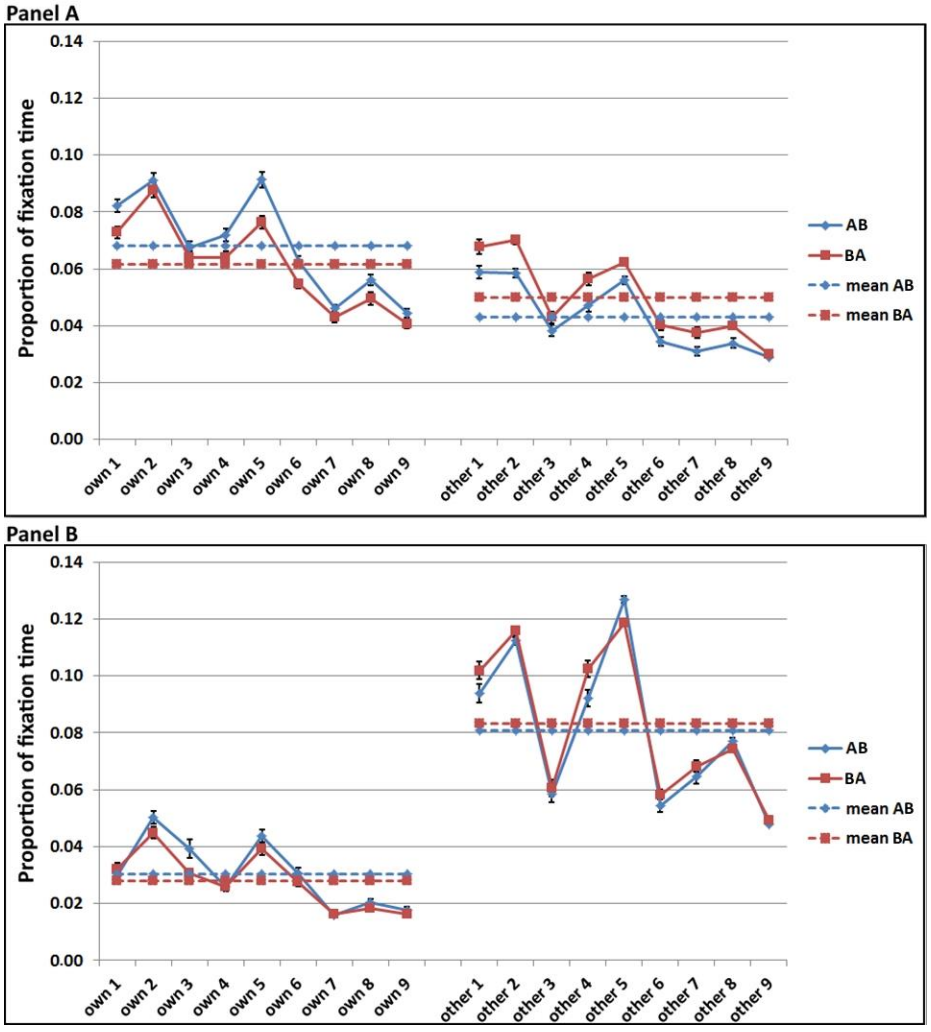


Supplementary Fig. 1. Possible positions of the fixation points (in orange), randomized across trials.

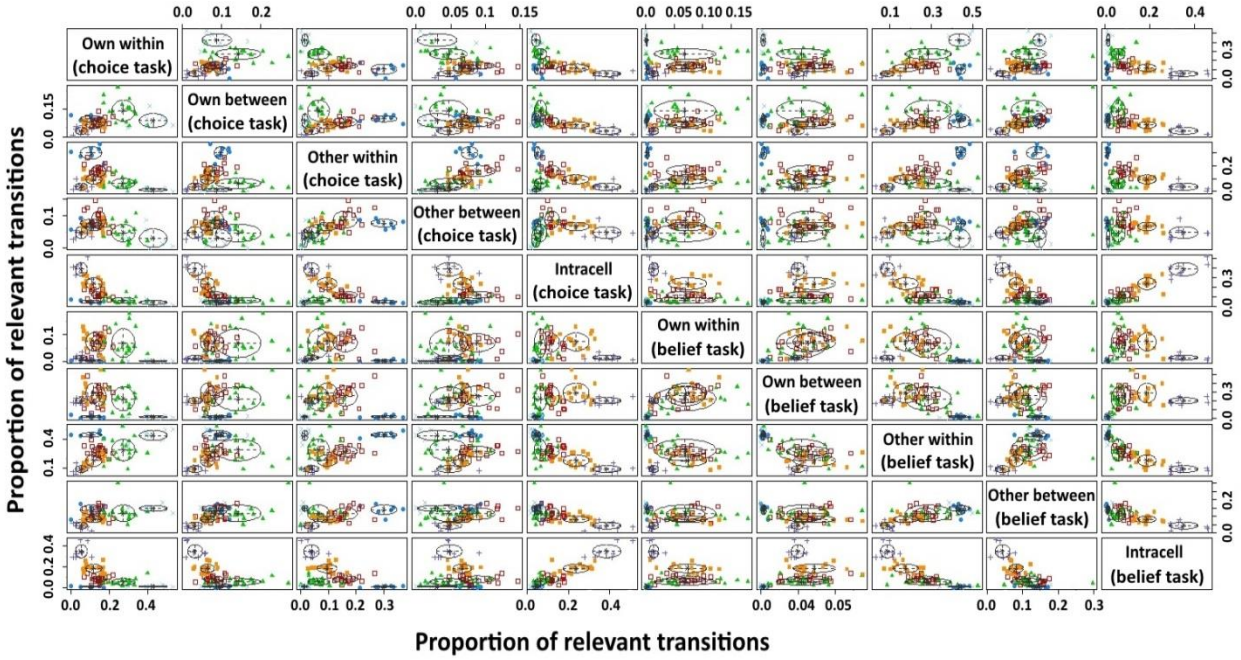
Appendix D: Additional analyses



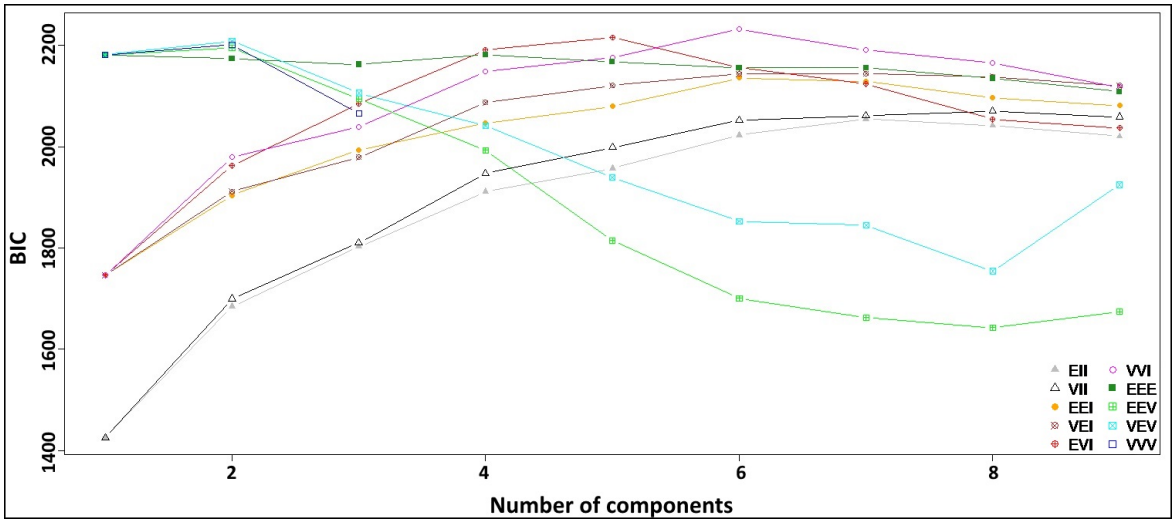
Supplementary Fig. 2. Cumulative frequency distribution of number of participants with *n* (ranging from 0 to 18) best responses to their own stated beliefs by treatment (*AB* and *BA*). The observed distributions are different from random.



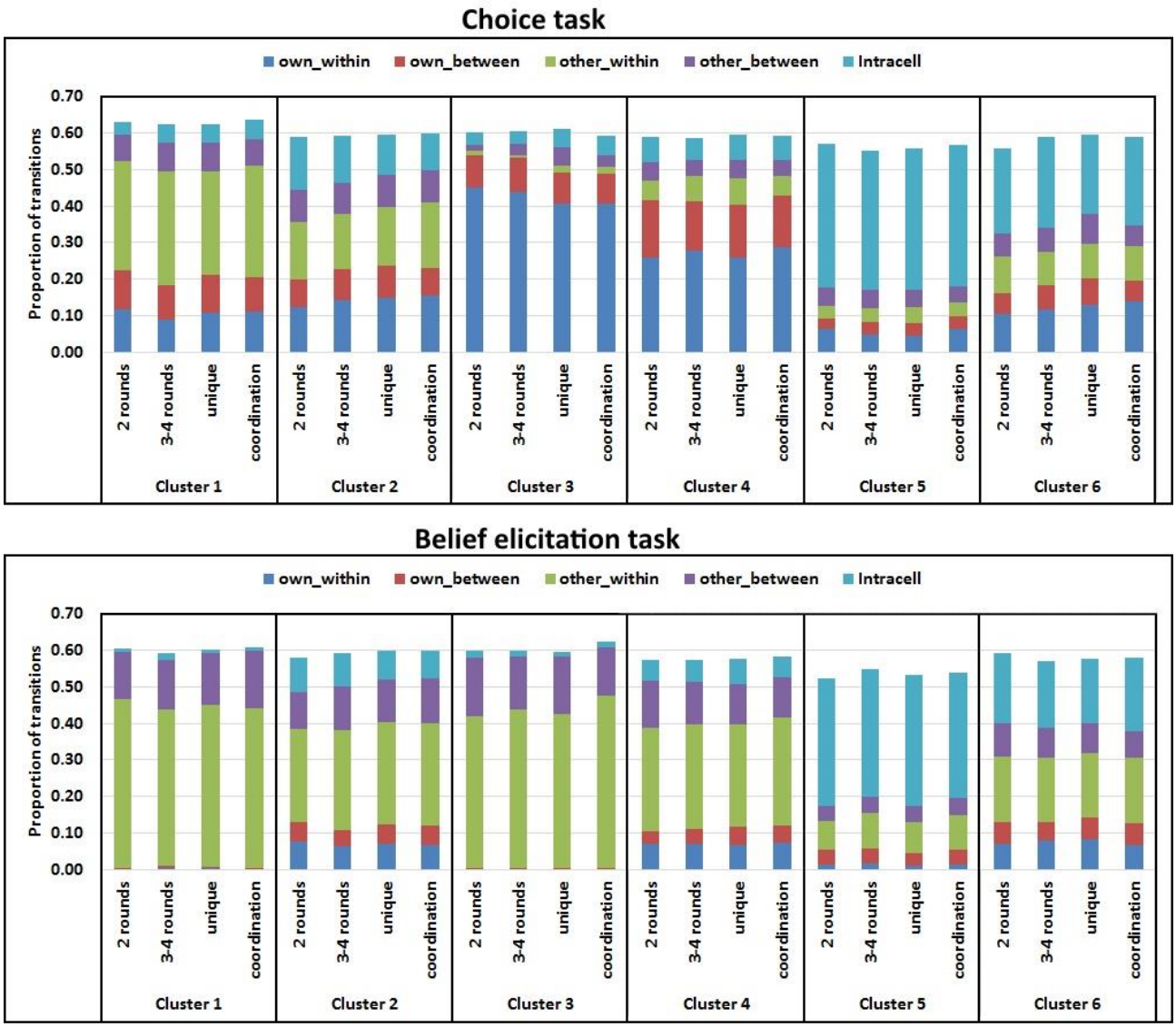
Supplementary Fig. 3. Proportion of fixation time within the 18 AOIs for the action choice (Panel A) and the belief elicitation (Panel B) tasks. The dashed lines indicate the average proportion of fixations on own and other player's payoffs for the two treatments (*AB* and *BA*).



Supplementary Fig. 4. Pairs plot of the 10 variables. Where each variable represents the proportion of one of the five types of relevant transitions in the choice and in the belief elicitation tasks: 1) own within transitions (choice task). 2) Own between transitions (choice task). 3) Other within transitions (choice task). 4) Other between transitions (choice task). 5) Intracell transitions (choice task). 6) Own within transitions (belief elicitation task). 7) Own between transitions (belief elicitation task). 8) Other within transitions (belief elicitation task). 9) Other between transitions (belief elicitation task). 10) Intracell transitions (belief elicitation task). The cells display all paired combinations of the 10 variables (their name is reported in the off-diagonal cells). The points represent participants, and the color the cluster to which they belong.



Supplementary Fig. 5. Bayesian information criterion (BIC) of the ten models by number of clusters (components: from 1 to 9). The models are fitted to the proportion of the five types of relevant transitions in the choice and belief elicitation tasks (10 variables in total). The following is a short description of the 10 multivariate mixture models tested by the clustering method: 1) "*EII*" = spherical, equal volume. 2) "*VII*" = spherical, unequal volume. 3) "*EEI*" = diagonal, equal volume and shape. 4) "*VEI*" = diagonal, varying volume, equal shape. 5) "*EVI*" = diagonal, equal volume, varying shape. 6) "*VVI*" = diagonal, varying volume and shape. 7) "*EEE*" = ellipsoidal, equal volume, shape, and orientation.8) "*EEV*" = ellipsoidal, equal volume and equal shape. 9) "*VEV*" = ellipsoidal, equal shape.10) "*VVV*" = ellipsoidal, varying volume, shape, and orientation. Where the first term (spherical, diagonal or ellipsoidal) refers to the type of the multivariate distribution. The second term (equal volume or varying volume) specifies whether the clusters have the same volume. The third term (equal or variable shape) specifies whether the clusters have the same shape. For our data, the BIC is maximized at 2232 by a diagonal model varying volume and shape (VVI) yielding six clusters.



Supplementary Fig. 6. Individual proportion of relevant transitions for the six clusters, in the four categories of games. The proportions are calculated separately for the choice task (upper part of Figure 11) and the belief elicitation task (lower part of Figure 11) from the total number of transitions.

Appendix E: Accuracy of the Inequity aversion model with different combinations of parameters α_i and β_i

Supplementary Table 1
On the left, predictions of the Inequity aversion model with different combination of parameters in the choice task (Top=T, Middle=M, Bottom=B, for the row players and Left=L, Middle=M, Right=R for the column players). On the right: proportion of choices predicted by the model reported from the perspective of the row players. In our games, the model predictions do not appear to be very sensitive to different combinations of the two parameters.

	Choice task (70 participants)							
	Predictions of the Inequity aversion model				Accuracy of the Inequity aversion model			
Games	α=1 β=0.25	α=1 β=0.6	α=2 β=0.6	α=4 β=0.6	α=1 β=0.25	α=1 β=0.6	α=2 β=0.6	α=4 β=0.6
1	M,M	M,M	M,M	M,M	0.40	0.40	0.40	0.40
2	M,L	M,L	M,L	M,L	0.54	0.54	0.54	0.54
3	T,L	T,L	T,L	T,L	0.64	0.64	0.64	0.64
4	M,R	M,R	M,R	M,R	0.17	0.17	0.17	0.17
5	T,R	B,R	B,R	B,R	0.47	0.47	0.47	0.47
6	B,M	B,M	B,M	B,M	0.09	0.09	0.09	0.09
7	M,R	M,R	M,R	M,R	0.37	0.37	0.37	0.37
8	B,R	B,R	B,R	B,R	0.50	0.50	0.50	0.50
9	T,L	T,L	T,L	T,L	0.76	0.76	0.76	0.76
10	B,R	B,R	B,R	B,R	0.41	0.41	0.41	0.41
11	M,M	M,R	M,R	M,R	0.51	0.41	0.41	0.41
12	M,M	M,M	M,M	M,M	0.80	0.80	0.80	0.80
13	T,M	B,M	T,M	T,M	0.49	0.47	0.49	0.49
14	M,M	M,M	M,M	M,L	0.41	0.41	0.41	0.30
15	B,R	B,R	B,R	B,R	0.63	0.63	0.63	0.63
16	T,L	T,L	T,L	T,L	0.54	0.54	0.54	0.54
17	M,R	M,R	M,R	M,R	0.59	0.59	0.59	0.59
18	T,R	T,R	T,R	T,R	0.61	0.61	0.61	0.61
Average:					0.50	0.49	0.49	0.48

Supplementary Table 2
Beliefs about the model of choice of the counterpart. On the left, predictions of the *Inequity aversion* model with different combinations of parameters in the belief elicitation task (Left = L, Middle = M, Right = R, for the row players and Top = T, Middle = M, Bottom = B for the column players). On the right, average probabilities of stated beliefs with which the participants estimate the counterpart to choose in accordance with the *Inequity aversion* model. Data are reported from the perspective of the row players. Similarly to what we find in the choice task, the model predictions do not appear to be very sensitive to different combinations of the two parameters.

	Belief elicitation task (70 participants)							
	Predictions of the Inequity aversion model				Accuracy of the Inequity aversion model			
Games	α=1 β=0.25	α=1 β=0.6	α=2 β=0.6	α=4 β=0.6	α=1 β=0.25	α=1 β=0.6	α=2 β=0.6	α=4 β=0.6
1	T,M	M,L	M,L	B,R	0.49	0.49	0.49	0.49
2	T,L	M,M	M,M	B,R	0.49	0.49	0.49	0.49
3	B,M	T,M	T,R	T,M	0.21	0.21	0.21	0.21
4	T,M	T,L	M,L	T,L	0.62	0.62	0.62	0.62
5	T,L	B,L	B,M	B,L	0.14	0.14	0.14	0.14
6	M,M	M,R	B,R	M,R	0.37	0.48	0.48	0.48
7	M,R	B,R	M,R	T,L	0.53	0.53	0.53	0.53
8	B,R	B,L	B,R	M,M	0.24	0.24	0.24	0.24
9	M,R	T,L	T,R	T,R	0.27	0.27	0.27	0.27
10	B,M	T,L	B,L	B,L	0.65	0.65	0.65	0.65
11	M,R	B,M	M,M	M,M	0.55	0.40	0.55	0.55
12	M,M	M,R	M,M	B,L	0.26	0.26	0.26	0.28
13	B,R	T,M	T,R	T,R	0.37	0.31	0.31	0.31
14	M,M	B,M	M,M	T,L	0.59	0.59	0.59	0.59
15	B,R	B,R	B,R	T,L	0.45	0.45	0.45	0.45
16	T,L	T,L	T,L	M,M	0.50	0.50	0.50	0.50
17	M,R	M,R	M,R	B,L	0.54	0.54	0.54	0.54
18	T,R	T,R	T,R	B,M	0.50	0.50	0.50	0.50
Average:					0.43	0.43	0.44	0.44