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Risk Taking and Social Exposure

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Risk Taking and Social Exposure[1]

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Abstract. The paper examines in the laboratory how risk-taking situations are affected by the conditions of observing other's choices (observer) and being observed by others (source). By extending Yechiam et al.'s (2008) experimental design to the domain of gains we find that observers are more probable than sources to choose risky alternatives producing rare gains than equiprobable gains. The impact of social exposure is also analyzed and interpreted in the context of personality traits to assess how heterogeneity influences risky decisions.

JEL Classification: C91, D01, D81.

Keywords: risky shift, social exposure, personality traits

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1. Introduction

Being real-world decisions characterized by non-isolation, individual choices among risky outcomes are influenced by a variety of social factors which have been investigated in empirical research. For instance, risk perception in street crossing may depend on the presence of other pedestrians. Zhou, Horrey, and Yu (2009) and Sueur, Class, Hamm, Meyer, and Pelé (2013) provide evidence that conformity tendencies and cultural differences influence the effect of others' presence on pedestrian crossing behaviour. Hamed (2001) find that road-crossing time decreases as the number of pedestrians attending to cross increases. These findings suggest that individuals tend to increase their level of risk-taking in contexts of social exposure, a condition in which decision-makers are observed by other individuals when making choices or, alternatively, in which they observe others taking decisions.

Social exposure may critically influence individual choices, particularly in interactions aimed at achieving social aims or fulfilling social needs (Fehr & Gächter, 2000). Experimental research (Cooper & Kagel, 2013) shows that social context affects utility functions, causes people to exhibit other-regarding preferences and pro-social attitudes and behave on the basis of non-monetary purposes, such as altruism, fairness, or reciprocity (Trautmann & Vieider, 2012). Although motivations behind pro-social behaviour are not fully explained, a variety of non-selfish behavioural models have been proposed to account for social influences (Sobel, 2005) and a number of experimental studies on social decision-making have been conducted on non-humans (Brosnans & de Waal, 2003; Rosati & Hare, 2012) and humans (Loewenstein, Rick, & Cohen, 2008). As a result, the fact that people care about the presence of others is now supported by economists and psychologists. It has also been emphasized that the impact of social influence is characterized by heterogeneity across individuals and that social behaviour is affected by gender, socioeconomic status, and other situational and environmental factors (Fehr & Schmidt, 2006). Specifically, individuals are found to be more cooperative when they know to be observed by others. Indeed, an increasing level of cooperation is induced not only in situation of indirect reciprocity, where information about others plays a crucial role (Barclay, 2004), but also in contexts in which the mere presence of others is only perceived. Bateson, Nettle, and Roberts (2006) examine the relationships between the level of contribution to an honesty box (i.e., a container used to collect money for something to buy without the presence of an attendant) and the feeling of being observed by the image of a pair of eyes. They found that the level of contribution is sharply higher in the presence of the cue of being watched than in the presence of a control image of flowers. This result is confirmed by Haley and Fessler (2005), who find that eye-spots tend to increase the generosity of participants, and Burnham and Hare (2007), who investigate the effect of being watched by the eyes of a robot on public goods contribution.

Since it is not yet clear if the increased level of cooperation is reached because of other-regarding preferences, reputational effects, or other influences, the research on the impact of social context on decision-making has mainly been focused on specific issues such as group settings, social learning, social facilitation, and charitable donation (e. g., Andreoni & Miller, 2002; Ariely & Levav, 2000; Carpenter, 2007; Charness & Rabin, 2002). Some interesting results emerged from this literature. Firstly, people tend to make social comparison such that social reference points determine individual preferences (Bault, Coricelli, & Rustichini, 2008). Particularly, individuals are typically more affected by being worse, rather than better, than others (Fehr & Schmidt, 1999). Social comparison depends on individual characteristics and is particularly relevant for people with pro-social preferences and when other subjects are perceived as relevant or having positive reputation (Linde & Sonnemans, 2012). Secondly, individuals tend to increase their propensity for risk when they are in group, especially in situations in which a group discussion is needed to take a decision or characterized by a prior tendency to sustain higher risks (Clark & Willems, 1969; Ertac & Gurdal, 2012; Lamm, Schaude, & Trommsdorft, 1971). Researchers have also tried to identify the reasons behind this risky shift, such as imitation, commitment, diffusion of responsibility or cultural norms and different models of the relations between risky shift and group choice have been proposed (Eliaz, Ray, & Razin, 2005; Falck & Ichino, 2006; Gray & Stafford, 1988; Zajonc, Wolosin, Wolosin, & Loh, 1970).

Despite these extensive studies, risk perception in contexts of social exposure remains poorly understood. A notable exception is represented by Yechiam, Druyan, and Ert (2008), who investigate the effect of social exposure in two decision tasks involving monetary losses. In their first treatment, subjects are asked to make choices by being or not being observed by other participants. Two choices are submitted in which the choice is between a safe and a risky loss, but the risky option is rare (5%) in one condition and equiprobable (50%) in the other. The comparison between the social exposure condition and the isolated control condition shows that the proportion of risky choices increases in both decision problems, although the increase is higher in the rare than in the equiprobable loss condition. In the second treatment, the effect of being observed by others (source condition) is compared with the effect of observing others' choices (observer condition). Findings show that increased risk taking is associated with the observer condition, while in the source condition no social exposure effect is observed.

Our paper extends this line of research in two directions. Firstly, we aim at checking if Yechiam et al.'s (2008) results on the effect of social exposure are confirmed in the case of lotteries involving monetary gains. Secondly, we propose to obtain some insight into the reasons explaining the effect of social exposure by analyzing individual behaviour and personality traits of decision makers.

The first purpose of our analysis is motivated by the extensive evidence collected on the asymmetry of choice between risky alternatives producing rare or equiprobable gains or losses. A well established result (Barron & Erev, 2003; Hertwig, Barron, Weber, & Erev, 2004) shows that subjects facing probability distributions overweight the probability of rare events and prefer to choose alternatives with rare losses and typical gains. Our experiment intends to test this finding under social exposure. In line with literature on gender differences (Powell & Ansic, 1997), we also hypothesize that males exhibit more risk-taking behaviour in these contexts than females. We also expect that individual reaction times differ between the conditions of source and observer, as argued by previous literature on the negative effect of audience in social facilitation (Bell, Loomis, & Cervone, 1982; Gonzales, Dana, Koshino, & Just, 2005; Yechiam & Hochman, 2012; Zajonc et al., 1970).

The second objective of the study is to examine how personal characteristics affect risky choices under social exposure. As mentioned above, individual attitudes are markedly heterogeneous in decisions affected by social comparisons (Deck, Lee, Reyes, & Rosen, 2008; Linde & Sonnemans, 2012). As for personality traits, many personality factors have been studied in association with risk perception. Among the methods to assess the relation between individual characteristics and decision-making, the five-factor model of personality has received wide support (Chauvin, Hermand, & Mullet, 2007; Goldberg, 1990; Lauriola, Russo, Lucidi, Violani, Levin, 2005), since it has been found to have a well-established reliability and validity, as well as a cross-context and cultural comparability (McCrae, 2002). The five domains of the model include Extraversion, Agreeableness, Openness, Conscientiousness, and Neuroticism. Our analysis focuses on agreeableness and consciousness. Agreeableness trait has been found to influence decision-making processes in a context of social influence, through features such as empathy and interpersonal sensitivity. Specifically, people high in agreeableness tend to be compassionate and cooperative rather than antagonistic towards others (Chauvin et al., 2007) and they are found to be more concerned about others' well-being, trustworthy in social relationships, and more accommodating in social contexts (Chamorro-Premuzic & Furnham, 2011; John, Robins, & Pervin, 2010; Leary & Hoyle, 2009). Conversely, individuals with low agreeableness scores make judgments based on cold rationalism rather than sympathy and take risky decisions where caution is valued because they disregard the situational norm (Olson & Suls, 2000). People low in agreeableness have also been found to engage in risky unsafe health behaviours, substance abuse, and, in combination with low levels of consciousness, in impulsive and sensation-seeking behaviours (Brooner, Herbst, Schmidt, Bigelow, & Costa, 1993; Trobst, Herbst, Maters, & Costa, 2002; Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993). The conscientiousness dimension also reflects a tendency to show self-discipline, act dutifully, aim for achievement, and adopt planned rather than spontaneous behaviour. As a consequence, people with high degree of conscientiousness exhibit less risk-taking decisions (Paunonen & Ashton, 2001; Vollrath, Knoch, & Cassano, 1999) and tend to undervalue external risks associated with their actions (Chauvin et al., 2007). On this basis, and also considering that a dispositional approach can be useful to predict and understand decision-making, our experiment intends to verify if subjects have a risk shift in the observer condition with respect to the source condition and if this shift is tied with lower levels of agreeableness and consciousness. In line with Deck et al. (2008), we hypothesize that personality impacts risk taking and may predict individual choices.

The rest of the paper is organized as follows. Section 2 describes the design. Section 3 provides laboratory findings and data interpretation. Section 4 concludes.

2. Design

Participants

Fifty-two undergraduate faculty students at the Faculty of Economics, University of Siena, were recruited via email announcements to participate in the experiment, including 21 females and 31 males. Their average age was 22 years. Participants were paid in cash at the end of the session and received between 8.00 and 17.00 Euros, based on the token achieved during the experimental task (1 token = EUR 0.10, average of 117.80 tokens).

At the end of the experimental session, participants were assessed on Big Five personality traits using a 10-item measure developed by Gosling, Rentfrow, and Swann (2003), which was found to have high correlation with the longer version of the Big Five inventories (John & Srivastava, 1999). Particularly, participants had to indicate to what level they agree or disagree with each statement of the questionnaire, from 7 (strongly agree) to 1 (strongly disagree).

Subjects were informed that at the end of the experiment they would be paid according to the choices made. Since the experimental task also involved losses, each subject received an initial endowment of 120 tokens.

Materials and procedures

The experiment was conducted using the programming software z-Tree (Fischbacher, 2007). Stimuli were adapted from the design implemented by Yechiam et al. (2008). Each subject completed a task involving 30 repeated choices: 15 rare or equiprobable gains and 15 rare or equiprobable losses. For each choice, subjects were asked to select the safe option (S) or the risky option (R). The risky option had an expected value higher (lower) for gains (losses) than the fixed values of the safe option as shown in Table 1. The sequence of choices was randomly determined.

Table 1 Experimental design

	Rare Gain-Loss Condition		Equiprobable Gain-Loss Condition	
	Problem 1. Rare Gain	Problem 2. Rare Loss	Problem 3. Equiprobable Gain	Problem 4. Equiprobable Loss
Safe option (S)	Gain 2 tokens (EV = 2)	Lose 2 tokens (EV = -2)	Gain 2 tokens (EV = 2)	Lose 2 tokens (EV = -2)
Risky option (R)	Gain 30 tokens (prob. 5%) or Gain 1 token (prob. 95%) (EV = 2.5)	Lose 30 tokens (prob. 5%) or Lose 1 token (prob. 95%) (EV = -2.5)	Gain 4 tokens (prob. 50%) or Gain 1 token (prob. 50%) (EV = 2.45)	Lose 4 tokens (prob. 50%) Or Lose 1 token (prob. 50%) (EV = -2.45)

Half of the participants were assigned randomly to the rare gain-loss condition and the other half to the equiprobable gain-loss condition. At the beginning of the session, each participant was also randomly and anonymously paired to another one and each pair was assigned a group number. Within each pair, one subject was assigned the role of source and the other was assigned the role of observer. The assigned group and role remained the same throughout the experiment.

Preliminary instructions offered a detailed description of the events displayed during the experimental trials so that it became clear that sources made decisions individually and their feedbacks (i.e. the outcome for each choice and the total of payoffs obtained during the experiment) were related only to their own choices, whereas observers made decisions after seeing choices and feedbacks received by the paired sources and were informed that their choices and outcomes were not observed by any other participants.

The risky option was randomly presented, counterbalancing for the left and the right side of the screen. When risky option was chosen, the outcome was the result of a random draw, independently for each trial, between the two payoffs. No time limits were given for the experiment. The outcomes and the gained payoffs were presented after each trial as shown in Figure 1.

Figure 1. Computer screens (observer on the left and source on the right)

3. Results

Data were analyzed using the R 2.15.1 software developed by the R Foundation for Statistical Computing (R Development Core Team, 2010 - http://www.r-project.org/). We also studied the influence of different variables on choices, i.e. sign of the choice (gains vs. losses), gender, experimental condition (rare vs. equiprobable) and problem (rare-gain, rare-loss, equiprobable-gain, and equiprobable-loss). In order to investigate the main differences between sources and observers, a preliminary descriptive analysis of the data is carried out.

As shown in Table 2, the percentage of risky options chosen by the observers was higher then those chosen by the sources.

Table 2. Choices by roles and option types

	Sources	Observers	Total
Safe option	44.36	40.26	42.31
Risky option	55.64	59.74	57.69

These results were driven by the preferences in the gain domain (problems 1 and 3, see Table 1) and indeed the percentage of risky options was lower in the loss domain, especially for equiprobable-loss choices (problem 4) and for subjects in the source role (37.44% vs. 48.21%). Consistent with Yechiam et al.'s findings, the analysis of choices sequence shows that in the second 15 trials both sources and observers choose less risky options (-3.59% for sources and -0.51% for observer). This result was irrespective of the number of tokens gained that was quite similar in the two halves of the experiment.

From descriptive analysis three additional main findings also emerged (Table 3). Firstly, the percentage of risky choices in the gain domain was considerably higher than in the loss domain, for both sources and observers. As a result, in both roles subjects exhibited a gain-loss asymmetry which is in line with previous experimental literature. Secondly, no significant choice difference emerged between the rare and the equiprobable conditions. The only relevant choice pattern is that the percentage of risky options selected was slightly higher in the rare than in the equiprobable condition, but only for losses and subjects in the role of source. This finding is consistent with Yechiam et al. (2008), in which social exposure increased the proportion of risky losses, especially for sources in the rare-loss task. Thirdly, when considering choices by gender, the percentage of chosen risky options was greater for men than for women. Moreover, males preferred risky choices in each problem of the two conditions, except for the equiprobable-loss problem, while the percentage of risky options obtained for females was greater in the rare-loss problem only.

Table 3: Choices by sign, condition, and gender

		Sources		Observers	
		S option	R option	S option	R option
Sign	Gains	29.23	70.77	26.92	73.08
	Losses	59.49	40.51	53.59	46.41
Condition	Rare	43.85	56.15	42.31	57.69
	Equiprobable	44.87	55.13	38.21	61.79
Gender	Females	49.33	50.67	41.21	58.79
	Males	41.25	58.75	39.56	60.44

An independence test was applied to calculate the significance of the differences observed between the two roles. The test between decisions in source and observer roles was significant (p<.05). Fisher's exact test of independence also resulted significant for the relationship between the decision, the dichotomous variable indicating whether or not choosing the risky option, and the variables sign, gender, and problem with all the level of significance p<.001, expect for the variable gender (p<.1). The significance of these relationships was also confirmed by using logistic and ordinal regression at different level of significance, except for the equiprobable-gain problem (Table 4). Results were comparable in the two roles.

Table 4: Logistic (by sign and gender) and ordinal (by problem) regression

Variables	Coefficient (SE) (p-value)
Sign (loss)	-1.20369 (0.11) (<.001)
Gender (male)	0.19011 (0.10) (<.1)
Problem (rare-loss)[1]	-1.0721 (0.15) (<.001)
Problem (equiprobable-loss)[1]	-1.1243 (0.15) (<.001)

[1] base: problem (rare-gain)

Moreover, the nonparametric Wilcoxon signed rank test was significant for the variables total profit and reaction time, indicating that these variables were different in the two roles (p<.01 and p<.001, respectively).

The analysis of reaction times shows that they were quite similar for sure and risky options. But a difference emerged between sources and observers for risky choices (5.05 vs. 3.49 sec.) and between losses and gains, especially for subjects in the source role (5.91 vs. 3.89 sec.) that also exhibited a gender difference (females 5.01 sec. vs. males 4.82 sec.). Our findings confirm previous literature on reaction times, which are higher for subjects acting in presence of other individuals, especially for females and in the loss domain. It seems that observers put less mental effort in making choices considering that they have more time to think about their preferences, since they made decisions after seeing choices and feedbacks received by the paired participant.

Risk attitudes, personality traits and social exposure

All the participants were assessed on the short version of the Big Five inventory and classified according to the percentage of risky/sure options chosen. Specifically, subjects preferring the risky option over the sure one most of the time were classified as risk-taking subjects, whereas participants preferring the sure options were identified as non-risk-taking. As a result, we classified participants according to their *role* as risk-taking or non-risk taking sources, and risk-taking or non-risk taking observers. Please note that the relationship between subject role and the variable decision was found to be statistically significant ($p<.001$).

Data from participants' role were evaluated in relation to the two personality traits here investigated, that are the consciousness and the agreeableness dimensions. Two main findings emerged from our analysis. Firstly, the percentage of individuals high (and medium-high) in consciousness was eight percentage points higher for risk-taking sources than observers (36% vs. 28%). This result suggests that these latter, which are more likely to engage in risky choices than sources in the same role, are also less frequent in the consciousness dimension.

More interestingly, the percentage of risk-taking observers high in the agreeableness dimension was found to be less than half of the percentage observed for subjects in the source role, i.e. risk-taking sources (19% vs. 44%). In line with previous empirical research, this finding supports our starting hypothesis that individuals that are less trustworthy and sympathetic to others are inclined to increase risk taking. The relationship between the subject role and the agreeableness dimension was found to be significant ($p<.1$).

As a result, combining the lower level of risk-taking observers in the agreeableness and consciousness dimension, we confirmed our hypothesis that personality impacts risk-taking behaviour and that risk shift is also tied with individual attitudes. This was also confirmed by the fact that for those subjects observing others' choices that was found to be high in agreeableness or consciousness, the level of risk observed was lower when comparing to the whole sample of observers.

4. Discussion

The aim of the present study was to investigate the effect of social exposure on choices of risky monetary alternatives producing rare or equiprobable losses and gains. We also examined personality traits according to subject's experimental role and type of choice to analyze the impact of heterogeneity on individual decisions.

Firstly, a risky shift emerged in the laboratory. We extended to monetary gains Yechiam et al.'s (2008) findings that subjects in the observer condition are more risk-taking than sources. Both sources and observers were found to be less risk-taking in the loss domain but more in the gain one, even if the increase in risk taking was higher for men than for women. However, in contrast with Yechiam et al. (2008), a significantly higher effect for the rare than for the equiprobable loss condition was not found. Despite we confirmed that social exposure increased the proportion of risky losses especially in the rare condition, this choice pattern was not observed either for gains or for observers. The percentages of risky choices for rare and equiprobable conditions were indeed very similar. As a result, in our experiment, social exposure appeared to be moderated more by the sign of the choice and by gender than by the type of risk faced. Particularly, individuals seemed to be more concerned with loss or gain rather than the level of the payoff produced by the risky option, which was lower in the equiprobable condition, in absolute terms.

Our second result is the statistically significant difference in the reaction times across the two roles in the social exposure task. Sources were found to have higher mean reaction times, suggesting that the presence of others increases the time it took subjects to state a preference. This is in line with studies on the negative audience effect in social facilitation. As expected, moreover, males appeared to be faster than females. This longer reaction time has been reported across studies, particularly in the loss domain where avoidance of losses has been found to require more attention (Yechiam & Hochman, 2012).

Thirdly, in our study, risk perception appeared to be strictly related to the personality characteristics of the subjects and dependent on individual heterogeneity. Particularly, we showed that observers' increasing risk-taking is associated with a lower level of agreeableness and consciousness, traits that have been jointly identified as playing a role in explanation of sensation-seeking behaviours. This hypothesis is supported by the findings that when observers are high in agreeableness, their level of risk decreases. The same applied for the consciousness trait.

Finally, it should be acknowledged that in literature risky shifts have been found to depend from many factors other than social exposure, such as situational and dispositional factors. Our experimental design restricts possible interpretations in some ways. The main limit is represented by the choice patterns submitted in the laboratory. Specifically, it is not possible to infer individual risk propensity by applying smooth utility functions. Rather, in order to make the comparison with Yechiam et al.'s (2008) findings, we inferred risk taking behaviour from individual choices between equiprobable and non-equiprobable alternatives.

We also observed that participants often alternated between the risky and the safe option. The design mixed gain and loss choices and this may have determined a continuous change in the reference point, inducing subjects to switch between positive and negative alternatives.

Despite these limitations, however, the present study highlights the role of important factors, such as outcome sign, gender, personality traits, and reaction times, which affect individual risky behaviour but have been not yet extensively investigated in the context of social exposure.

Many open issues still remain to be investigated. For instance, if the presence of others influences decision-making in risky situations, such as road-crossing, it should be analyzed if the same condition increases cooperation. The same impact of social exposure on rationality remains largely unclear. According to our view, insights from the field of neuroscience could provide a powerful contribution to the understanding of mechanisms underlying social influence in decision-making (Tomlin, Nedic, Prentice, Holmes, & Cohen, 2013). We also believe that the investigation of risk-taking processes should be conducted in more evocative settings. In order to mimic risky situations in the laboratory, virtual simulations (Harrison, Haruvy, & Rutström 2011) could be a valid tool in situations in which individual features of risk perception can be fruitfully studied.

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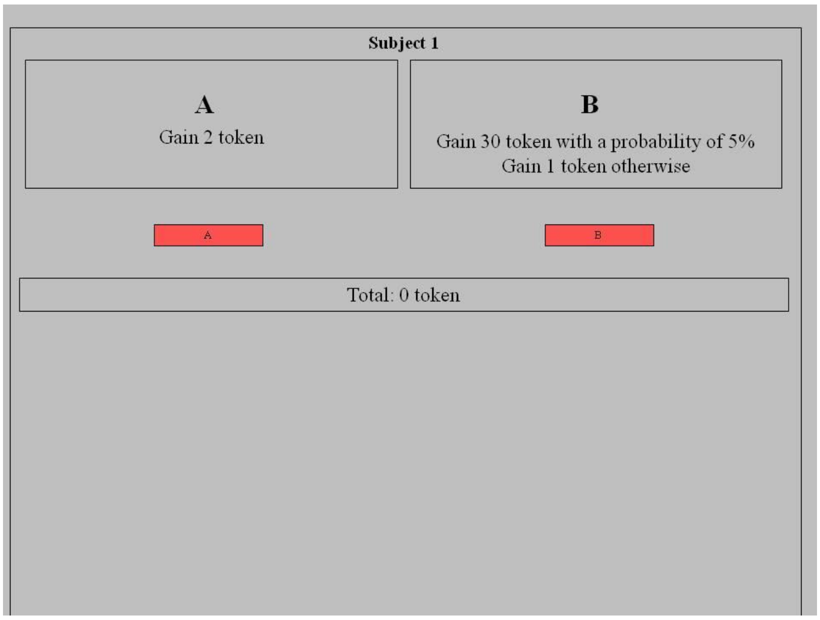
APPENDIX: Instructions

Welcome to the lab!

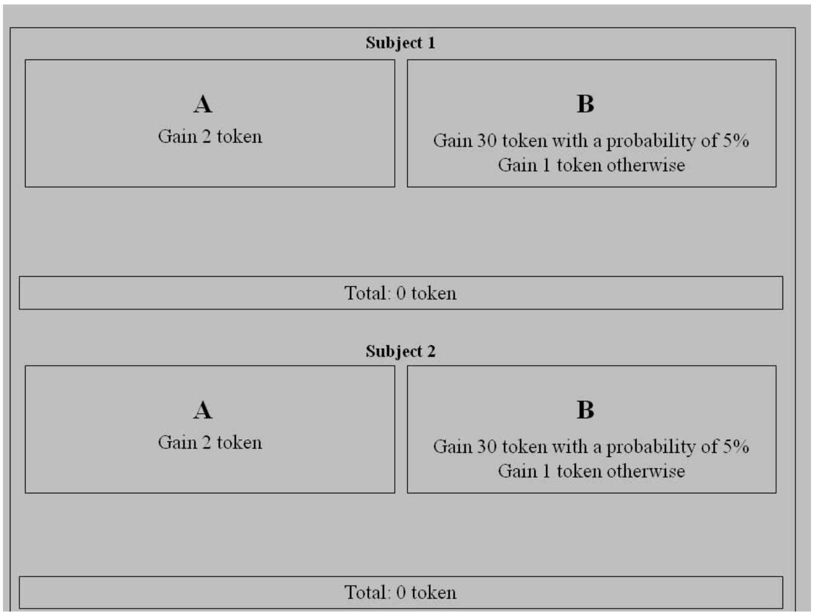
You are about to participate in an experiment on cognitive processes in economic decisions. By following the simple instructions that I am going to read, you can earn a sum of money, whose amount depends on the choices made during the experiment. For the purposes of the experiment, the session will not be a waste of time and public money only if you do not communicate in any way with the other participants.

Instructions

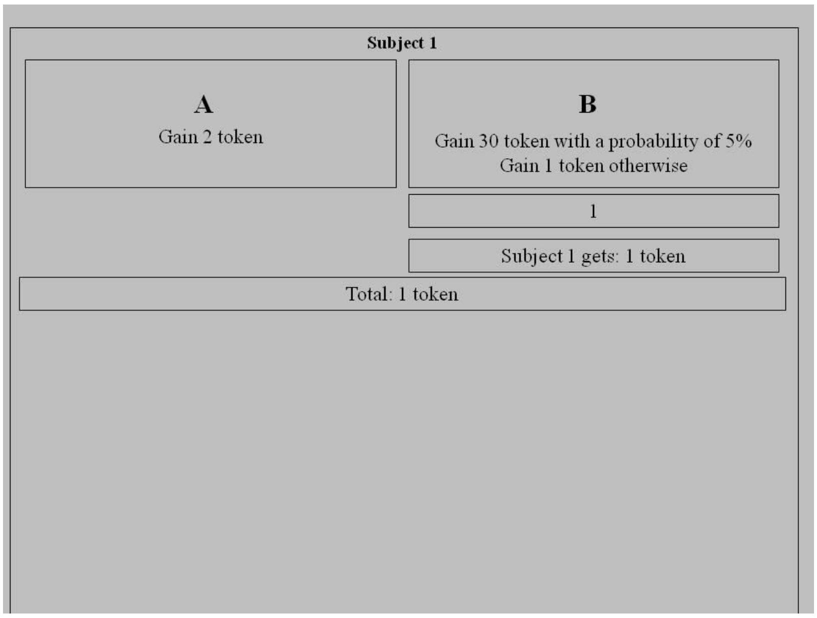
At the start of the session, the computer will assign you an initial endowment of 120 tokens and match randomly all of you in pairs, composed by Agent 1 or Agent 2. The pairs and the type of agent will remain the same throughout the session. This means that if, for example, you will be assigned to the group X with the role of Agent 1, you will be agent 1 in the group X for all the session.
During the session, you will be shown a number of positive (gains) and negative (losses) alternatives on the screen, one of which is sure and the other is risky, and you will be asked to choose which one you prefer. To choose one of the two alternatives, you must select the button A or B that appear on the screen. In case of choosing the sure option, your earnings will be known, while in the case of choosing the risky option, the computer will make the draw according to the shown probabilities shown and calculate the gain or loss obtained for that choice.
At first, the following screen will be shown to Agent 1 (*the values given in this and subsequent figures are for illustrative purposes only and are not intended to be, and should not to be interpreted as, recommendations*).



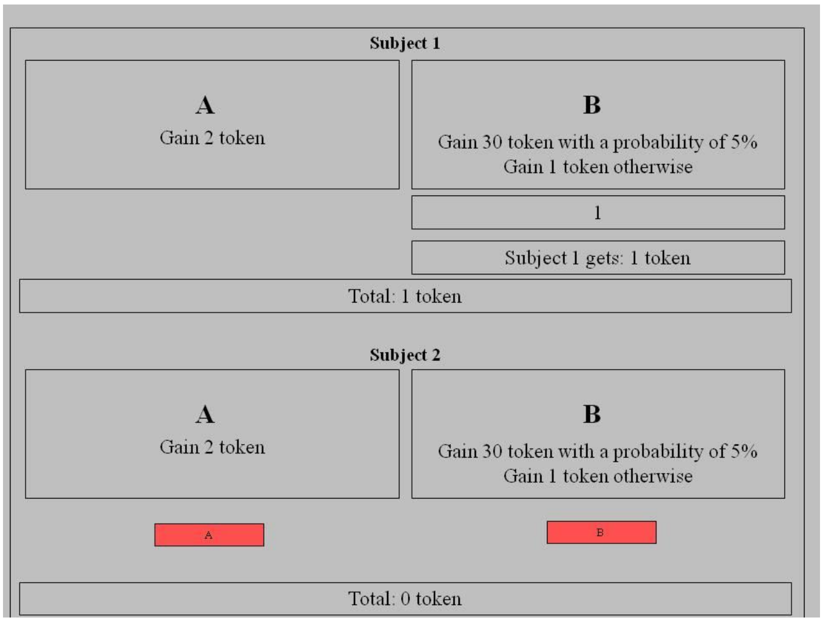
The boxes on the top of the screen will show two alternatives to be chosen by Agent 1 by pushing the buttons below. The screen will also show the total of tokens accumulated during the session.
At the same time, the following screen will be shown to Agent 2.



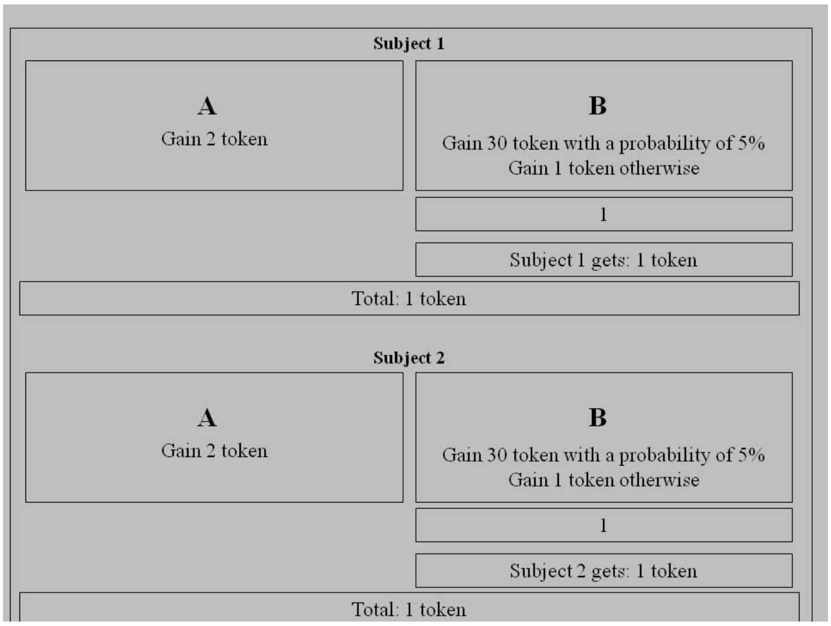
The upper part will be identical to that shown to Agent 1, but the buttons will be missing. In the bottom part the same alternatives will be shown but referred to Agent 2.
After Agent 1 has made his/her choice, the buttons will disappear and the computer will determine the decision outcome that will be displayed as shown in the screen below.



After Agent 1 has made his/her own choice, the following screen will be instead displayed to Agent 2.



The upper part will show information about the decision taken by Agent 1 and his/her outcome, while the lower part will show the same alternative with the buttons required to take the decision. After Agent 2 has taken his/her decision, the buttons will disappear and information about the tokens gained or lost will be displayed. A button will appear to move to the next decision.



This same procedure will be repeated 30 times.

In summary, a number of positive (gains) and negative (losses) alternatives will be presented on the screen, one of which is sure and the other one is risky, and you will be asked to choose which one you prefer. Before making his/her decision, each Agent 2 will have the opportunity to see the choices made and the results obtained by the paired Agent 1. Agents 1 will not receive any information on decisions taken and results obtained from anyone else during the experiment.

It is very important to keep in mind that the same alternatives, positive (gains) or negative (losses), will be presented to Agent 1 and Agent 2 of the same group. As mentioned before, an alternative option will be sure while the other one will be risky. The risky alternative may be shown on the right or the left side of the screen. In case of risky decision, the computer will draw according to the known probabilities and calculate the result. All extractions will be independent of each other. In other words, the fact that an extraction has a certain outcome will have no effect on the likelihood of subsequent extraction. Please keep in mind that there are neither correct answers nor time limits.

Your decisions will determine your final earnings. At the beginning of the session, you will be provided of 120 tokens worth a total of 12 Euros (each token is worth 10 cents). During the session, according to the choices you make, you can gain or lose tokens which will be added to / subtracted from your initial endowment. At the end of the session, you will receive the value of the tokens accumulated in cash according to the following conversion rate:

1 token = 10 Euro cents

We start the experiment with some trial sessions, in which you can practice and no compensation will be given.

Thanks for collaborating on this research!
Have a good experiment!

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