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On the Elicitation and Measurement of Betrayal Aversion*

Simone Quercia[α]

Abstract Betrayal aversion has been operationalized as the evidence that subjects demand a higher risk premium to take social risks compared to natural risks. This evidence has been first shown by Bohnet and Zeckhauser (2004) using an adaptation of the Becker – DeGroot – Marshak mechanism (BDM, Becker et al. (1964)). We compare their implementation of the BDM mechanism with a new version designed to facilitate subjects' comprehension. We find that, although the two versions produce different distributions of values, the size of betrayal aversion, measured as an average treatment difference between social and natural risk settings, is not different across the two versions. We further show that our implementation is preferable to use in practice as it reduces substantially subjects' mistakes and hence the likelihood of noisy valuations.

Keywords: experiments, betrayal aversion, trust game, Becker – DeGroot – Marshak mechanism, preference elicitation.

JEL codes: C90 - D81

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1. Introduction

Recent experimental evidence from binary trust games shows that subjects are more reluctant to take *social risks* (where the outcome is determined by another human being) than *natural risks*, (where the outcome is determined by nature independently of human decisions; Bohnet and Zeckhauser (2004), Bohnet et al. (2008), Aimone and Houser (2011), Aimone and Houser (2012), Aimone and Houser (2013)). This evidence reveals that people anticipate the psychological cost of trust betrayal that they suffer on top of monetary costs.

This phenomenon, commonly referred to as *betrayal aversion*, has been first investigated by Bohnet and Zeckhauser (2004) through the comparison of probability equivalents in social versus natural risk situations. Their design employs an adaptation of the Becker – DeGroot – Marshak mechanism (BDM, see Becker et al. (1964)) to elicit minimum acceptance probabilities (MAPs), i.e., the minimum probability of the good outcome that subjects require to choose a risky bet rather than a certain payoff. Betrayal aversion is measured between-subjects as the difference in MAPs in a social and a natural risk settings. If MAPs are on average higher in the social risk setting, subjects are betrayal averse as they require a higher risk premium when the source of risk is another person rather than nature.

In this paper, we ask two relevant questions regarding the elicitation of probability equivalents in the context of betrayal aversion: (i) do different implementations of the BDM mechanism yield systematically different MAPs? (ii) If yes, does this translate into differences in the measured *size* of betrayal aversion?

Our questions are particularly important for two main reasons. First, recent evidence shows that the BDM mechanism may be empirically not reliable due to its complexity and to subjects' misconceptions of the incentive structure (see, e.g., Cason and Plott (2014)). Second, the MAP design uses the BDM mechanism in an unusual way compared to the previous literature as it elicits a probability instead of a price. In most applications, the BDM mechanism is used in selling or buying tasks and subjects are asked the minimum price demanded to give up an object or the maximum price they would be willing to pay to buy the object. The MAP design, instead, asks subjects to reveal the minimum value of a probability that they would require to play a lottery. Arguably this may further increase the complexity of the mechanism.

Study 1, reported in Section 2, investigates experimentally questions (i) and (ii). Our experiment consists of two conditions: the open-ended (OE) condition replicates the design and procedures of Bohnet and Zeckhauser (2004), whereas the choice list (CL) condition introduces a novel instrument and procedures to measure betrayal aversion. In CL, we address several potential problems of the original Bohnet and Zeckhauser (2004) design: first, we present the BDM mechanism as a choice list, which has been reported to be more easily understood by subjects (Harrison and Rutström (2008)). Second, we frame the odds of the risky choice in terms of frequencies and not in terms of probabilities, another factor that has been shown to be critical for subjects' understanding of statistical concepts (Gigerenzer and Hoffrage (1995)). Finally, we change the text of the instructions including more detailed explanations and examples to make the procedures as clear as possible for subjects in our experiment. In line with our objective of testing whether clearer procedures have an impact on elicited values, we did not change one element at the time but apply all the changes that were in our view necessary to make procedures as clear as possible.

Our results from Study 1 show that the way the BDM mechanism is presented to subjects has a significant impact on elicited values. The two elicitation methods generate two statistically different distributions of data, with the CL distribution of MAPs being more peaked and presenting less variation. However, when we compare the estimated betrayal aversion (the average difference of MAPs in the social versus the natural risk situation), we find no differences between OE and CL. This suggests that, if a bias exists in one or both treatments, it affects elicited values symmetrically both in the social and natural risk settings and hence does not affect the measurement of betrayal aversion.

We ask next which method is preferable to use in practice. To answer this question, in Study 2, we conduct a survey with a sample of undergraduate students, where we compare the experimental instructions of OE and CL used in Study 1 on the basis of perceived complexity and number of mistakes made in a set of comprehension questions. We show that our CL instructions are better understood than the OE instructions in terms of both perceived complexity and number of mistakes in the comprehension questions.

Overall, our results point to the existence of systematic mistakes in the measurement of subjects' preferences caused by the complexity of the BDM mechanism. Furthermore, we show that these mistakes can be reduced by writing instructions carefully to make the mechanism as clear and transparent as possible. We discuss the implication of these findings in our concluding section.

2. Study 1 – Two versions of the BDM mechanism for the elicitation of betrayal aversion

2.1 Experimental design and procedures

Our design consists of two treatments: the OE and the CL treatment. The OE treatment is an exact replication of Bohnet and Zeckhauser (2004).[1] The CL treatment introduces a new instrument, procedures and instructions to measure betrayal aversion.

Following Bohnet and Zeckhauser (2004), each of our treatments permits a between-subjects comparison of two conditions called trust game (TG) and risky dictator game (RDG).[2] Figure 1 describes the extensive form of the trust game and the risky dictator game. In both decision tasks, a first mover chooses between a certain and a risky option. The certain option gives 10 points to him and 10 to his counterpart. The risky option can produce either an unequal outcome of 8 points to the first mover and 22 to his counterpart or an equal split giving 15 points to both. While in the trust game, the outcome of the risky option is determined by a second mover, in the risky dictator game, it is determined by nature with the probabilities of outcomes (15; 15) and (8; 22) being respectively p and $1 - p$. This is the only difference between the two conditions.

[1] We use the instructions from the web appendix of Bohnet et al. (2008), a cross-cultural study on betrayal aversion that uses same instructions and procedures of Bohnet and Zeckhauser (2004).

[2] The original Bohnet and Zeckhauser (2004) design is actually composed of three treatments called trust game, risky dictator game and decision problem. The comparison between choices made in the first and the second treatment measures betrayal aversion, while the comparison between choices made in the second and in the third measures social preferences. As we are mainly interested in measuring betrayal aversion, we implemented only the trust game and the risky dictator game.

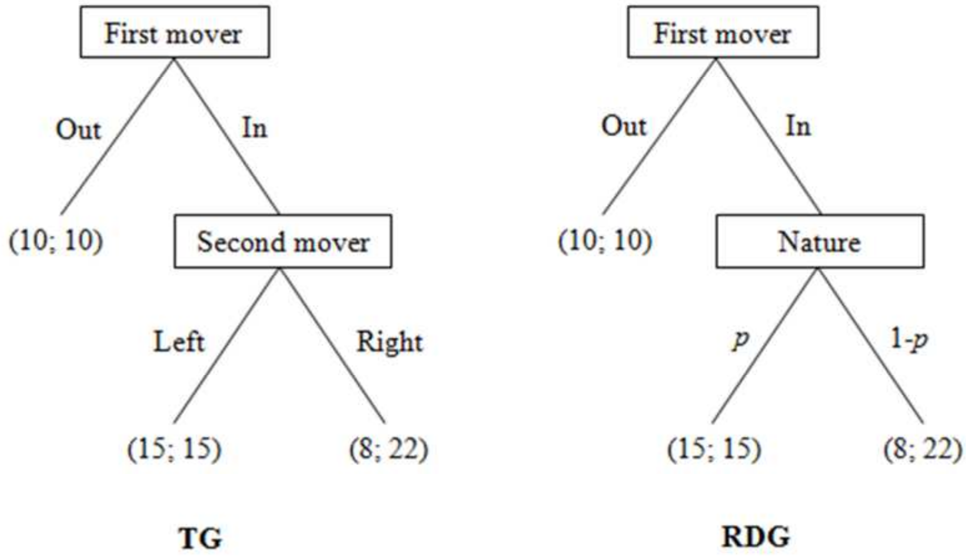

Figure 1: Monetary payoffs in the Trust Game (TG) and in the Risky Dictator Game (RDG).

The variable of interest is the probability of the outcome (15; 15) which makes first movers indifferent between In and Out. Following Bohnet and Zeckhauser (2004), we shall call this value the minimum acceptance probability (MAP). In TG, the MAP corresponds to the fraction of trustworthy second movers required by first movers to engage in the *socially* risky bet that would result from playing In. In RDG, the MAP corresponds to the probability of the good outcome required by first movers to engage the *naturally* risky bet that would result from playing In in this case. If the average difference in elicited MAPs between TG and RDG is positive, that is ($\overline{MAP}_{TG} - \overline{MAP}_{RDG} > 0$), subjects are on average betrayal averse, i.e., they require a higher risk premium in the social risk compared to the natural risk situation. In what follows, we describe our two treatments in detail.

Open ended (OE) elicitation of betrayal aversion (Bohnet and Zeckhauser (2004))

Both in TG and RDG, each first mover is asked to state directly the MAP by writing it down on their answer sheet. In particular, in TG each first mover is asked the following question:

“KEY QUESTION: How large would the probability p of being paired with a Person Y who chose Option 1 minimally have to be for you to pick Alternative B over Alternative A? (like any probability it must lie between 0 and 1).”[3]

At the same time, second movers are asked to reveal their strategy using the strategy method (Selten (1967)), namely they are asked whether they would choose to be trustworthy or not in case their first mover choses In (Alternative B according to Bohnet and Zeckhauser (2004) labels). After collecting the answers, the experimenter computes the actual fraction of trustworthy second movers in the session and determines the decision of first movers according to their stated MAP. If their MAP is greater than the actual fraction of trustworthy second movers, they are deemed to choose Out (Alternative A). If, instead, their MAP is less or equal than the actual fraction of trustworthy second movers, they are deemed to choose In (Alternative B) and the outcome depends on their second mover’s choice. This mechanism to determine first movers’ action is known to first movers but unknown to second movers. Second movers only know that first movers will make a choice between In and Out. This is important to guarantee that second movers do not take decisions to strategically influence first movers’ behavior.

In RDG, recipients are simply asked to wait for the decision of first movers. Each first mover is instead asked the following:

“KEY QUESTION: How large would the probability p of the lottery producing Option 1 minimally have to be for you to pick Alternative B over Alternative A? (like any probability, it must lie between 0 and 1).”

Analogously to TG, recipients do not know that first movers are stating a MAP; they only know that they will choose either In or Out. The mechanism to determine outcomes is similar to TG except that the elicited MAP is compared with a probability *p* which is predetermined before the experiment and unknown to subjects. If the stated MAP is greater than *p*, the subject is deemed to choose Out (Alternative A), while if the MAP is less or equal than *p*, the subject is

[3] In the OE treatment, we used the original labelling of strategies as in Bohnet et al. (2008) instructions (see Appendix A.2 for the full set of Instructions). For the ease of exposition, in the remainder of the paper we always use the labels of Figure 1, which correspond to our CL treatment.

deemed to choose In (Alternative B). At the end of the session the experimenter reveals the actual value of *p* and the lottery is implemented.

The advantage of the open-ended version is that it is fast to implement and it elicits values with high precision, because subjects can state "point" valuations. The main disadvantage is that, in standard implementations like selling or buying tasks, it is not clear whether subjects fully understand the functioning of the bidding mechanism (see Harrison and Rutström (2008)). In the context of probability elicitation, there is the risk that the mechanism and the wording of the “KEY QUESTION” may be more even more obscure to subjects compared to standard implementations. For example, in a selling task the typical question would be something like “What’s the lowest price at which you would sell?” which less likely creates comprehension problems compared to the probability elicitation setting described above.

Our innovation – Choice list (CL) elicitation of betrayal aversion

The procedure used to elicit the decisions of second movers is identical to the OE treatment. First movers, instead, are presented with a table similar to the example in Figure 2. In the trust game they have to circle In or Out for each possible fraction of second movers choosing Left. In the risky dictator game, everyone is told that a draw from an urn with a predetermined number of green and yellow balls will determine the outcome for the subjects who chose In. First movers have to circle In or Out for each possible number of yellow balls in the urn. It is further explained to subjects that only one row is relevant for earnings (the one corresponding to the actual number of trustworthy second movers or to the actual number of yellow balls), but that they will know which row is relevant only after they have taken their decisions.

Number of participants in Group B choosing **Left** [Number of **yellow balls** in the urn]	You choose	
20 out of 20	In	Out
19 out of 20	In	Out
18 out of 20	In	Out
17 out of 20	In	Out
16 out of 20	In	Out
15 out of 20	In	Out
…	…	
5 out of 20	In	Out
4 out of 20	In	Out
3 out of 20	In	Out
2 out of 20	In	Out
1 out of 20	In	Out
0 out of 20	In	Out

Figure 2: Structure for the elicitation table for first movers in TG [RDG]

We expect subjects to choose In in the first row of the table when the outcome (15; 15) is certain and switch to Out when the risk of being the sucker [unlucky] increases.[4] We infer the MAPs from subjects' choices by taking the middle point between the last probability for which they choose In and the first probability for which they choose Out going from the top to the bottom of the table.

The CL treatment varies three elements compared to the OE treatment: the choice list format, the descriptions of second movers' actions as frequencies instead of probabilities and the text of the instructions adding more detailed explanations and examples to make the mechanism as clear as possible (see Appendix A.2). The advantage of using the choice list format is that it is generally easy to explain to participants and it minimizes subjects' confusion. However, it has two potential disadvantages. First, it elicits only interval values rather than "point" valuations

[4] We decided not to restrict single switches. This implies that we are not able to infer a MAP for some subjects who switch more than once and that we are constrained to exclude them from the analysis.

and is, thus, less precise than the open-ended method. Second, it can be prone to framing effects, such as for example, subjects' tendency to switch in the middle of the table rather than at their "true" value (see, e.g., Andersen et al. (2006) and (2008)). Regarding the presentation of probabilities as frequencies, evidence from psychology has shown that statistical reasoning is improved if problems are presented using frequencies rather than percentages or probabilities (see Gigerenzer and Hoffrage (1995)). Thus, expressing the problem using frequencies may help subjects understand the functioning of the BDM mechanism.

Procedures

All the sessions were conducted at the University of Nottingham. Upon their arrival to the room where the experiment was conducted, subjects were randomly assigned to cubicles which separated participants visually and protected anonymity throughout the experiment. We used the instructions and control questions from Bohnet et al. (2008) for the OE treatment.[5] We developed novel instructions and control questions for the CL treatment (see Appendix A.2).

All the experimental sessions in both treatments were composed of several parts. In Part 1, we conducted the experiment reported in this paper and in the other parts we conducted other experiments. Subjects knew of the existence but no details about subsequent parts while they were completing Part 1.

We had in total 592 undergraduate student participants from various disciplines recruited via ORSEE (Greiner (2004)). In each experimental session, Part 1 lasted approximately 20 minutes. All outcomes were described as point earnings and converted at an exchange rate of £0.2 per point. Average hourly earnings were around £8.

2.2 Experimental Results

Result 1. The two elicitation methods yield significantly different distributions of MAPs. CL generates significantly less variation and a more peaked distribution compared to OE.

[5] We use the instructions from the web appendix of Bohnet et al. (2008), a cross-cultural study on betrayal aversion that uses same instructions and procedures of Bohnet and Zeckhauser (2004). The instructions are available online at http://www.aeaweb.org/aer/data/mar08/20051024_app.pdf. We thank the authors for also making their control questions available.

Support. The support for Result 1 comes from Figure 3, where we show the histograms and estimated kernel density functions of MAPs in OE (two upper panels) and CL (two lower panels). The distribution of MAPs is statistically different across elicitation methods both in TG and RDG according to Kolmogorov – Smirnov tests (p = 0.029 and p = 0.042, respectively). OE generates a less peaked distribution as suggested by the kernel density estimates. Moreover, it generates less dispersion around the mean as revealed by the significantly higher standard deviation in OE compared to CL (standard deviations are 0.23 and 0.18, respectively; two – sided Levene test, p = 0.003). This is true also looking separately at TG and RDG (standard deviations are 0.25 and 0.22 in OE and 0.18 and 0.17 in CL, respectively; two-sided Levene-tests, p = 0.012 and p = 0.055, respectively).

As discussed in Section 2.1, one critique of choice lists is the potential framing effect that may lead subjects to switch in the middle of the elicitation table. A strict interpretation of this claim is rejected by our data as the modal response does not correspond to the middle row in either TG or in RDG.[6] However, if we interpret the claim as choice lists tending to produce less extreme values and switching points "around" the middle of the elicitation table, this is supported by our data as shown by the higher peaks in the kernel density estimates and the significant difference in the observed standard deviations.

[6] In RDG, the most frequent observation is 0.375, which correspond to subjects switching in the bottom half of the table. In TG both the most and second most frequent observation are also in the bottom half of the table (0.375 and 0.425, respectively).

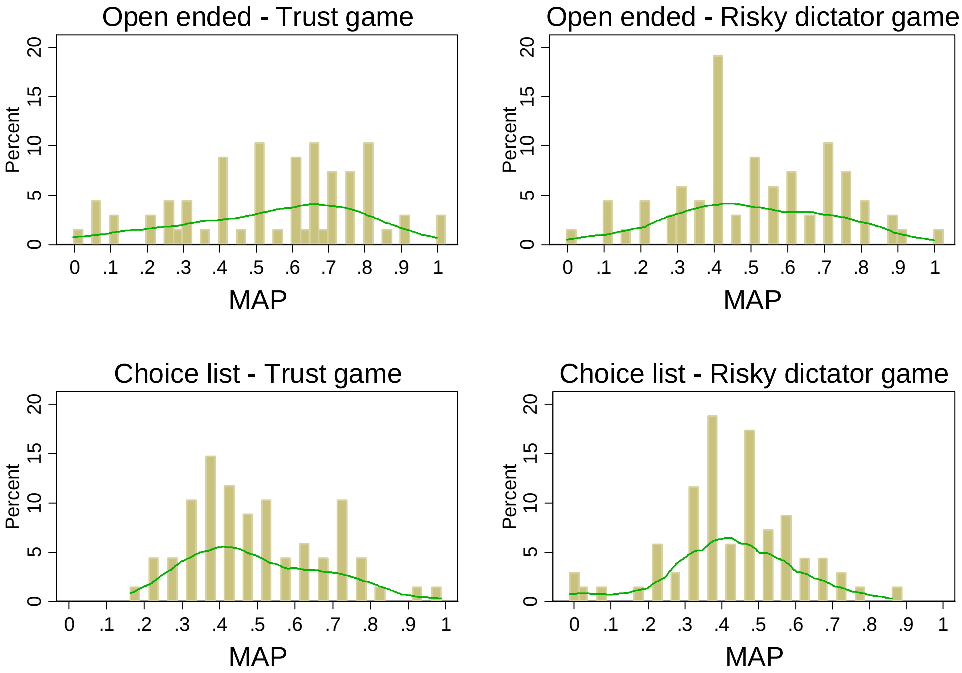

Figure 3: Distribution of MAPs across treatments.

Result 2. The *size* of betrayal aversion ($\overline{MAP}_{\text{TG}}$ - $\overline{MAP}_{\text{RDG}}$) is 0.04 in OE and 0.07 in CL. Statistical analysis reveals that the size of betrayal aversion is not significantly different between the two treatments.

Support. As a first step, we look at the two methods in isolation. In Table 1 we report the average MAP in each treatment for both methods. The *size* of betrayal aversion ($\overline{MAP}_{TG} - \overline{MAP}_{RDG}$) is similar across the two methods (0.04 in OE and 0.07 in CL). While the MAPs from TG and RDG are not statistically different according to a Mann – Whitney U-test in the OE treatment (z = 1.156, p = 0.248), they are marginally significantly different in the CL treatment (z = 1.809, p = 0.070).

Table 1 Betrayal aversion in CL and OE treatments (mean (Std. dev.)).

	$\overline{MAP}_{TG}$	$\overline{MAP}_{RDG}$	$\overline{MAP}_{TG} - \overline{MAP}_{RDG}$
CL (*n* = 137)	**0.50** (0.18)	**0.43** (0.17)	**0.07*** (0.17)
OE (*n* = 136)	**0.54** (0.25)	**0.50** (0.22)	**0.04** (0.23)

Notes: * p < 0.10 according to Mann – Whitney U-test. For the difference between MAPs, we report the pooled standard deviation.

As a second step, we use regression analysis to directly compare the two methods. We report OLS regression estimates in Table 2. In Model (1), we regress the variable MAP on two treatment dummies: TG takes value 1 if the observation is collected in the trust game and zero otherwise and OE takes value 1 if the observation is collected using the OE version and zero otherwise. The estimated coefficient of TG suggests that MAPs increase significantly by 5 percentage points in the trust game compared to the risky dictator game. This supports the presence of significant betrayal aversion in our entire sample. Additionally, the OE's coefficient reveals that MAPs elicited with the OE method are on average 6 percentage points higher than the ones elicited with the CL mechanism. Additionally, we control for the gender of the participants by including the dummy "Female". Interestingly, females report significantly higher MAPs than males both in the trust game and risky dictator game. This is in line with the finding that women tend to be generally more averse to risks than men (Croson and Gneezy (2009)).

Model (2) adds the interaction term between the variables TG and OE to Model (1). If the size of betrayal aversion elicited in CL is significantly higher than the one elicited in OE, we should expect the interaction term to be negative and significant. Although the sign is indeed negative, the coefficient is not significant. This leads us to conclude that, on average, the measures of betrayal aversion obtained with the two methods are not statistically different.

Table 2 OLS regressions. Dependent variable: MAPs.

	(1)	(2)
TG	0.053**	0.072**
	(0.024)	(0.029)
OE	0.060**	0.079**
	(0.024)	(0.033)
TG × OE		-0.039
		(0.049)
Female	0.108***	0.108***
	(0.024)	(0.024)
Intercept	0.383***	0.374***
	(0.023)	(0.025)
N	273	273
R^2	0.103	0.105

Notes: Robust standard errors in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

We ask next which of the two methods is preferable to use in practice. In Study 1, we observe a general tendency of CL to generate less extreme values and less variation in the distribution of MAPs compared to OE. This could be due to a framing effect of the choice list, if subjects are led to switch more in the middle of the table. However, it could also be that subjects are less confused and these extreme values are in fact noisy valuations that the CL version helps to eliminate.

One way to assess whether this is the case is to check subjects' understanding in OE and CL. We conjecture that the comprehension of procedural aspects of the mechanism will be inversely related to the noise present in the elicited distributions of MAPs, and thus measuring subjects' understanding would reveal which method minimizes subjects' misconceptions. In order to address this, we report, in the next section, the results of Study 2 aimed at measuring subjects' understanding across our two versions of the BDM mechanism.

3. Study 2 – Assessing subjects' understanding of the instructions

In Study 2, we conduct an online survey study where we compare the instructions of OE and CL asking subjects to read the instructions and answer a set of comprehension questions.

3.1 Survey design and procedures

Our participants were undergraduate students (n = 209) from the University of Nottingham who had not taken part in the experiments reported in Section 2. We recruited subjects through ORSEE (Greiner (2004)). Upon their acceptance to participate in our online survey, subjects were told that the task was part of a research project and were invited to read an instruction document. After reading the instructions, they were asked a set of comprehension questions. Participants were informed before they started the task that we would ask them "some questions" about the instructions and that they would not participate in the experiment. In Question 1, subjects had to answer the following: "How difficult do you think the instructions are?" on a scale from 0 to 10, where 0 corresponds to "very difficult," 5 to "neither difficult nor easy," and 10 to "very easy." Questions 2 and 3, each of which comprises three sub-items, were hypothetical scenarios where subjects in the role of the first movers were asked questions on the functioning of the BDM mechanism (see Appendix A.1 for the list of questions). Subjects were presented only the experimental instructions from the trust game. We assume that any difference would translate analogously to the risky dictator game. Participants were entered in a prize draw if they completed the task, i.e., if they answered the full set of questions. There were two prizes of £50 each.

3.2 Survey Results

In Table 3 we report the average response (standard deviation) to Question 1 and the percentage of mistakes in Question 2 and 3. The self-reported assessment of difficulty (Question 1) reveals that CL is perceived significantly easier than OE. Average ratings amount to 6.40 and 4.90, respectively (0 corresponds to "very difficult" and 10 to "very easy"; MWU-test, z = -4.307, p = 0.000).

Furthermore, when we look at the comprehension questions (Questions 2 and 3), we find also significant evidence that CL is better understood than OE. Indeed, for all sub-items of Question 2 and 3, we find that the percentage of mistakes is significantly lower in CL than OE. These results suggests that CL is significantly easier for subjects' understanding and that we were successful in reducing subjects' confusion and mistakes.

Table 3. Answers to comprehension questions in CL and OE

	CL (n = 107)	OE (n = 102)	Tests	Significance
Question 1	6.40 (2.34)	4.90 (2.40)	Mann-Whitney	***
Question 2				
a)	5.6%	23.5%	χ^2 test	***
b)	14%	27.5%	χ^2 test	**
c)	15%	26.5%	χ^2 test	**
Question 3				
a)	20.6%	32.4%	χ^2 test	*
b)	38.3%	59.8%	χ^2 test	***
c)	39.3%	60.8%	χ^2 test	***

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
All percentages are percentages of wrong answers.

4. Summary and concluding discussion

In this paper, we have investigated whether different implementations of the BDM mechanism affect the elicitation of probability equivalents in the context of betrayal aversion. We have compared the original Bohnet and Zeckhauser (2004) instructions and procedures (OE treatment) with a different implementation of the BDM mechanism (CL treatment).

Our experimental results show that two different versions produce different distributions of elicited MAPs. In particular, CL generates less variation and a more peaked distribution with less extreme values of MAPs. However, these differences do not translate into significant differences in the levels of betrayal aversion. This suggests that betrayal aversion is robust to different versions of the BDM mechanism. As a second step of our analysis, we have assessed which implementation is preferable to use in practice by eliciting perceived complexity and subjects' understanding of the mechanism in an online study. Study 2 compares the experimental instructions used in Study 1 and reveals that CL is preferable both in terms of perceived and inferred complexity. Given the latter result, we speculate that the greater incidence of extreme values in OE compared to CL may be attributable to the higher rate of mistakes in OE rather than a potential framing effect of the choice list in CL, leading subjects to switch more in the middle of the table.

Overall, our results confirm the presumption that valuations elicited through the BDM mechanism may be biased due to subjects' mistakes and misconceptions of the incentive system (Cason and Plott (2014)). We further show that these mistakes can be reduced by employing a set of instructions which make the decision situation as clear as possible. Hence, tools designed to test the clarity of instructions and procedures should be employed to minimize the likelihood of noisy valuations.

We conclude with one observation on the generalizability of our results for other settings using the BDM mechanism. We notice that there might be some settings or some research questions where the mistakes do not constitute a threat for the measurement of the phenomenon under investigation. In particular, in the context of betrayal aversion the fact that our OE version likely produces more noisy valuations than our CL version does not affect the estimate of betrayal aversion which is measured as a difference between two conditions (social risk vs. natural risk). This is good news for future research willing to use the BDM mechanism to elicit a difference between two valuations or more generally two treatments. However, researchers interested in using the mechanism to elicit a valuation for just one condition, for example in our case to measure *just* social risk preferences (as, for example, in Bohnet et al. (2010)), should use a version of the mechanism that minimizes subjects' mistakes to avoid biases in the elicited values. In this sense, our CL version constitutes a significant improvement compared to the OE instructions.

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APPENDIX

A.1 STUDY 2 STRUCTURE AND EXAMPLE QUESTIONS

(*Introduction common to both treatments*)
Please imagine that you are a participant in an experiment who has to read the following instructions. At the end we will ask you some questions about this text. Remember that the monetary amounts mentioned in this text do not apply to you; you will be entered in a prize draw if you answer all the questions.

(*Instructions – see Appendix A.2*)

Please answer the questions below. Click on the back button at the end of the page if you want to read again the instruction document.

Questions (treatment *CL*)

1. How difficult do you think the instructions are to understand? Rate on a scale from 0 to 10 where 0 corresponds to very difficult to understand and 10 corresponds to very easy to understand.
2. Suppose you were a participant and you filled in the table in the following way:

Number of participants in Group B choosing **Left**	You choose	
20 out of 20	In	Out
19 out of 20	In	Out
18 out of 20	In	Out
17 out of 20	In	Out
16 out of 20	In	Out
15 out of 20	In	Out
14 out of 20	In	Out
13 out of 20	In	Out
12 out of 20	In	Out
11 out of 20	In	Out
10 out of 20	In	Out
9 out of 20	In	Out
8 out of 20	In	Out
7 out of 20	In	Out
6 out of 20	In	Out
5 out of 20	In	Out
4 out of 20	In	Out
3 out of 20	In	Out
2 out of 20	In	Out
1 out of 20	In	Out
0 out of 20	In	Out

Suppose the experimenter then revealed that there are 14 participants in Group B choosing Left.

a. Would your payoff depend on your counterpart's choice? Yes/No

Suppose your counterpart chose Left:

b. How many points would you get? _______
c. How many points would your counterpart get? _______

3. Now suppose instead that you filled in the table in the following way:

Number of participants in Group B choosing **Left**	You choose	
20 out of 20	(In)	Out
19 out of 20	(In)	Out
18 out of 20	(In)	Out
17 out of 20	(In)	Out
16 out of 20	(In)	Out
15 out of 20	(In)	Out
14 out of 20	(In)	Out
13 out of 20	(In)	Out
12 out of 20	(In)	Out
11 out of 20	(In)	Out
10 out of 20	(In)	Out
9 out of 20	(In)	Out
8 out of 20	(In)	Out
7 out of 20	(In)	Out
6 out of 20	(In)	Out
5 out of 20	In	(Out)
4 out of 20	In	(Out)
3 out of 20	In	(Out)
2 out of 20	In	(Out)
1 out of 20	In	(Out)
0 out of 20	In	(Out)

For this case suppose that the experimenter then revealed that there are 4 participants in Group B choosing Left.

a. Would your payoff depend on your counterpart's choice? Yes/No

Suppose your counterpart chose Right:

b. How many points would you get? _______
c. How many points would your counterpart get? _______

Questions (treatment *OE*)

Please answer the questions below. Click on the back button at the end of the page if you want to read again the instruction document.

1. How difficult do you think the instructions are to understand? Rate on a scale from 0 to 10 where 0 corresponds to very difficult to understand and 10 corresponds to very easy to understand.

2. Suppose you were a participant and your answer to the KEY QUESTION was 0.5.

Suppose the experimenter then informed you that the percentage of Persons Y who chose Option 1 was 70%.

a. Would your payoff depend on your Person Y's choice? Yes/No

Suppose your Person Y chose Option 1:
b. How many points would you get? _______
c. How many points would your counterpart get? _______

3. Now suppose instead that your answer to the KEY QUESTION was 0.3.

For this case suppose that the experimenter then informed you that the percentage of Persons Y who chose Option 1 was 20%.

a. Would your payoff depend on your Person Y's choice? Yes/No

Suppose your Person Y chose Option 2:
b. How many points would you get? _______
c. How many points would your counterpart get? _______

A.2 INSTRUCTIONS

Experimental instructions OE treatment

Welcome to research project C.1! **[First Movers – TG]**

You are participating in a study in which you will earn some money. The amount will depend on the outcome of a game you will play. The amount of money which you earned with your decisions will paid to you in cash at the end of the experiment. We will not speak of Pounds during the experiment, but rather of points. At the end of the study, the total amount of points you earned will be converted to Pounds at the following rate:

1 point=£0.2

How the study is conducted. The study is conducted anonymously. Participants will be identified only by participation numbers. There is no communication among them. We will call individuals who are in the same role as you "Persons S". You are randomly paired with another person present in this room, call him/her "Person Y", whose identity you will never know. Neither your choice nor Y's choice will be known to other participants or to the researchers.

What the study is about. The study seeks to understand how people decide. You are confronted with two alternatives, A and B. A gives you a payoff for sure and Person Y takes no action. B gives you an outcome that depends on Person Y's behaviour. Person Y chooses between options 1 and 2.

Payoff table

Result of your decision	Nature of choice	Your earnings	Earnings to Person Y
A	Certainty	10	10
B	Person Y chooses		
	1	15	15
	2	8	22

The payoff table read as follows:

If you end up choosing A, you and Person Y will each get 10 points.

If you end up choosing B and Person Y chooses 1, you and Person Y will each get 15 points.

If you end up choosing B and Person Y chooses 2, you will get 8 points and Person Y will get 22 points.

KEY QUESTION: How large would the probability p of being paired with a Person Y who chose Option 1 minimally have to be for you to pick Alternative B over Alternative A? (like any probability it must lie between 0 and 1).
YOUR ANSWER: I choose B if p is at least______
Note: You do not know what the actual value of p is. Your choice does not influence the value of p. It is determined by the fraction of Persons Y choosing Option 1. With YOUR ANSWER you indicate how large the fraction of Persons Y who choose 1 has to be before you pick B over A.

Conduct of the study C.1

1. While you answer the KEY QUESTION, each of the individuals playing Persons Y has to answer the following question:
   "Which option, 1 or 2, do you choose in case B?"
   After you and your Person Y have decided, we will collect the answer forms. Please fold them so that nobody can see YOUR ANSWER.
2. We will then calculate the percentage of Persons Y who chose Option 1 and inform everyone of it. This gives you p*, the probability of being paired with a Person Y who chose Option 1.
3. **If p* is greater than or equal to your required value of p (from YOUR ANSWER above), we will follow your instructions. Your earnings will be determined by your Person Y's choice**.
   a. If your Person Y chose 1, you and your Person Y will get 15 points each.
   b. If your Person Y chose 2, you will get 8 points and your Person Y will get 22 points.
4. **If p* is less than your required value of p (from YOUR ANSWER above), we will follow your instructions: you and your Person Y will get Certainty A, namely 10 points each.**

Completion of Study

Before we conduct the study we ask you to complete a pre-study questionnaire.
We will start the study once everyone has correctly filled out this questionnaire.

Welcome to research project C.2! **[Second movers – TG]**

You are participating in a study in which you will earn some money. The amount will depend on the outcome of a game you will play. The amount of money which you earned with your decisions will be paid to you in cash at the end of the experiment. We will not speak of Pounds during the experiment, but rather of points. At the end of the study, the total amount of points you earned will be converted to Pounds at the following rate:

1 point=£0.2

How the study is conducted. The study is conducted anonymously. Participants will be identified only by participation numbers. There is no communication among the participants. We will call you and participants who are in the same role as you "Persons Y". You are randomly paired with another person present in this room, call him/her "Person S", whose identity you will never know. Neither your choice nor S's choice will be known to other participants or to the researchers.

What the study is about. The study seeks to understand how people decide. Person S is confronted with two alternatives, A and B. A gives you and Person S a payoff for sure. You do not take any action. If Person S's decision results in B, you have to choose one of two options, 1 or 2.

Payoff table

Result of Person S' decision	Nature of choice	Your earnings	Earnings to Person S
A	Certainty	10	10
B	You choose		
	1	15	15
	2	22	8

The payoff table read as follows:

If Person S' decision results in A, you and Person S will each get 10 points.

If Person S' decision results in B and you choose 1, you and Person S will each get 15 points.

If Person S' decision results in B and you choose 2, you will get 22 points and Person S will get 8 points.

KEY QUESTION: Which option, 1 or 2, do you choose in case B?

YOUR ANSWER: I choose______

After you have answered this question we will collect your answer form.

Completion of Study

Before we conduct the study we ask you to complete a pre-study questionnaire. We will start the study once everyone has correctly filled out this questionnaire.

Welcome to research project B.1! **[First movers – RDG]**

You are participating in a study in which you will earn some money. The amount will depend on the outcome of a game you will play. The amount of money which you earned with your decisions will be paid to you in cash at the end of the experiment. We will not speak of Pounds during the experiment, but rather of points. At the end of the study, the total amount of points you earned will be converted to Pounds at the following rate:

1 point=£0.2

How the study is conducted. The study is conducted anonymously. Participants will be identified only by participation numbers. There is no communication among them. We will call individuals who are in the same role as you "Persons S". You are randomly paired with another person present in this room, call him/her "Person X", whose identity you will never know. Neither your choice nor Y's choice will be known to other participants or to the researchers.

What the study is about. The study seeks to understand how people decide. You are confronted with two alternatives, A and B. A gives you and Person X a payoff of 10 points for sure. B gives you and Person X an outcome that depends on a lottery. The lottery can produce Options 1 or Option 2.

Payoff table

Result of your decision	Nature of choice	Your Earnings	Earnings to Person X
A	Certainty	10	10
B	Lottery produces 1	15	15
	2	8	22

The payoff table read as follows:

If you end up choosing A, you and Person X will each get 10 points.

If you end up choosing B and the lottery produces 1, you and Person X will each get 15 points.

If you end up choosing B and the lottery produces 2, you will get 8 points and Person X will get 22 points.

KEY QUESTION: How large would the probability p of the lottery producing Option 1 minimally have to be for you to pick Alternative B over Alternative A? (like any probability, it must lie between 0 and 1).

YOUR ANSWER: I choose B if p is at least______

Note: You do not know what the actual value of p is. Your choice does not influence the value of p. The value of p was determined before the start of this experiment. It is in a sealed envelope. With YOUR ANSWER you indicate how large p has to be before you pick B over A.

Conduct of the study B.1

1. While you answer the KEY QUESTION, we will post the envelope containing the value of p on the blackboard. After you have decided, we will collect the answer forms. Please fold them so that nobody can see YOUR ANSWER.
2. We will then open the sealed envelope and inform everyone of the value of p for this experiment. This gives you p*, the probability of receiving Option 1.
3. **If p* is greater than or equal to your required value of p (from YOUR ANSWER above), we will follow your instructions: Your earnings will be determined by the outcome of the lottery.**
   We will create and then conduct the lottery. We will put green and blue balls into a urn. Out of all balls in the urn, the percentage of green balls will be the same as p*. The remaining balls will be blue. We will then randomly pull a ball from the urn.
   a. If the ball is green, you and your Person X will get 15 points each.
   b. If the ball is blue, you will get 8 points and your Person X will get 22 points.
4. **If p* is less than your required value of p (from YOUR ANSWER above), we will follow your instructions: You and your Person X will get Certainty A, namely 10 points each.**

Completion of Study
Before we conduct the study we ask you to complete a pre-study questionnaire.
We will start the study once everyone has correctly filled out this questionnaire.

Welcome to research project B.2! **[Recipients – RDG]**

You are participating in a study in which you will earn some money. The amount will depend on the outcome of a game you will play. The amount of money which you earned with your decisions will be paid to you in cash at the end of the experiment. We will not speak of Pounds during the experiment, but rather of points. At the end of the study, the total amount of points you earned will be converted to Pounds at the following rate:

1 point=£0.2

How the study is conducted. The study is conducted anonymously. Participants will be identified only by participation numbers. There is no communication among them. You are

randomly paired with another person present in this room, call him/her Person S, whose identity you will never know. S's choice will not be known to other participants or to the researchers.
What the study is about. The study seeks to understand how people decide. Person S has to choose one of two alternatives, A or B. A gives you and Person S a payoff of 10 points for sure. B gives you and Person S a chance outcome: The probability p is the likelihood that you and Person S will get 15 points each; with probability 1-p you will get 22 points and Person S will get 8 points.

Payoff table

Result of Person S decision	Nature of choice	Your earnings	Earnings to Person S
A	Certainty	10	10
B	Lottery produces 1	15	15
	2	22	8

The payoff table reads as follows:
If Person S chooses A, you and Person S will each get 10 points.
If Person S chooses B and the lottery produces 1, you and Person S will each get 15 points.
If Person S chooses B and the lottery produces 2, you will get 22 points and Person S will get 8 points.
Note: Neither you nor Person S know what the actual value of p is. The value of p was determined before the start of this experiment. It is in a sealed envelope.

<u>You do not take any action but wait until Persons S will have made their decisions.</u>

Conduct of the study B.2

1. While you are waiting, Persons S answer the following question:
   "How large would p have to be for you to pick B over A?"
   After all Persons S have answered this question, we will collect their answer forms.
2. After the second experiment, we will then open the envelope and inform everyone on the value of p for this experiment. Call it p*.
3. **If p* is greater than or equal to the value of p required by your Person S, you and Person S will get Lottery B.**
   We will create and then conduct the lottery. We will put green and blue balls into a urn. Out of all balls in the urn, the percentage of green balls will be the same as p*. The remaining balls will be blue. We will then randomly pull a ball from the urn:
   a. If the ball is green, you and your Person S will get 15 points each.
   b. If the ball is blue, you will get 22 points and your Person S will get 8 points.

4. **If p* is less than the value of p required by your Person S, you and Person S will get Certainty A, namely 10 points for sure.**

Completion of Study

Before we conduct the study we ask you to complete a pre-study questionnaire. We will start the study once everyone has correctly filled out this questionnaire.

Experimental instructions CL treatment

Welcome to research project CGQ.1! **[First movers – TG]**

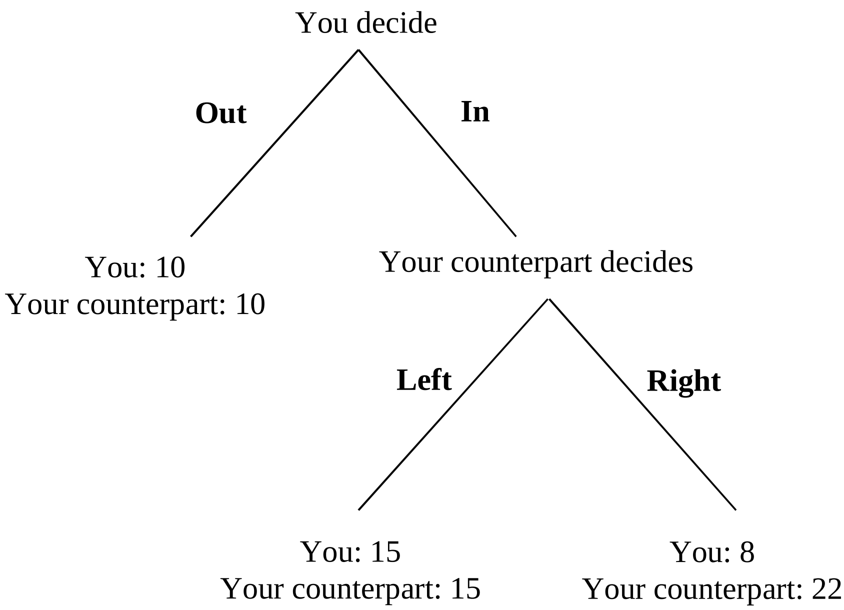
You are participating in a study in which you will earn some money. The amount you earn will depend on the outcome of a game you will play. It will be paid to you in cash at the end of today's session. However, during the session, we will speak of points, rather than Pounds. At the end, the points you earn will be converted to Pounds at the following rate:

1 point=£0.20

The decision situation

We first introduce you to the basic decision situation. You are randomly matched with another participant: your counterpart. You are confronted with two alternatives, **In** or **Out**. If you play **Out,** you and your counterpart get 10 points each. If you play **In**, the outcome depends on your counterpart's decision.

Your counterpart chooses between **Left** or **Right**. If he/she plays **Left,** you and your counterpart get 15 points each. If instead, he/she plays **Right,** you get 8 points and your counterpart gets 22 points.



The experiment

The experiment is based on the decision situation just described to you.
In this experiment there are 40 participants in total, divided into two groups: Group A and Group B. You belong to Group A, which is composed of 20 participants. Every participant in Group A has to decide between **In** and **Out**. Your counterpart belongs to Group B, which is also composed of 20 subjects. Every participant in Group B has to decide between **Left** and **Right**. In this experiment, we ask you to take your decisions considering not only the possible action of your counterpart but also the possible actions of all participants in Group B. In particular, we ask you to take a separate decision between **In** and **Out for each possible value of the number of participants in Group B who choose Left**.
We ask you to take your decisions by filling in a table that will be distributed later but which will look similar to the one below.

Number of participants in Group B choosing **Left**	You choose	
20 out of 20	In	Out
19 out of 20	In	Out
18 out of 20	In	Out
...	...	
2 out of 20	In	Out
1 out of 20	In	Out
0 out of 20	In	Out

The first column indicates the possible values of the number of participants in Group B who choose **Left.** The second column indicates your choice. In EACH row of the table, you have to circle either **In** or **Out**. Your choice will determine your action in the event that the actual number of participants in Group B choosing **Left** is the number given at the start of the row.
For example, if you circle **In** in the second row, it means that you would choose **In** for the case where 19 out of 20 participants in Group B choose **Left**.
We imagine that, if all 20 participants in Group B play Left, you will probably want to play **In**, since this would give you and your counterpart 15 points each, instead of just 10 points each. However, there may be some rows where the number of participants in Group B playing Left is low enough for you to prefer to select **Out** in them. If you do feel this way, you would choose **In** in the top row and perhaps some more rows, and **Out** in some lower rows. Thus, you would switch from **In** to **Out** at some point in the table. We emphasise, however, that it is entirely up to you what to choose in each row.

(While you are circling either **In** or **Out** in each row of the table, all the participants in Group B have to answer the following question:
"Which option, **Left** or **Right**, do you choose in case your counterpart chooses **In**?"
After all participants have made their choices, we will collect the response sheets. We will then count the number of participants in Group B who chose **Left**.This will indicate the row of the table you completed that determines your action and so is relevant for your earnings. Thus, all the decisions you take in the table are potentially important because you don't yet know what the actual number of participants in Group B choosing **Left** will be.
Two examples should make this clear.
EXAMPLE 1: Suppose 19 out of 20 participants in Group B choose **Left**. Then, we will determine your action by selecting your decision in the second row of the table you completed. Suppose further that, in that row, you circled **In**. Then, **In** would be the decision of yours relevant to your earnings. At that point, there would be two possible cases: either your counterpart is one of the 19 participants in Group B who chose **Left** or he/she is the one who chose **Right**. In the former case, you and your counterpart get 15 points. In the latter case, you get 8 points and your counterpart gets 22 points.

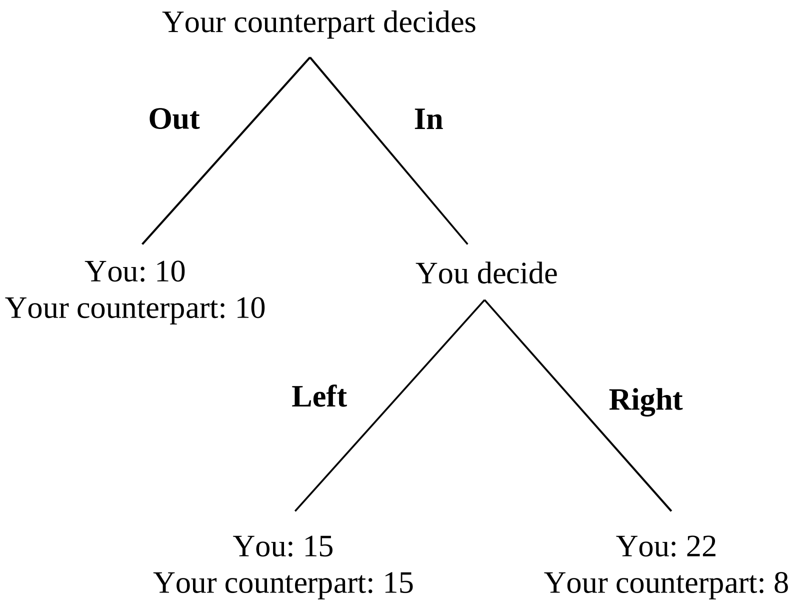
EXAMPLE 2: Suppose 1 out of 20 participants in Group B choose **Left** and suppose further that in the corresponding row you circled **Out**. Then, **Out** will be the decision you took that is relevant for your earnings. In this case, you and your counterpart each get 10 points, regardless of whether your counterpart chose **Left** or **Right**.
.
Before you take your decisions, we ask you to complete a pre-study questionnaire to help us check that you understand the determination of your income. We will distribute the response sheets for the experiment once everyone has correctly filled out their questionnaire.

Welcome to research project CGQ.2! **[Second movers – TG]**
You are participating in a study in which you will earn some money. The amount you earn will depend on the outcome of a game you will play. It will be paid to you in cash at the end of today's session. However, during the session, we will speak of points, rather than Pounds. At the end, the points you earn will be converted to Pounds at the following rate:

1 point=£0.20

<u>The decision situation</u>
We first introduce you to the basic decision situation. You are randomly matched with another participant: your counterpart. He/she is confronted with two alternatives, **In** or **Out**. If he/she plays **Out** you and your counterpart get 10 points each. If he/she plays **In**, the outcome depends on your decision. You choose between **Left** or **Right**. If you choose **Left** you and your

counterpart get 15 points each. If, instead, you choose **Right** you get 22 points and your counterpart gets 8 points.



In this experiment, we ask you to answer the following question on a separate response sheet that we will distribute later: **which option, Left or Right, do you choose in case your counterpart chooses In?**

Before you take your decisions, we ask you to complete a pre-study questionnaire to help us check that you understand the determination of your income. We will distribute the response sheets for the experiment once everyone has correctly filled out their questionnaire.

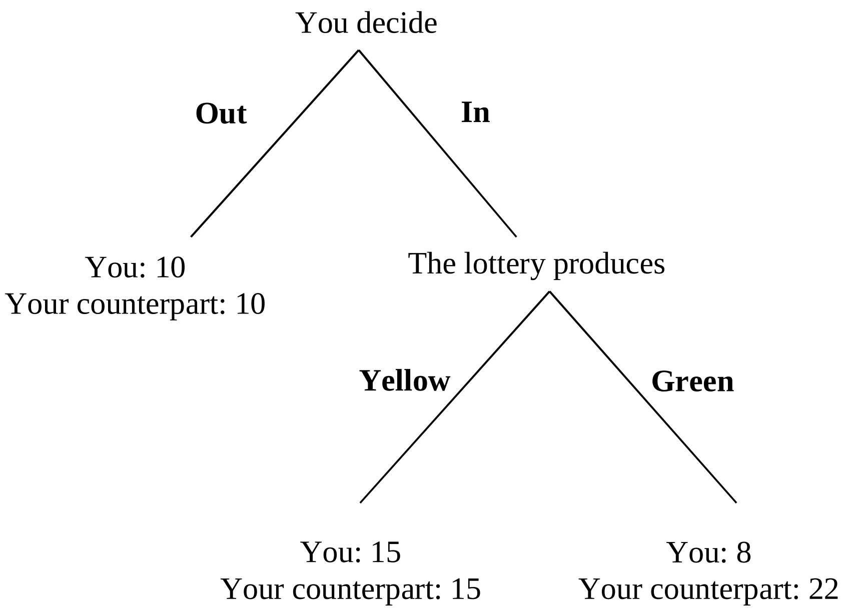
Welcome to research project CGQ.3! **[First movers – RDG]**

You are participating in a study in which you will earn some money. The amount you earn will depend on the outcome of a game you will play. It will be paid to you in cash at the end of today's session. However, during the session, we will speak of points, rather than Pounds. At the end, the points you earn will be converted to Pounds at the following rate:

1 point=£0.20

<u>The decision situation</u>

We first introduce you to the basic decision situation. You are randomly matched with another participant: your counterpart. You are confronted with two alternatives, **In** or **Out**. If you play **Out,** you and your counterpart get 10 points each. If you play **In**, the outcome depends on a random lottery. The lottery can produce **Yellow** or **Green**. If the lottery produces **Yellow** you and your counterpart get 15 points each. If, instead, the lottery produces **Green** you get 8 points and your counterpart gets 22 points.



The lottery will be conducted at the end of the experiment. We will draw one ball from an urn containing a total of 20 coloured balls, each of which may be either yellow of green. If one yellow ball is drawn the lottery produces **Yellow**. If one green ball is drawn the lottery produces **Green**. The number of yellow balls (and consequently green balls) in the urn has been pre-determined before the experiment. You will know the actual number of yellow balls in the urn for this session only after you take your decisions.

<u>The experiment</u>

The experiment is based on the decision situation just described to you.
In this experiment, we ask you to take your decisions considering all the possible values of the number of yellow balls in the urn. In particular, we ask you to take separate decision between **In** and **Out for each possible value of the number of yellow balls in the urn**.
We ask you to take your decisions by filling in a table that will be distributed later but which will look similar to the one below.

Number of **Yellow** balls in the urn	You choose	
20 out of 20	In	Out
19 out of 20	In	Out
18 out of 20	In	Out
...	...	
2 out of 20	In	Out
1 out of 20	In	Out
0 out of 20	In	Out

The first column indicates the possible values of the number of yellow balls in the urn**.** The second column indicates your choice. In EACH row of the table, you have to circle either **In** or **Out**. Your choice will determine your action in the event that the actual number of yellow balls in the urn is the number given at the start of the row.

For example, if you circle **In** in the second row, it means that you would choose **In** for the case where where the number of yellow balls in the urn is 19 out of 20.

We imagine that, if all 20 balls in the urn are yellow, you will probably want to play **In**, since this would give you and your counterpart 15 points each, instead of just 10 points each. However, there may be some rows where the number of yellow balls in the urn is low enough for you to prefer to select **Out** in them. If you do feel this way, you would choose **In** in the top row and perhaps some more rows, and **Out** in some lower rows. Thus, you would switch from **In** to **Out** at some point in the table. We emphasise, however, that it is entirely up to you what to choose in each row.

(While you are circling either **In** or **Out** in each row of the table, all the participants in Group B have to answer the following question:

“Which option, **Left** or **Right**, do you choose in case your counterpart chooses **In**?”

After all participants have made their choices, we will collect the response sheets. We will reveal the number of yellow balls in the urn for this experiment. This will indicate the row of the table you completed that determines your action and so is relevant for your earnings. Thus, all the decisions you take in the table are potentially important because you don’t yet know what the actual number of yellow balls in the urn will be.

Two examples should make this clear.

EXAMPLE 1: Suppose there are 19 out of 20 yellow balls in the urn**.** Then, we will determine your action by selecting your decision in the second row of the table you completed. Suppose further that, in that row, you circled **In**. Then, **In** would be the decision of yours relevant to your earnings. At that point, there would be two possible cases: either we draw one yellow ball from the urn or we draw the green one. In the former case, you and your counterpart get 15 points. In the latter case, you get 8 points and your counterpart gets 22 points.

EXAMPLE 2: Suppose there are 1 out of 20 yellow balls in the urn and suppose further that in the corresponding row you circled **Out**. Then, **Out** will be the decision you took that is relevant for your earnings. In this case, you and your counterpart each get 10 points, regardless of whether we draw a yellow or a green ball from the urn.

Before you take your decisions, we ask you to complete a pre-study questionnaire to help us check that you understand the determination of your income. We will distribute the response sheets for the experiment once everyone has correctly filled out their questionnaire.

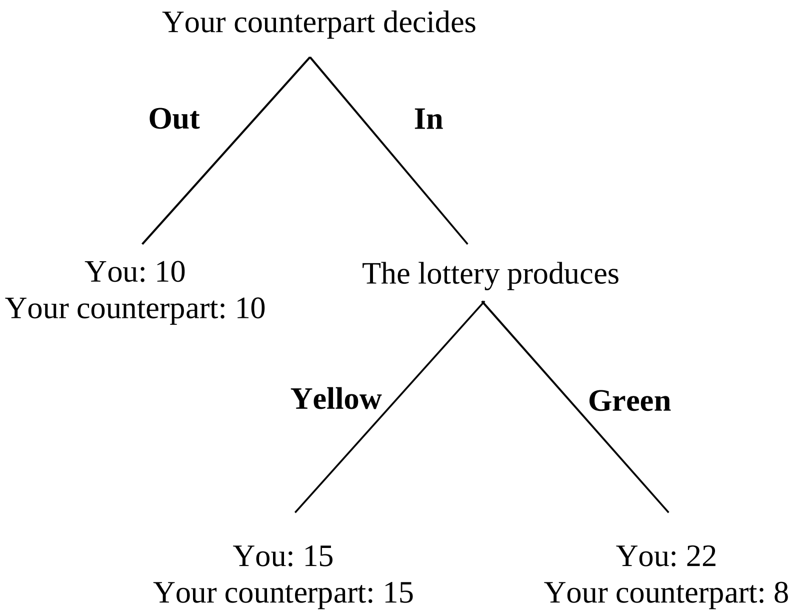
Welcome to research project CGQ.4! **[Recipients – RDG]**

You are participating in a study in which you will earn some money. The amount you earn will depend on the outcome of a game you will play. It will be paid to you in cash at the end of today's session. However, during the session, we will speak of points, rather than Pounds. At the end, the points you earn will be converted to Pounds at the following rate:

1 point=£0.20

The decision situation

We first introduce you to the basic decision situation. You are randomly matched with another participant: your counterpart. He/she is confronted with two alternatives, **In** or **Out**. If he/she plays **Out** you and your counterpart get 10 points each. If he/she plays **In**, the outcome depends on a random lottery. The lottery can produce **Yellow** or **Green**. If the lottery produces **Yellow** you and your counterpart get 15 points each. If, instead, the lottery produces **Green** you get 22 points and your counterpart gets 8 points.



The lottery will be conducted at the end of the experiment. We will pick a ball from an urn containing a total of 20 coloured balls, which can be either yellow or green. If one yellow ball is drawn the lottery produces **Yellow**. If one green ball is drawn the lottery produces **Green**. The number of yellow balls (and consequently green balls) in the urn has been pre-determined before the experiment.

Before your counterpart takes his/her decision, we ask you to complete a pre-study questionnaire to help us check that you understand the determination of your income.