

2015

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Brice Corgnet

*Chapman University*, [corgnet@chapman.edu](mailto:corgnet@chapman.edu)

Antonio M. Espín

*Middlesex University Business School*

Roberto Hernán-González

*University of Nottingham*

Praveen Kujal

*University of Nottingham*

Stephen Rassenti

*Chapman University*, [rassenti@chapman.edu](mailto:rassenti@chapman.edu)

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## Recommended Citation

Corgnet, B., Espín, A., Hernán-González, R., Kujal, P., and Rassenti, S. "To trust, or not to trust: Cognitive reflection in trust games," *Journal of Behavioral and Experimental Economics*, 000 (2015) 1–8, Available online 26 October 2015.  
doi: 10.1016/j.socec.2015.09.008

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# To Trust, or Not to Trust: Cognitive Reflection in Trust Games

## Comments

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**TO TRUST, OR NOT TO TRUST:  
COGNITIVE REFLECTION IN TRUST GAMES<sup>1</sup>**

Brice Corgnet<sup>a,b</sup>, Antonio M. Espín<sup>c</sup>, Roberto Hernán-Gonzalez<sup>d</sup>, Praveen Kujal<sup>c</sup>,  
and Stephen Rassenti<sup>b</sup>

<sup>a</sup> Argyros School of Business and Economics, Chapman University, Orange, CA, USA

<sup>b</sup> Economic Science Institute, Chapman University, Orange, CA, USA

<sup>c</sup> Economics, Business School, Middlesex University, London, UK

<sup>d</sup> Division of Industrial Economics and Finance, Business School, University of Nottingham, Nottingham, UK

**Abstract:** We present results from two studies that show a positive relation between cognitive reflection and trusting behavior, but no significant relation with trustworthy behavior. Our finding holds regardless of individual distributional social preferences and risk aversion. Our results add to a growing body of literature that illustrates the role of cognitive ability in helping explain outcomes in economic experiments.

**KEYWORDS:** cognitive reflection; trust; trustworthiness; social preferences; betrayal aversion

**JEL CODES:** C92, D31, D81.

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<sup>1</sup> The authors acknowledge financial support from the International Foundation for Research in Experimental Economics, the Argyros School of Business and Economics at Chapman University, the Spanish Ministry of Education [Grant 2012/00103/001], Spanish Plan Nacional I+D MCI [ECO2013-44879-R], 2014-17, and Proyectos de Excelencia de la Junta Andalucía [P12.SEJ.1436], 2014-18.

## INTRODUCTION

Trust is essential for the consummation of exchange and subsequent realization of gains ([Smith](#), 1759). [Arrow](#) (1972) argued that trust is indispensable for the proper functioning of any economic system: “*Virtually every commercial transaction has within itself an element of trust... It can be plausibly argued that much of the economic backwardness in the world can be explained by the lack of mutual confidence*” (p. 357). Relatedly, trust has been shown to impact economic variables such as growth and financial development ([Algan](#) and [Cahuc](#), 2010) as well as entrepreneurship and trade ([Guiso](#), [Sapienza](#) and [Zingales](#), 2004, 2006). In sum, trust is seen as the lubricant that facilitates exchange in society so its relevance cannot be overstated.

In this paper, we propose a microeconomic analysis of the determinants of trust. We build on the experimental economics literature that has developed ([Berg](#), [Dickhaut](#) and [McCabe](#), 1995) and extensively studied (see meta-analysis by [Johnson](#) and [Mislin](#), 2011) incentivized behavioral measures of trust and trustworthiness. Interestingly, there is evidence of a relation between the behavioral measure of trust developed in the lab and macroeconomic variables. For example, [Johnson](#) and [Mislin](#) (2011) found a positive correlation between GDP in a given country and the experimental measure of trust of a sample of its population.

Although a number of personal characteristics ranging from personality traits to education may affect trusting behavior, we focus on the role of cognitive ability. This is motivated by the fact that previous research has reported preliminary evidence of a positive correlation between intelligence and generalized trust (i.e. trust in other members of the society) ([Sturgis](#), [Read](#) and [Allum](#), 2010; [Hooghe](#), [Marien](#) and [de Vroome](#), 2012; [Carl](#) and [Billarri](#), 2014). Generalized trust is a self-reported measure of trust, which is assessed by non-incentivized survey questions such as “How often do you trust others?” Recently, [Carl](#) and [Billari](#) (2014) have shown that there exists a positive correlation between generalized trust and measures of intelligence in a large, nationally representative sample of U.S. adults. Their measures of intelligence were both objective and subjective: subjects were evaluated on the basis of exactly how they responded to a verbal test, or the perception of an interviewer regarding how well they understood the questions asked. We extend this research by studying a behavioral measure of trust that was elicited in a controlled and incentivized environment. In addition, we consider

whether a validated and widely used measure of cognitive ability: the Cognitive Reflection Test (CRT) can explain trust or trustworthiness behavior in our particular experiment.

Our work also contributes to the growing body of research on the relation between cognitive abilities and economic behavior in the experimental economics literature. A large number of experimental studies have used the CRT ([Frederick, 2005](#)) both because of its short duration and its unprecedented success in predicting economic decisions (e.g. Oechssler, Roider, and Schmitz, 2009). For example, student performance in the CRT has been shown to correlate positively with earnings in experimental asset markets (Corgnet, Hernán-González, Kujal and Porter, 2015) and other individual tasks and games involving risk and time preferences ([Frederick, 2005](#); Oechssler, Roider, and Schmitz, 2009; Brañas-Garza, García-Muñoz, and Hernán-González, 2012). The CRT has also been shown to be positively correlated with general measures of intelligence such as the SAT ([Frederick, 2005](#)).

The CRT may be an especially relevant measure of cognitive ability for the study of strategic economic decisions (e.g. trust) because it simultaneously captures the ability to engage in reflective processes and execute computational tasks measured in standard intelligence tests (e.g. SAT or Raven matrices; Toplak, West and Stanovich, 2011). In the CRT, respondents are given three questions to which there is an intuitive (automatic) yet incorrect answer. However, with a little deliberation (or cognitive reflection) subjects can override the intuitive response and figure out the correct answer.

In this paper we employ two studies to look at the relation between cognitive reflection and trust. In the first part we examine data from a trust study that uses the standard CRT measure. In the second, we use an augmented version of the CRT (Toplak, West and Stanovich, 2014) as well as elicit subjects' distributional social preferences à la Bartling et al. (2009) and risk attitudes ([Holt and Laury, 2002](#)). We find a positive relation between scores on both CRT tests and trust, but not a significant relation with trustworthiness. Our results are robust to whether participants play only one role (Study 1) or both (Study 2) and also whether the game is implemented as a direct-response (Study 1) or strategy method (Study 2). Finally, these results hold when controlling for social preferences and risk aversion (Study 2).

## Study 1: A first look at the relation between CRT, Trust and Trustworthiness

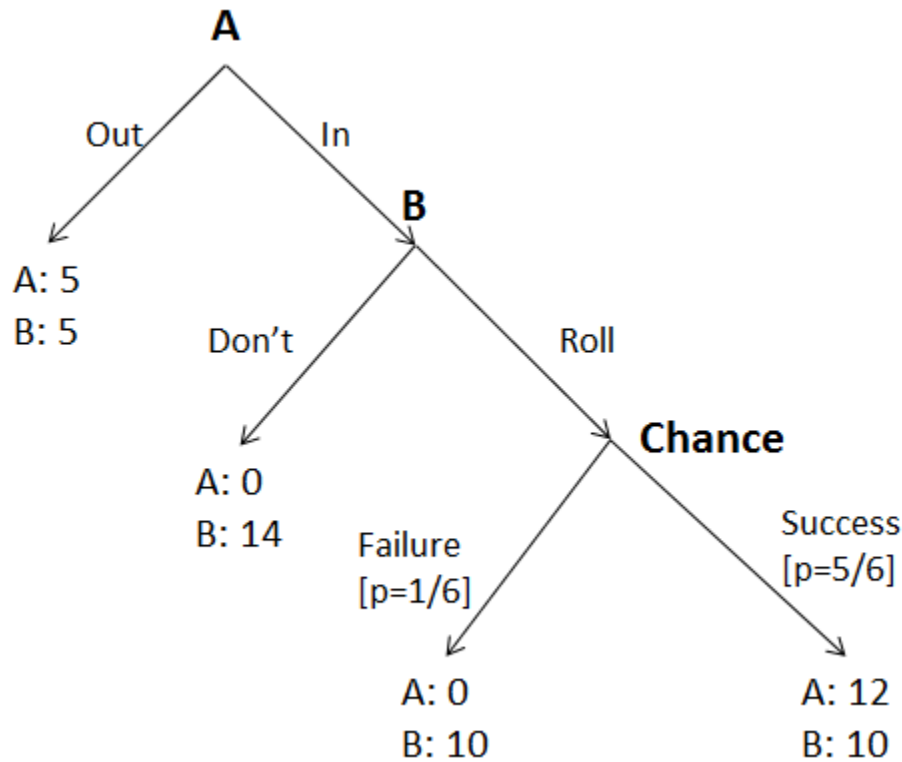
### Methods

As part of a project studying communication and trust, we recruited 80 subjects (52.50% female) to participate in a baseline treatment. We conducted a total of 6 independent sessions with either 12 or 14 subjects in each session. Subjects were recruited from a database of more than 2,000 students attending a major U.S. university. A subset of the whole database received invitations at random for participating in the current study. The experiment lasted for one hour and subjects earned an average of \$14.25 including a \$7 show-up fee.

**Measurement of trust.** In this study, we use the game of trust described in Charness and Dufwenberg (2006; 2010). In the first stage of the game, player A decides whether to play *In* or *Out*. If player A chooses *Out* then the game is over and each player earns \$5. If player A chooses *In* then player B has to select either *Don't* or *Roll*. If player B chooses *Don't* then player B gets \$14 whereas player A gets nothing. If player B chooses *Roll*, then the roll of a six-sided die decides whether the final outcome of the game is a success or a failure. If it is a success (which occurs with probability 5/6) player A gets \$12 and player B gets \$10, and if it is a failure player A gets nothing while player B gets \$10. The payoffs of the game are described in Figure 1. This game can be seen as a game of trust à la Berg et al. (1995) where player A is the trustor and player B is the trustee. The decision for player A to trust thus corresponds to choosing *In* and the decision for player B to be trustworthy corresponds to choosing *Roll*. This game slightly differs from the standard trust game because of the role of chance. As a result, if player A gets zero payoff in this game (s)he does not know whether this is due to player B choosing *Don't* roll the die or if it is due to bad luck in the *Roll*.

Upon arrival, subjects were randomly assigned to one of two separate rooms. All subjects in each room were assigned the same role (e.g. Player A) and were informed that they would be matched with a player in another room playing a different role (e.g. Player B). In contrast to [Charness and Dufwenberg \(2006; 2010\)](#), the game was not played using a strategy-method procedure. Instead, subjects in the role of player B were asked to *Roll* or *Don't roll* only if player A, who they had been matched with, had chosen *In*.

**Figure 1-** The Charness-Dufwenberg (2006; 2010) Trust Game



**Measurement of cognitive reflection.** In addition to playing the trust game, we asked subjects to complete the CRT. We list the CRT questions below:

- (1) A bat and a ball cost \$1.10 in total. The bat costs a dollar more than the ball. How much does the ball cost? \_\_\_\_ cents [Correct answer: 5 cents; intuitive answer: 10 cents]
- (2) If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? \_\_\_\_ minutes [Correct answer: 5 minutes; intuitive answer: 100 minutes]
- (3) In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? \_\_\_\_ days [Correct answer: 47 days; intuitive answer: 24 days]

Our measure of cognitive reflection is given by the total number of correct answers (*mean*  $\pm$  *SEM* = 1.52 $\pm$ 0.18 for females, 1.95 $\pm$ 0.19 for males; Mann-Whitney-Wilcoxon test,  $p = 0.102$ ).

As is standard practice, the cognitive reflection test was not incentivized ([Frederick, 2005](#); [Brañas-Garza et al. 2015](#)).

## Results

The distribution of CRT scores along with the relative frequency of trust (*In*) and trustworthy choices (*Roll*) is displayed in Table 1.

**TABLE 1:** Frequency of Trust and Trustworthiness decision by CRT scores

CRT	Trust ( <i>In</i> ) [n=40]	Trustworthiness ( <i>Roll</i> ) [n=27] <sup>+</sup>
0	57% [n=7]	25% [n=8]
1	50% [n=12]	40% [n=5]
2	67% [n=6]	40% [n=5]
3	87% [n=15]	55% [n=9]

<sup>+</sup>Since 67% (27 out of 40) of A players chose *In*, only 27 B players made a decision.

In Table 2 we report the regression analysis of the *Trust* decision (coded as a dummy that takes value 1 if Player A chose *In* and 0 otherwise) on CRT scores and gender using a probit regression with robust standard errors (regressions [1] and [2]). We obtain a positive and significant relation between CRT scores and trust. This relation holds, whether we control for gender ( $p\text{-value}=0.061$ , column [2]) or not ( $p\text{-value}=0.054$ , column [1]). Although trustworthiness also increases with CRT scores (Table 1), the same analysis for the *Trustworthiness* decision (coded as a dummy that takes value 1 if Player B chose *Roll* and value 0 otherwise) does not result in a significant CRT coefficient ( $p\text{-value}=0.215$  and  $p\text{-value}=0.214$  in columns [3] and [4]).



**TABLE 2.** Probit regression for Trust and Trustworthiness

	Trust		Trustworthiness	
	[1]	[2]	[3]	[4]
Intercept	-0.13 (0.37)	-0.03 (0.47)	-0.64 (0.41)	-0.51 (0.51)
CRT	0.36* (0.19)	0.35* (0.19)	0.25 (0.20)	0.26 (0.21)
Female		-0.13 (0.43)		-0.22 (0.51)
No. of observations	n = 40	n = 40	n = 27	n = 27
Pseudo-R <sup>2</sup>	0.07	0.08	0.04	0.05
Wald- $\chi^2$	3.70*	3.68	1.57	1.75

Female is a dummy variable that takes value 1 if subject is female and zero otherwise.

Estimation output using robust standard errors (in parentheses).

\*p-value<.10, \*\*p-value<.05, and \*\*\*p-value<.01

Given the limited number of observations in this first study, we take this finding as only suggestive of an effect of cognitive ability on trust. The role of chance in the outcome of player B's *Roll* decision may also be influencing the results. We thus designed a second study where we recruited a larger sample of subjects and for which we implemented a "standard" trust game following Berg et al. (1995). We also use Study 2 to collect data on distributional social preferences in order to evaluate whether the CRT effect is driven by its possible relation with social preferences.

Recent research has investigated the relation between social preferences and intelligence ([Brandstater and Guth, 2002](#); [Ben-Ner, Kong, and Putterman, 2004](#); [Millet and Dewitte, 2006](#); [Chen, Chiu, Smith and Yamada, 2013](#)). For example, [Chen et al. \(2013\)](#) find a positive relation between subjects' score in the Math section of the Scholastic Aptitude Test (SAT) and 'giving' in a standard dictator game, but a negative relation between their Grade Point Average (GPA) and 'giving'. Closer to our study, distributional social preferences have been recently found to correlate with CRT scores ([Corgnet, Espin and Hernan-Gonzalez, 2015](#); [Cueva et al., in press](#); [Ponti and Rodríguez-Lara, 2015](#)). Thus, controlling for subjects' preferences over simple payoff distributions provides an interesting robustness check.

Another possible confounding factor in the relation between trust and CRT is related to people's risk attitudes. [Frederick \(2005\)](#) found that subjects with higher CRT scores were less likely to be risk averse. The trust game, which can be framed as an investment game, involves substantial investment risks related to the uncertainty associated with the behavior of the trustee.

The willingness to trust could thus be positively related to CRT scores due to a higher willingness of more reflective individuals to engage in a risky investment. Even though prior evidence regarding the relation between trusting and risky decisions is mixed ([Eckel and Wilson, 2004](#); Fehr, 2009; Houser et al., 2010; Karlan, 2005; Kosfeld et al., 2005), we collected individual risk attitudes measures (à la [Holt and Laury, 2002](#)) to be used as controls in our regression analyses.

## **Study 2: A further inquiry into the relation between CRT, Trust and Trustworthiness**

### **Methods**

We recruited 100 subjects (47% female) to participate in the study. We conducted a total of 8 independent sessions with either 12 or 14 subjects in each session. Subjects were recruited from the same database of more than 2,000 students used in Study 1. A subset of the whole database received invitations at random for participating in the current study with the restriction that they had not participated in Study 1. In addition to the trust game, subjects were also asked to complete an extended CRT, a social preferences test and a risk elicitation task. These data were collected in the context of a larger research program on economic and social preferences, cognitive abilities and creativity.

**Measurement of trust.** We consider a variation of the trust game described in Study 1. First, chance played no role. Second, the game was implemented using the strategy method so that each of the 100 subjects played both the role of trustor and trustee (see for example [Eckel and Wilson, 2004](#) and Casari and Cason, 2009). The strategy method allows us to increase the sample size.

Both the trustor and the trustee were endowed with 100¢. In the role of the trustor, subjects had to decide whether to send their entire 100¢ endowment to the trustee or to keep it. As trustees, subjects had to decide how to split the amount received from the trustor. The amount sent by the trustor (100¢) was tripled (to 300¢) by the experimenter (as in Berg et al., 1995). The different allocations available to the trustee were as follows: {300¢,0¢}; {250¢,50¢}; {200¢,100¢}; {150¢,150¢}; {100¢,200¢}; {50¢,250¢} and {0¢,300¢}. Each subject was

randomly assigned to one role and matched with a single partner assigned to the other role to compute payments.

**Measurement of cognitive reflection.** We extended the CRT described in Study 1 ([Frederick, 2005](#)) by adding four questions recently developed by Toplak, West and Stanovich (2014) all of which have been validated as a measure of cognitive reflection ( $\alpha = 0.72$ ). The additional CRT questions are as follows:

(4) If John can drink one barrel of water in 6 days, and Mary can drink one barrel of water in 12 days, how long would it take them to drink one barrel of water together? \_\_\_\_\_ days [correct answer: 4 days; intuitive answer: 9]

(5) Jerry received both the 15th highest and the 15th lowest mark in the class. How many students are in the class? \_\_\_\_\_ students [correct answer: 29 students; intuitive answer: 30]

(6) A man buys a pig for \$60, sells it for \$70, buys it back for \$80, and sells it finally for \$90. How much has he made? \_\_\_\_\_ dollars [correct answer: \$20; intuitive answer: \$10]

(7) Simon decided to invest \$8,000 in the stock market one day early in 2008. Six months after he invested, on July 17, the stocks he had purchased were down 50%. Fortunately for Simon, from July 17 to October 17, the stocks he had purchased went up 75%. At this point, Simon has: a. broken even in the stock market, b. is ahead of where he began, c. has lost money [correct answer: c, because the value at this point is \$7,000; intuitive response: b].

Again, this test was not incentivized and males obtained a higher score ( $mean = 4.26 \pm 0.29$ ) than females ( $mean = 3.06 \pm 0.29$ ; Mann-Whitney-Wilcoxon test,  $p = 0.005$ ).

**Measurement of social preferences.** We elicited distributional (also referred to as ‘outcome-based’, see [Fehr and Schmidt, 2006](#)) social preferences by asking participants to make four choices (Bartling et al., 2009). Each choice was between two possible allocations of money for that person and another anonymous participant with whom they were randomly matched (see Table 3). In each choice Option A always provided an even distribution of money (\$2 to the self and the other participant), while Option B provided one of four uneven payoffs: (\$2, \$1), (\$3, \$1), (\$2, \$4), and (\$3, \$5) in Choices 1, 2, 3 and 4, respectively. In Bartling et al. (2009), the four choices are labeled as the ‘prosociality’, ‘costly prosociality’, ‘envy’ and ‘costly envy’ games, respectively (see the last column of Table 3). In the ‘prosociality’ game, participants had to

decide whether to increase the payoff of a worse-off counterpart at no personal cost. In contrast, increasing the counterpart’s payoff was costly for the decision maker in the ‘costly prosociality’ game. In the ‘envy’ game, participants could reduce the payoff of a better-off counterpart at no personal cost, whereas it was costly in the ‘costly envy’ game. Following Bartling et al. (2009), participants who chose the egalitarian allocation (Option A) in both the ‘prosociality’ and the ‘costly prosociality’ games are categorized as ‘*aheadness averse*’ (27% in our sample), whereas those who chose the egalitarian allocation in both the ‘envy’ and the ‘costly envy’ games are categorized as ‘*behindness averse*’ (23% in our sample). In each experimental session, two subjects,  $i$  and  $j$ , were randomly selected for payment. Then, one of the four choices made by participant  $i$  was randomly chosen and used to allocate the payoffs of both participants,  $i$  and  $j$ .

**TABLE 3.** Social preferences elicitation (Bartling et al. 2009).

Choice	<u>Option A</u>	<u>Option B</u>	Social Preference ‘Game’
	Payoff self, Payoff other	Payoff self, Payoff other	
1	\$2,\$2	\$2,\$1	Prosociality
2	\$2,\$2	\$3,\$1	Costly Prosociality
3	\$2,\$2	\$2,\$4	Envy
4	\$2,\$2	\$3,\$5	Costly Envy

**Measurement of risk attitudes.** We elicited risk attitudes following Holt and Laury (2002) by asking subjects to make ten binary lottery choices. One lottery (out of 10) was selected at random for each subject and used for payment. We follow Holt and Laury (2002) and use the number of safe choices in the ten binary lottery choices to categorize subjects’ risk attitudes. We only report data for the subjects (95 out of 100) who completed the ten binary lottery choices without switching back and forth between the safer and the riskier options.<sup>2</sup>

## Results

As can be seen in Table 4, the raw data appear to confirm the results of Study 1 by showing that trust increases along with CRT scores, whereas no clear pattern is observed between CRT scores and trustworthiness. To understand the magnitude of the effect on trust, note that subjects with

<sup>2</sup> The proportion of inconsistent switching was similar to the proportion reported by Holt and Laury (2002) which varies between 5.5% and 13.2%.

the highest CRT score trust on average almost *two and a half times* more frequently (90.0%) than subjects with the lowest CRT score (37.5%).

**TABLE 4:** Trust and Trustworthiness decisions by CRT scores (extended test)

CRT [observations]	Trust <i>Percentage of subjects sending money</i>	Trustworthiness <i>Average amount returned (out of 300)*</i>
0 [8]	38	125
1 [9]	56	78
2 [18]	56	114
3 [11]	64	123
4 [15]	53	137
5 [12]	75	100
6 [17]	77	85
7 [10]	90	95

\* In the case that the trustor has sent his/her initial endowment.

The positive relation between trust and CRT scores is statistically significant in a probit regression with trust (i.e., a dummy that takes value 1 if the trustor sends his/her endowment, and value 0 otherwise) as the dependent variable (Table 5, regression [1]). Controlling for gender (Female Dummy = 1 if female) does not qualitatively affect the result (regression [2]).

Due to the possible link between trust and risk attitudes, we also controlled for risk aversion in our regression analysis (regressions [3] and [5]). The positive effect of CRT on trust continues to hold. We found no significant relation between risk aversion and trust.<sup>3</sup>

Finally, as mentioned above, recent research has shown that subjects' distributional social preferences are related with their CRT scores (Corgnet et al., 2015a; Cueva et al., in press; Ponti and Rodríguez-Lara, 2015). In particular, Corgnet et al. (2015a) find that individuals with higher CRT scores are more likely to make choices consistent with "mild" altruism and less likely to be driven by either egalitarian or spiteful motives.<sup>4</sup> In order to account for distributional preferences as a potential confound in the relation between trust and CRT, we included dummies for both 'aheadness' and 'behindness' aversion as controls (regressions [4] and [5]).

<sup>3</sup> We do not find a significant relation between CRT and risk aversion either (Pearson rho = 0.04, p = 0.678; Spearman rho = -0.002, p = 0.987).

<sup>4</sup> We find similar results in our sample. These results are available upon request.

We find that the effect of CRT on trust cannot be accounted for by distributional preferences. The coefficient associated with CRT remains positive and significant after the inclusion of these controls.<sup>5</sup> In addition, those subjects who display a stronger aversion to advantageous inequality (‘ahead averse’) are more likely to trust, although this effect is significant only in regression [5] where risk attitudes are controlled.

**TABLE 5.** Probit regression for TRUST

TRUST	[1]	[2]	[3]	[4]	[5]
Intercept	-0.24 (0.25)	0.05 (0.33)	0.57 (0.59)	0.03 (0.35)	0.68 (0.60)
CRT	0.17*** (0.06)	0.15** (0.06)	0.15** (0.07)	0.14** (0.07)	0.15** (0.07)
Female Dummy		-0.42 (0.28)	-0.47* (0.29)	-0.40 (0.28)	-0.48 (0.29)
Risk Aversion			-0.08 (0.08)		-0.11 (0.08)
Ahead Averse Dummy				0.51 (0.32)	0.69** (0.34)
Behind Averse Dummy				-0.37 (0.33)	-0.26 (0.36)
No. of observations	n = 100	n = 100	n = 95	n = 100	n = 95
pseudo R <sup>2</sup>	0.06	0.07	0.09	0.11	0.13
Wald- $\chi^2$	7.39***	11.01***	11.93***	13.29***	14.58***

Estimation output using robust standard errors (in parentheses).

\*p-value<.10, \*\*p-value<.05, and \*\*\*p-value<.01

In line with Study 1, we find that, unlike trust, trustworthiness is not significantly related to cognitive reflection. This is true for all our model specifications (see Table 6).<sup>6</sup> In addition, subjects who are more averse to advantageous inequality tend to return more money to the trustor (regressions [4] and [5]). Finally, more risk averse individuals also exhibit more trustworthiness (regressions [3] and [5]).

<sup>5</sup> The results are robust to different specifications of our measures of distributional preferences. For example, the CRT coefficient is 0.125 ( $p=0.063$ ) when we include four dummy variables, one for each decision in the social preferences task. Also, the CRT coefficient remains significant if we control for each dummy variable separately (all  $p$ 's < 0.054).

<sup>6</sup> The results are also consistent if we estimate ordered multinomial probit instead of linear regressions, reporting a CRT coefficient of -0.048 ( $p = 0.379$ ), -0.043 ( $p = 0.414$ ), -0.049 ( $p = 0.339$ ), -0.051 ( $p = 0.350$ ), and -0.055 ( $p = 0.291$ ) for regressions [1], [2], [3], [4], and [5], respectively.

**TABLE 6.** Linear regression for the amount returned TRUSTWORTHINESS

TRUSTWORTHINESS	[1]	[2]	[3]	[4]	[5]
Intercept	118.73*** (14.16)	115.41*** (15.77)	53.56* (28.43)	105.67*** (17.17)	52.51* (30.51)
CRT	-3.04 (3.43)	-2.73 (3.38)	-3.11 (3.18)	-3.11 (3.41)	-3.27 (3.18)
Female Dummy	-	4.65 (13.75)	5.59 (13.80)	5.64 (13.61)	5.62 (13.59)
Risk Aversion			10.18*** (3.89)		8.96** (4.04)
Ahead Averse Dummy	-	-		43.79*** (13.36)	39.56*** (13.62)
Behind Averse Dummy	-	-		-4.85 (17.53)	-7.33 (17.99)
No. of observations	n = 100	n = 100	n = 95	n = 100	n = 95
R <sup>2</sup>	0.01	0.01	0.07	0.09	0.13
F	0.78	0.40	2.62*	2.95**	3.63***

Estimation output using robust standard errors (in parentheses).

\*p-value<.10, \*\*p-value<.05, and \*\*\*p-value<.01

### Discussion: Why Would More Reflective People Trust More?

We have shown that cognitive ability is positively related to trust in two experiments where trusting decisions have real monetary consequences, thus supporting previous findings from self-report surveys (Sturgis et al., 2010; Hooghe et al., 2012; Carl and Billarri, 2014). Furthermore, our data indicate that the relation between CRT scores and trust is not mediated by subjects' distributional or risk preferences.

One likely explanation to the current results could be that individuals with higher cognitive skills are more able to correctly guess the distribution of trustees' choices and/or to choose so as to maximize their expected returns given such distribution. Results from Berg et al. (1995) and others would suggest that attaching a reputation to players might even increase the propensity to trust. It is not hard to imagine that the ability to trust is largely beneficial in a society where survival and prosperity crucially hinge upon the capacity to engage in exchanges with counterparts with various degrees of familiarity. All such transactions, as was argued by Adam Smith (1759), require an important element of trust. Indeed, evolutionary psychologists have hypothesized that the capacity to attach a reputation to interaction partners (for which

trusting others may be a necessary prerequisite) is a distinctive form of human social intelligence favored by natural selection (e.g. Yamagishi, 2001 and Cosmides, Barrett and Tooby, 2010). In our second study, the decision to trust and send 100¢ to the trustee produced a median (average) return of 150¢ (107.5¢). Trusting led to a significant increase in earnings compared to not trusting ( $p = 0.0599$  for the Wilcoxon sign-rank test), supporting such a hypothesis. However, in our first study, trust led to a non-significant decrease in earnings (\$5 vs. \$4.07; Wilcoxon sign-rank test,  $p = 0.652$ ). Therefore, our results are not completely coherent with an explanation based on the higher ability of high-CRT individuals to maximize their expected returns in the trust game.

An alternative explanation of our findings relates to betrayal aversion. Trusting others involves “social risk” because the returns from trusting depend on another person’s decision and not on chance alone (e.g. Bohnet et al., 2008). There is evidence that betrayal aversion leads people to take less risk in situations in which the return on investment is determined by other people’s decisions rather than by chance alone (Bohnet and Zeckhauser, 2004; Bohnet, Herrmann and Zeckhauser, 2010; Aimone and Houser, 2012). Since betrayal aversion has an important emotional basis (Aimone, Houser and Weber, 2014), it might be argued that the capacity to override prepotent responses intended to avoid the anticipated emotional costs of being betrayed by another person is ‘measured’ by the CRT (Frederick, 2005). An interesting avenue for future research is to explore the mechanisms underlying the positive relation between CRT scores and trust.



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## Appendix A (Instructions)

### A.1. The Charness-Dufwenberg (2006; 2010) Trust Game (Study 1)

#### Page 1

#### Welcome

Thank you for participating in this experiment. The purpose of this experiment is to study how people make decisions in a particular situation. Feel free to ask questions as they arise, by raising your hand. Please do not speak to other participants during the experiment.

#### Page 2

You will receive \$7 for participating in this session. You may also receive additional money, depending upon the decisions made (as described below). Upon completion of the session, this additional amount will be paid to you individually and privately.

#### Page 3

You will be participating in a decision task where you will make a certain choice.

During the session, you will be paired with another person located in a different room.

No participant will ever know the identity of the person with whom he or she is paired.

#### Page 4

In each pair, one of you will have the role of **Person A**, and the other will have the role of **Person B**. The amount of money you earn depends upon the decision made in your pair.

#### Page 5

#### The Diagram

The decision making problem you will see looks similar to the one you see in the diagram.

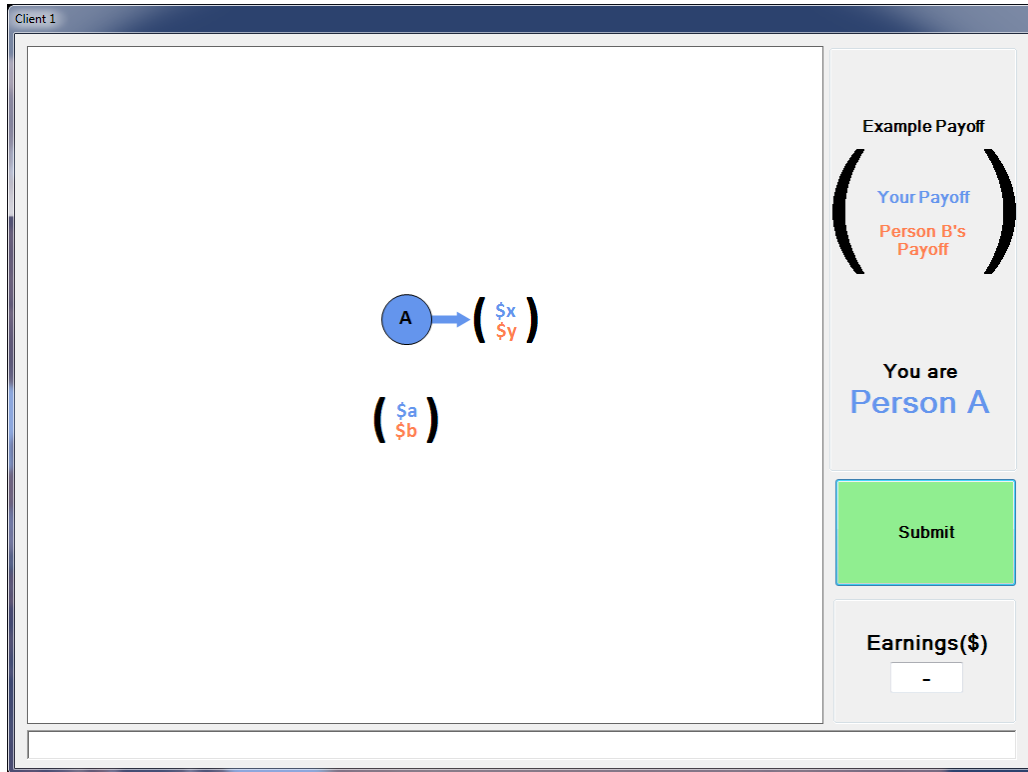
Payoffs to you and the other person will be displayed in parenthesis in the diagram. There are two numbers:

**Person A** will earn what is in **blue**, and

**Person B** will earn what is in **orange**

if that decision is made.

You and the other person will jointly determine a path through the diagram to a set of payoffs, which will be described next.



[Diagram shown to Player A]  
 [The blue arrow flips from one node to the other]

**Page 6**

**The Diagram Continued**

A circle in the diagram is a point at which one person makes a decision. Each circle is color coded to indicate whether **Person A** or **Person B** will be making that decision. You will always have two options. Those options will include some combination of clicking on a set of payoffs and/or clicking on a circle.

If a person chooses a circle, another person will make the next decision at the next level in the diagram.

If a set of payoffs is chosen, the round ends with each of you receiving your respective earnings.

**Page 7**

**Example 1**

Choose a payoff (by clicking on one of the payoffs in the diagram) and click the **Submit** button.

**Page 7 (after click the **Submit** button)**

**Example 1**

Choose a payoff (by clicking on one of the payoffs in the diagram) and click the **Submit** button.

(done)

Given your choice in this example.

Person A earns \$a [\$x].

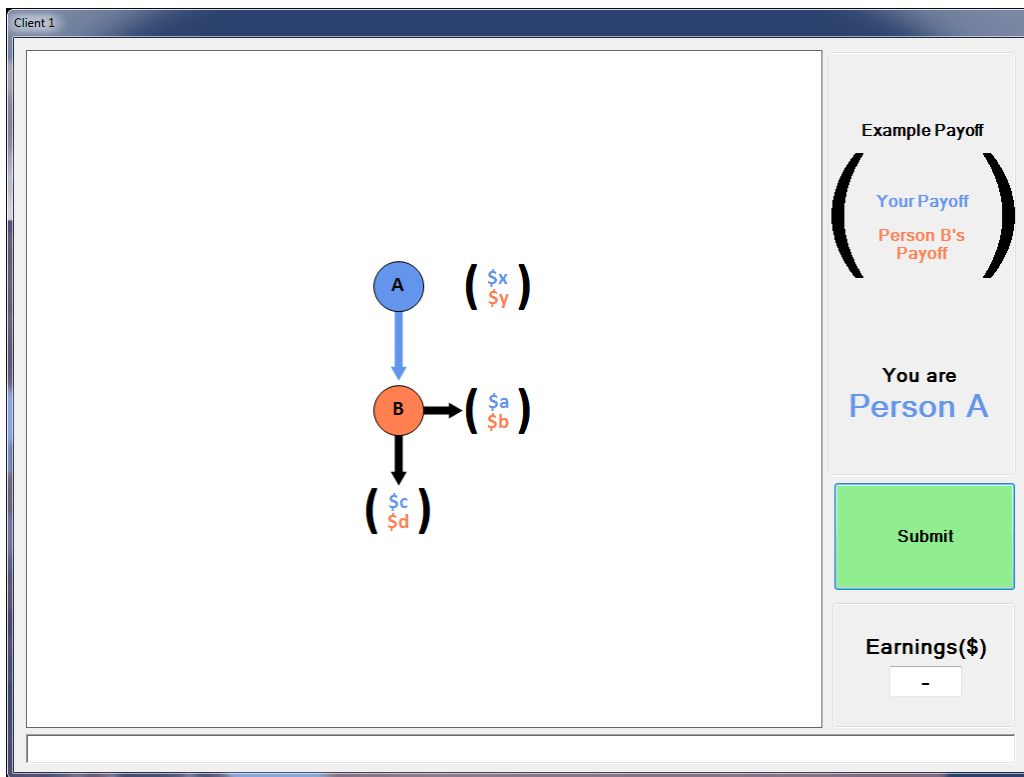
Person B earns \$b [\$y].

Continue to the next page of instructions.

**Page 8**

**Example 2**

Click on the Orange circle and press the Submit button.



[Diagram shown to Player A]  
[The blue arrow flips from one node to the other]

**Page 8 (after click the Submit button)**

**Example 2**

Click on the Orange circle and press the Submit button. (done)

Person B now makes the next decision. He or she will choose a set of payoffs.

Continue to the next page of instructions.

**Page 9**

Notice that in the example below the payoffs are determined with the roll of a computerized die.

If **Person A** chooses **Don't** (roll a die), then **A** receives  $\$a$  and **B** receives  $\$b$ .

If **Person A** chooses **Roll** then a six sided die is rolled to determine the payoffs.

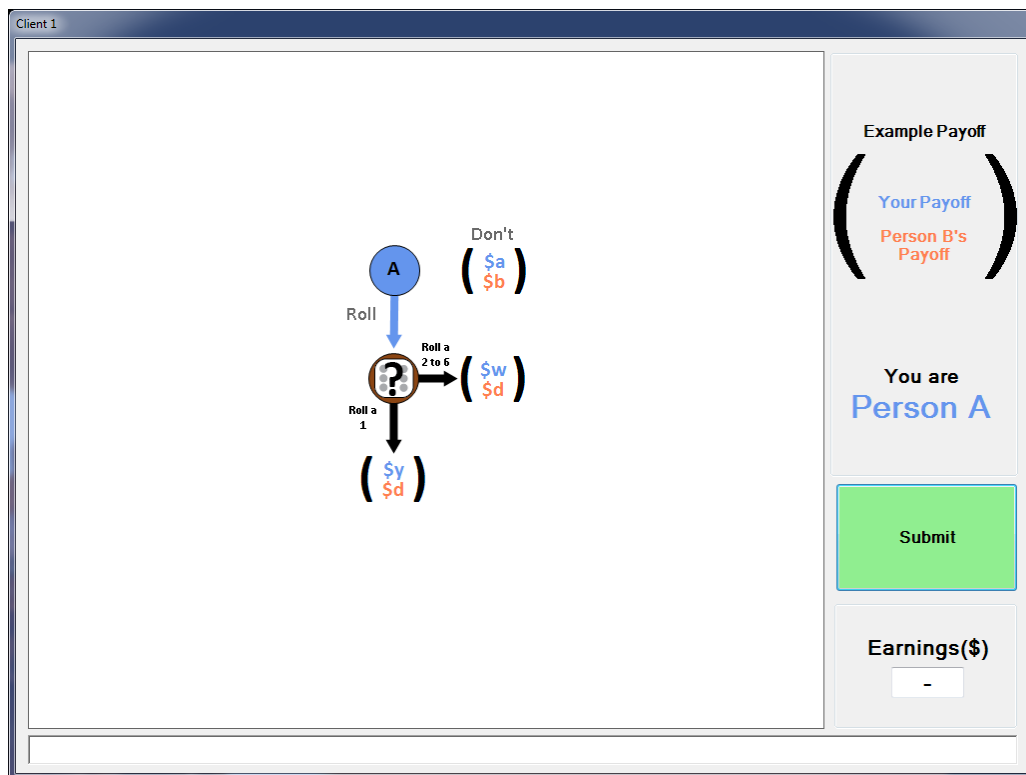
If the die comes up 1, **A** receives  $\$y$  and **B** receives  $\$d$ .

If the die comes up 2-6, **A** receives  $\$w$  and **B** receives  $\$d$ .

Notice that **Person B's** payoff is always  $\$d$ .

### Example 3

Click on the Die and press the **Submit** button.



[Diagram shown to Player A]

[The blue arrow flips from one node to the other]

### Page 9 (after click the **Submit** button)

Notice that in the example below the payoffs are determined with the roll of a computerized die.

If **Person A** chooses **Don't** (roll a die), then **A** receives  $\$a$  and **B** receives  $\$b$ .

If **Person A** chooses **Roll** then a six sided die is rolled to determine the payoffs.

If the die comes up 1, **A** receives  $\$y$  and **B** receives  $\$d$ .

If the die comes up 2-6, **A** receives  $\$w$  and **B** receives  $\$d$ .

Notice that **Person B**'s payoff is always **\$d**.

### Example 3

Click on the Die and press the **Submit** button. (done)

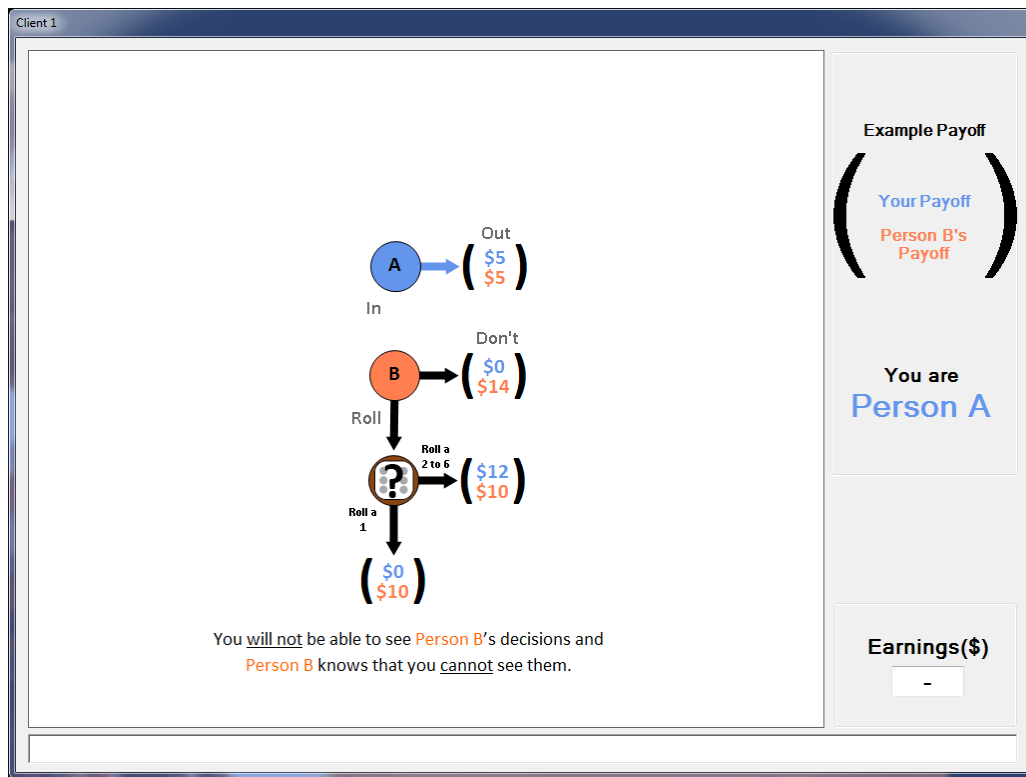
A computerized die will be rolled to determine the payoffs (**\$w/\$d**) or (**\$y/\$d**).

Continue to the next page of instructions.

### Page 10

**The actual decision making problem is now displayed.**

Continue to the next page of instructions.



[Diagram shown to Player A]

[The blue arrow flips from one node to the other]

### Page 11

**The actual decision making problem is now displayed.**

In this decision making problem **Person A** will decide first by choosing **In** or **Out**.

If **Person A** chooses **Out**, **A** and **B** each receive \$5.

If **Person A** chooses **In**, then following **Person A's** choice, **Person B** will indicate whether he or she wishes to choose **Roll** or **Don't** (roll).



If A has chosen **In** and B chooses **Don't** (roll), then B receives \$14 and A receives \$0.

If A has chosen **In** and B chooses **Roll**, B receives \$10, and rolls a six sided die to determine A's payoff.

If the die comes up 1, A receives \$0.

If the die comes up 2-6, A receives \$12.

Person A will NOT be able to see Person B's decisions.

## Page 12

The payoff information is summarized in the chart below:

	A receives	B receives
A chooses <b>Out</b>	\$5	\$5
A chooses <b>In</b> , B chooses <b>Don't</b> (roll)	\$0	\$14
A chooses <b>In</b> , B chooses <b>Roll</b> , die = 1	\$0	\$10
A chooses <b>In</b> , B chooses <b>Roll</b> , die = 2,3,4,5, or 6	\$12	\$10

If you have any questions, please raise your hand and a monitor will come by to answer them.

If you are finished with the instructions, please click the **Start** button. The instructions will remain on your screen until everyone has clicked the **Start** button.

We need everyone to click on the **Start** button before the experiment can begin.

## A.2. The Berg, Dickhaut and McCabe (1995) Trust Game (Study 2)

In this part you are going to be paired with another participant. Both of you will make decisions in the role of two players, S and R. Once all the decisions have been made the computer will randomly select one of you to be player S and the other person will be player R. Finally, payoffs will be computed according to the decisions made by each participant in the role randomly assigned by the computer.

Both players start with an initial endowment of \$10. Then, player S has to decide whether to keep his or her \$10 or pass them to player R. If player S decides to pass the \$10 to player R, the \$10 will be multiplied by three. In this case, player R will decide how to allocate the \$30 between both players. The different options are as shown in the next screen.

	\$0 for yourself and 300 for player S
	\$50 for yourself and 250 for player S
	\$100 for yourself and 200 for player S
	\$150 for yourself and 150 for player S
	\$200 for yourself and 100 for player S
	\$250 for yourself and 50 for player S
	\$300 for yourself and 0 for player S

Example 1: If player S chooses the option “keep the \$10”:

- The participant in the role of player S will receive \$10 corresponding to his or her initial endowment.
- The participant in the role of player R will receive \$10 corresponding to his or her initial endowment.

Example 2: If player S chooses the option “pass the \$10” and player R chooses the option “\$15 for yourself and \$15 for player S”:

- The participant in the role of player S will receive \$15.
- The participant in the role of player R will receive \$25, that is, \$15 corresponding to the final allocation and \$10 corresponding to his or her initial endowment.

### A.3. Risk Aversion elicitation (Study 2)

For each line in the table in the next screen, please state whether you prefer option A or option B. Notice that there are a total of 10 lines in the table but just one line will be randomly selected for payment. Each line is equally likely to be chosen, so you should pay equal attention to the choice you make in every line. At the end of the experiment, a number between 1 and 10 will be randomly selected by the computer. This number determines which line is going to be paid.

Your earnings for the selected line depend on which option you chose in that line: option A or option B. To determine your earnings, a second number between 1 and 10 will be randomly selected by the computer. This number is then compared with the numbers in the line and option selected (see the table in the next screen):

- If you selected option A and the second number shows up in the upper row you earn \$2.00. If the number shows up in the lower row you earn \$1.60.
- If you selected option B and the second number shows up in the upper row you earn \$3.85. If the number shows up in the lower row you earn \$0.10.

To summarize, you will make ten choices: for each decision row you will have to choose between Option A and Option B. You may choose A for some decision rows and B for other rows, and you may change your decisions and make them in any order.

Line	OPTION A	OPTION B
1	1/10 of \$2.00, 9/10 of \$1.60	1/10 of \$3.85, 9/10 of \$0.10
2	2/10 of \$2.00, 8/10 of \$1.60	2/10 of \$3.85, 8/10 of \$0.10
3	3/10 of \$2.00, 7/10 of \$1.60	3/10 of \$3.85, 7/10 of \$0.10
4	4/10 of \$2.00, 6/10 of \$1.60	4/10 of \$3.85, 6/10 of \$0.10
5	5/10 of \$2.00, 5/10 of \$1.60	5/10 of \$3.85, 5/10 of \$0.10
6	6/10 of \$2.00, 4/10 of \$1.60	6/10 of \$3.85, 4/10 of \$0.10
7	7/10 of \$2.00, 3/10 of \$1.60	7/10 of \$3.85, 3/10 of \$0.10
8	8/10 of \$2.00, 2/10 of \$1.60	8/10 of \$3.85, 2/10 of \$0.10
9	9/10 of \$2.00, 1/10 of \$1.60	9/10 of \$3.85, 1/10 of \$0.10
10	10/10 of \$2.00, 0/10 of \$1.60	10/10 of \$3.85, 0/10 of \$0.10

#### A.4. Social preferences elicitation (Study 2)

In this part of the experiment you will be asked to make a series of choices in decision problems. For each line in the table in the next screen, please state whether you prefer option A or option B. Notice that there are a total of 4 lines in the table but just one line will be randomly selected for payment. Each line is equally likely to be chosen, so you should pay equal attention to the choice you make in every line.

Your earnings for the selected line depend on which option you chose: if you chose option A in that line, you will receive \$2 and the other participant who will be matched with you will also receive \$2. If you chose option B in that line, you and the other participant will receive earnings as indicated in the table for that specific line. For example, if you chose B in line 2 and this line is selected for payment, you will receive \$3 and the other participant will receive \$1. Similarly, if you chose B in line 3 and this line is selected for payment, you will receive \$2 and the other participant will receive \$4. Note that the other participant will never be informed of your personal identity and you will not be informed of the other participant's personal identity.

After all of you have made their choices the computer will select two and only two participants in the room. The decision table of the first participant will determine the payoff of the two subjects. Then the computer will randomly determine which line of the first subject decision table is going to be paid.

The remaining participants will not be rewarded for this part of the experiment.

**TABLE D2.** Social preferences elicitation (Bartling et al. 2009).

Decision	<u>Option A</u>	<u>Option B</u>
	Payoff self, Payoff other	Payoff self, Payoff other
1	\$2,\$2	\$2,\$1
2	\$2,\$2	\$3,\$1
3	\$2,\$2	\$2,\$4
4	\$2,\$2	\$3,\$5