Coordination and Cheap Talk: Indirect versus Direct Messages

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Abstract

In this paper, we experimentally compare the effect of costless direct and indirect messages on the risky action choices, hence on coordinations in stag-hunt games. We show that there is no effect of costless indirect messages on the frequency of risky action choices and hence on coordination on the payoff-dominant equilibrium. With direct messages, however, we find that there is a significant effect of pre-play communication on efficient coordination. One potential reason of not seeing a significant effect of indirect messages is the difference in agents' message-interpretations. Another potential reason may be the existence of lie-averse agents.

Keywords: coordination, cheap talk, risk information, costless messages
JEL classification codes: C72, C91, D82, D84

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1 Introduction

Incomplete information exists in many interactions. In these interactions people may use signals to convey some information about themselves to their opponents. The framed degree in your doctor's office, the celebrity endorsement of a popular dietician, and the pictures of politicians on the wall of a restaurant are all signals. The signals are potentially valuable because they allow you to infer useful information. These signals are indirect and require interpretation. They may be subject to manipulation. The doctor's diploma tells you something about the doctor's qualifications, but knowing where and when the doctor studied does not prove that she is a good doctor.

This paper analyzes the outcome of a stag-hunt game with pre-play one way costless communication. One of the players, sender, is given the chance to either signal his risk attitude or tell which action he would choose to the other player before playing the game. As the signals mentioned in the first paragraph, the signal about the player's risk attitude is indirect and requires interpretation whereas the latter is direct and requires no interpretation. Such an indirect signal is important for the game when the payoffs from the game are monetary and strategic risk exists in the game. In a stag-hunt game, players choose between strategically safe and risky actions (respectively, Action A and Action B in Table 1). Depending on a player's own action choice as well as her opponent's action choice, they may end up in the payoff-dominant equilibrium ((Action B, Action B)), in the risk-dominant equilibrium ((Action A, Action A)), or out of equilibrium ((Action A, Action B), (Action B, Action A)).

Table 1: 2x2 Stag-Hunt Game

	Action A	Action B
Action A	a, a	a, c
Action B	c, a	b, b

$b > a > c > 0$

An indirect signal about a player's risk attitude may affect a player's action (hence the game outcome) for the following reasons: Agents' utility representations differ according to their risk aversion.[1] In the game, risk-averse, risk-neutral, and risk-loving agents expect different payoffs from Action A (or Action B) for the same belief about the other person's action choice. Hence,

[1]Some earlier studies (Bolton, 1998; Camerer, 1997; Holt and Laury, 2002; Goeree, Holt, and Palfrey, 2002) show deviations from the equilibrium predictions in experimental results when subjects' risk attitudes are not taken into account for the payoffs.

their optimal action choices may change as a response to their beliefs: It may be optimal for a risk-averse agent to choose Action A even when she thinks that her opponent chooses Action A with a low probability. On the other hand, it may be optimal for a risk-loving agent to choose Action A only when she thinks that her opponent chooses Action A with a high probability. This difference stems from the concave (convex) utility function of a risk-averse (risk-loving) agent. Similarly, when a player gets a signal about how risk averse the other person is, she may form her beliefs accordingly. She may expect a risk-averse (risk-loving) opponent to choose Action A with a higher (lower) probability and best respond to her belief by choosing Action A (Action B).

A direct signal, simply saying which action a player intends to take before playing the game, is different than indirect signal. For direct messages, Farrell and Rabin (1996) state that in order to have a message to be credible in a game, the message should hold two properties: self-committing and self-signaling. A signal is self-committing when it creates an incentive for the sender to fulfill it if it is believed by the receiver. For instance, consider a cheap talk situation for the game in Table 1. Row player's message saying that he will take Action B in the game, is self-committing, if the row player thinks that the receiver (column player) believes this message (he will take Action B) then row player best responds to that by choosing Action B. A signal is self-signaling if the sender sends it if it is true. The row player sends a message saying that he will take Action B in the game only if he really plans to do it. Since one cannot understand from the message whether it is true or not, the message is not self-signaling in such a game. Aumann (1990) states that cheap talk should be ignored when the message is not self-signaling. Nevertheless, although messages may not be self-signaling, in coordination games as in Table 1, cheap talk increases coordination levels (Charness, 2000; Cooper et al., 1992; Clark, Kay and Sefton, 2001; Duffy and Feltovich, 2002, 2006).[2] For indirect messages, self-committing signal means that the sender chooses the risky action if the sender believes that his message about his risk lovingness will convince receiver to choose the risky action. Self-signaling signal means that only sender sends that "he is risk loving (message)" if he aims to choose the risky action.

This paper compares the effect of an indirect signal through which the receiver interprets how likely the sender's risky action choice with a direct signal through which the receiver gets a sure

[2] Van Huyck, Battalio, and Beil (1990, 1991), Cooper et al. (1990, 1992), and Straub (1995) show that subjects may not always coordinate on the payoff-dominant equilibrium. The result from this literature is that when players do not communicate, mostly Pareto-dominated equilibrium is observed as the game outcome, with the use of pre-play messages mostly Pareto-efficient outcome is observed.

message about the sender's risky action choice. In particular, we compare coordination rates/risky action choices in the stag-hunt games with pre-play communication for two cases: 1) sender says how risk lover or how risk averse he is to his opponent (indirect message). 2) sender is simply saying which action he wants to take (direct message).

To see the effect of sending direct or indirect messages compared to the baseline, we design an experiment with three stages. In the first stage, we use a common technique (due to Holt and Laury, 2002) to elicit subjects' risk aversion. This technique involves two lotteries: one risky and one safe. The riskiness of the lotteries is determined by the difference between the high and low payoffs. There are ten different situations and individuals are asked at which situation they want to switch from a 'safe' lottery to a 'risky' lottery. At a given situation the probability of obtaining the high payoff is identical in both lotteries. These probabilities range from 1/10 to 1 in increments of 1/10 between situations. The expected payoff of the risky lottery becomes higher than the expected payoff of the safe lottery after Situation 5. Depending on agents' being risk loving, risk averse, or risk neutral, they can switch from the safe lottery to the risky lottery before, after, or at Situation 5, respectively.[3]

The second stage differs according to treatment. We have three treatments including baseline in the experiment. In the first treatment of the experiment, senders have a chance to signal their risk-aversion levels[4] to the receivers before playing the game in Table 2. In the second treatment, senders have a chance to tell which action they would like to choose to the receivers before playing the game in Table 2. In the baseline treatment, subjects play the game in Table 2 without a communication stage.

In the treatments, the subject group is divided into two: one group is composed of senders and the other group is composed of receivers. Senders and receivers are matched to play the game in Table 2. However, before playing the game, in the first treatment, senders are asked to choose one of the following: "I do not want to send a message" or a message saying which group they belong to. If a sender switched from Option A to Option B in situations 1, 2, 3, and 4 in the first stage, she belongs to "Group 1"; if she switched from Option A to Option B in situations 5, 6 and 7 in the first stage, she belongs to "Group 2", and if she switched from Option A to Option B in situations 8, 9 and 10 in the first stage, she belongs to "Group 3". In the second treatment, before playing

[3] For more information about this stage, please see Part 1 in the Appendix.

[4] In the experiment, we do not directly say the risk attitude; instead we ask information about the sender's choice in the first stage.

the game, senders are asked to choose one of the following: "I do not want to send a message", a message saying they would choose Action A in the game, and a message saying they would choose Action B in the game. In either treatment, senders and receivers know that senders do not need to send the true message about which group they actually belong to or choose the action they told they would choose. In the third stage, senders and receivers play the game in Table 2 with their matches.

Table 2: The Experimental Stag-Hunt Game

	Action A	Action B
Action A	$570, 570$	$570, 70$
Action B	$70, 570$	$770, 770$

We show that Aumann's conjecture is still valid for indirect messages. Indirect messages are considered as a cheap talk and does not significantly increase efficient coordination levels. However, our findings related to direct messages are inline with the experimental economics literature: direct cheap talk messages increase the efficient coordination levels. Our main contribution is to show that the structure of the cheap talk is also important to increase coordination in stag-hunt games. We also show that subjects learn to coordinate on the efficient equilibrium with direct messages. However, this learning process does not occur with indirect messages. We observe truth telling behavior in all treatments. In indirect message treatment, most subjects belong to Group 2 or Group 3 and they may choose to send a message saying that they are in Group 1. This type of strategic message would not hurt the receiver and would increase efficient coordination levels. Only 27% of the time subjects were strategic when sending a message and send a risk group message different than the actual risk group they belong to, i.e., they send messages telling that they belong to one of the extreme groups (Group 1 or Group 3) to increase coordination either on payoff-dominant or risk-dominant equilibrium.

The paper is organized as follows. In Section 2, we explain experimental design and the procedures. In Section 3, we present the results of our experiment. We conclude in Section 4. All supplementary material, including the instructions for the experiment, are presented in the Appendix.

2 Experimental Design and Procedures

The experiment was conducted at the FEAS Behavioral and Experimental Economics Laboratory (BEL) at the Middle East Technical University (METU). Subjects were recruited by e-mail using the BEL database, which consists of undergraduate students at METU. Overall, 144 subjects participated in the experiment. There were twelve sessions and each lasted 45 minutes. Each subject participated in only one session. All sessions were computerized using z-tree (Fischbacher, 2007). Throughout the experiment, payoffs were described in terms of "tokens". 100 tokens correspond to one Turkish Lira (TL) in our experimental design. A subject earned 14.92 TL on average, including a 5 TL participation fee.[5] The experiment for the baseline consisted of two stages and the treatments were three stages.[6]

In the first stage, we elicited the risk attitude of each subject by Holt and Laury's (2002) method. According to this method, subjects must choose one of two lotteries available for ten different situations (Figure 2 in Appendix A). In Situation 1, the less-risky lottery (Option A) has a higher expected payoff than the more-risky one (Option B). Hence, only very strong risk lovers pick Option B in this situation. Moving further down the table in Figure 2, the expected payoff difference between the lotteries in Option A and in Option B decreases and eventually turns negative in Situation 5. In Situation 10, all subjects must choose between a sure payoff of 400 tokens (Option A) and a sure payoff of 770 tokens (Option B). Since all rational individuals prefer the latter one in the last situation, by then all subjects should have switched from Option A to Option B. In this experiment, a consistent subject should switch from Option A to Option B just once. However, earlier experiments using Holt and Laury's (2002) method showed that some subjects may go back and forth between Option A and Option B. To prevent such behavior in our experiment, we asked subjects when they want to switch from Option A to Option B.

The payoffs for the lottery choices in the experiment were selected so that the risk threshold point[7] would provide an interval estimate of a subject's constant relative risk aversion (CRRA). With these payoffs, it is optimal for a risk-neutral subject to switch from Option A to Option B in Situation 5. Similarly, it is optimal for a risk-averse (risk-loving) subject to switch from Option A

[5] As of January 2016, the minimum wage rate is 8.13 TL per hour in Turkey.

[6] The instructions in a session were read in two groups: first instructions for the first stage is read then instructions for the second and third stage were read together. Full instructions for the stages of costless risk-group signalling can be found in the Appendix.

[7] The situation at which a subject switches from Option A to Option B.

to Option B after (before) Situation 5. The payment for this stage was determined according to a randomly chosen row among these ten situations and the subject's lottery choice in that particular row. Subjects learned their earnings from this stage at the end of the experiment.

The second stage differed according to the treatment. There were three treatments in our experiment: Baseline, costless risk-group signalling, and costless action signaling. We used between-subject design for the experiment. In baseline (No Communication) treatment, subjects played the one-shot stag hunt game in Table 2 for 12 periods. Each period, participants were anonymously and randomly re-matched, played the one-shot game, and saw the results of that period. However, they did not learn the identity or history of their opponents at any time during the experiment. Subjects were paid according to a randomly-drawn period's payoff for the experiment, in all treatments.

In costless risk-group signalling (Type Message) treatment the subject group was divided into two: one group was composed of senders and the other group was composed receivers. In each period, before playing the game in Table 2, senders had the option of not sending a message or sending a message about which of the three groups she belonged to according to her choices in the first stage. If the sender switched from Option A to Option B in situations 1, 2, 3, and 4 in the first stage, she was actually in “Group 1”; if she switched from Option A to Option B in situations 5, 6 and 7 in the first stage, she was actually in “Group 2”, and if she switched from Option A to Option B in situations 8, 9 and 10 in the first stage, she was actually in “Group 3”. The receivers were told that independent of which group senders are, senders could send any message. Either the message sent or not, subjects played the game in Table 2 in the third stage. Subjects repeated the described game 12 periods with new matches by keeping their roles during the whole session.[8]

In costless action signalling (Action Message) treatment the subject group was again divided into two: one group was composed of senders and the other group was composed receivers. In each period, before playing the game in Table 2, senders had the option of not sending a message or sending a message about which action he would choose in the third stage: "Action A" or "Action B". The receivers were told that senders can send a message, "Action A" or "Action B", independent of their action choices in the third stage. Either the message sent or not, subjects played the game in Table 2 in the third stage. Subjects repeated the described game 12 periods with new matches by keeping the same roles during the whole session. The possible messages in the treatments are summarized in Table 3.

[8] They remain as sender or receiver during a whole session.

Table 3: Messages in Treatments

Type	Action
Group 1(Risk-Loving Group)	Action A (Safe Action)
Group 2 (Medium Risk-Averse Group)	Action B (Risky Action)
Group 3 (High Risk-Averse Group)	–

3 Results

In this section, we first check how the frequency of risky action choice, coordination rate (coordination both under risk-dominant and payoff-dominant equilibrium) and coordination on the payoff-dominant equilibrium changes as treatments change. In Table 4, we summarize these frequencies under the Baseline (with no communication), Type-Message Treatment (when subjects are allowed to announce their risk group) and Action-Message Treatment (when subjects are allowed to announce which action they would choose in the game). As can be seen from the first two columns of the table, frequency of risky action choice (30% and 27% respectively), coordination rate (61% and 66% respectively) and coordination rate on the payoff-dominant equilibrium (11% and 9% respectively) are very similar under the Baseline and Type-Message Treatment. [9] However, these rates in the Action-Message Treatment are higher than the rates in the Baseline and Type-Message treatments. In particular, we do not see a welfare-enhancing effect of allowing agents to send their types (indirect messages) to their opponents compared to baseline. However, allowing agents to send which action they will choose in the game (direct messages) raises the coordination on the payoff-dominant from 11% to 67%.[10]

Table 4: Frequency of Risky-Action Choice and Coordination according to Treatments

	Baseline	Type-Message Treatment	Action-Message Treatment
Frequency of risky action choice	30%	27%	73%
Coordination rate	61%	66%	86%
Coordination rate on the payoff-dominant equilibrium	11%	9%	67%

[9] They are not significantly different according to t-test for two sample proportions.

[10] The proportions in baseline and Action-Message treatments are significantly different according to t-test for two sample proportions.

We also check what affects a subject's likelihood of choosing risky action. To this end, we coded our dependent variable as a bivariate one which takes the value 1 if a subject chooses Action B (the risky action) in a given round and 0 if he or she chooses Action B (the safe action). Then, we ran marginal effect probit regression analyses with the gender, level of risk aversion, number of prior rounds in which he or she played the game, and the treatment (Treatment variable takes value 1 if the data come from Type-Message Treatment, 0 if the data come from Baseline). In the random effects probit regression analysis, standard errors are clustered at the subject level. The results are presented in Table 5. As can be seen from the table only Period (the number of prior rounds) negatively affects the probability of risky action.[11]

Table 5: Results on Risky-Action Choices

Results of Probit Regression Standard Errors are Clustered at the Subject Level Dependent Variable: Choosing the Risky Action	
Independent Variables	#Subjects=96 #Observations=1152
Treatment (TypeMessage=1,Baseline=0)	−0.05(0.06)
Gender Indicator (Male=1, Female=0)	−0.05(0.06)
First stage decision (from 1 to 10)	−0.01(0.02)
Period	−0.02***(−0.004)
Coefficients represent marginal effects at the average of independent variables Standard Errors are in the parantheses. ***=statistically significant at 1% level	

Since the period variable affects the probability of risky action choice negatively, we divide the first row of Table 4 into three groups, i.e., we analyze the frequency of choosing the risky action in the first 4 periods (Periods from 1 to 4), in the second 4 periods (periods from 5-8), and in the third 4 periods (periods from 9 to 12). As can be seen from Table 6, although frequency of choosing risky action decreases in the baseline and Type-Message treatment (due to subjects'

[11] We did not run a regression with action data due to high collinearity between treatment variable and dependent variable, risky action choice.

losses in earlier periods, they chose the safe strategy in later periods), it increases in the Action-Message treatment (as subjects play the game repeatedly they learn how to coordinate on the payoff-dominant equilibrium through their messages).

Table 6: Frequency of Risky-Action Choice Across Periods

Frequency of risky-action choice	Baseline	Type-Message Treatment	Action-Message Treatment
Period 1-4	36%	38%	69%
Period 5-8	30%	22%	73%
Period 9-12	23%	19%	78%

Table 7 shows how the frequency of messages and given the message, the frequency of risky action by senders (receivers) change in the Type-Message and Action-Message treatments. Subjects chose to send messages in Action-Message treatment (92%) more frequently than Type-Message treatment (80%). [12]This may be due to the fact that subjects believed the effect of their messages, more in Action-Message Treatment. Although the percentage of senders chosing the risky action given they did not send a message (38%) is higher under Action-Message treatment than under Type-Message treatment (22%), the receivers chose the risky action less often if they "did not receive a message" under Action-Message treatment (15%) than under Type-Message treatment (27%). This implies that although sending no message in Action-Message treatment does not mean for the sender that he would choose the safe action, a receiver interprets it so and as a best reponse he chooses the risky action less frequently.

An agent may expect that the likelihood of his opponent's risky action choice should decrease as his opponent becomes more risk averse. As a result, we expect the frequency of risky action choice by senders and receivers to decrease with a message, saying that the sender belongs to a high risk-averse group (Group 3). As seen in Table 7, on the contrary, the frequency of risky action choice of the senders increases from 23% to 31% as they send a message saying that they belong to Group 2 to Group 3. Nevertheless, for the receivers the frequency of risky action choice when they receive a message with their opponents belong to Group 1 is higher (29%) than the frequency of risky action choice when they receive a message with their opponents belong to Group 2 (23%). This frequency for receivers does not change from Group 2 messages to Group 3 messages (23%

[12]This difference is significant according to t-test for two sample proportions.

in either case). Most of the messages in Type-Message treatment belong to Group 2 and Group 3 groups (60% in total). We speculate that this is due to truth telling behavior of the subjects. There is a vast experimental economics literature about lie aversion. We refer the reader to Erat and Gneezy (2012), Serra-Garcia-van Damme-Potters (2012) and Agranov and Schotter (2012) for more on this.

The percentage of subjects who chose to send "Safe Action" message in Action-Message treatment is very low (12%). Among those only 6% of the senders continued to choose the risky action despite their "Safe Action" messages. The percentage of subjects who chose to send "Risky Action" message in Action-Message treatment is quite high (80%). Senders, sending this message chose the risky action 86% of the time and receivers receiving this message chose the risky action 88% of the time.

Table 7: Frequency of Messages and the Actions Given the Sent (Received) Messages

Sent (Received) Message Type	Number of Messages	Given the message, frequency of risky action choice by Sender (Receiver)
No Message (Type)	59(20%)	22% (27%)
No Message (Action)	*23(8%)*	*38%(15%)*
Group 1	58(20%)	34% (29%)
Action A	*36(12%)*	*6%(8%)*
Group 2	77(27%)	23% (23%)
Action B	*229(80%)*	*86%(88%)*
Group 3	94(33%)	31% (23%)
–	–	–

Our results for the case of direct messages are consistent with the literature. Charness (2000) finds that the proportion of B signals was 95% and conditional on B signal the efficient outcome is achieved 89.5% of the cases. Clark et al. (2001) find that the probability of a B signal was 85% and the probability of subjects playing B was 77%. In our direct message setting the proportion of B signals was 80% and conditional on B signal the probability of subjects playing B was 86%. All of these papers conclude that pre-play communication have a significant effect on efficient coordination. We contribute to the existing literature on cheap talk in coordination experiments by showing that indirect messages may be ineffective in increasing efficient coordination as stated by Aumann's conjecture.

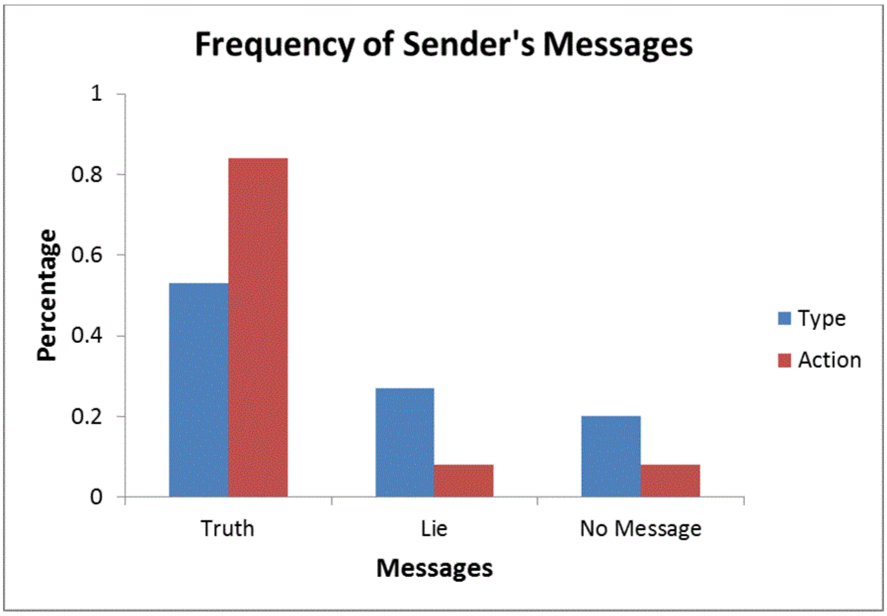

Figure 1: Frequency of Sender's True, Untrue, and No Messages

Figure 1 compares the frequency of true, untrue, and no messages between Type-Message and Action-Message treatments.[13] While 84% of the time subjects announced the action they will choose in the game truthfully, 53% of the time subjects announced the type group they belong to truthfully. While 8% of the time subjects lied about the action they will choose in the game, 27% of the time subjects lied about the group they belong to. When we look at the lies in Type-Message treatment in detail, among 77 untruthful messages, 33 subjects were saying that they belong to Group 1 while they are not; 36 subjects were saying that they belong to Group 3 while they are not; and only 8 subjects were saying that they belong to Group 2 while they are not. This observation shows us that subjects are strategic while telling a lie. In other words, telling their opponents they belong to Group 2 will have the least effect on affecting their opponents' beliefs. However, telling they belong to one of the extreme groups either Group 1 or Group 3, may affect their opponents' beliefs and help coordination either in payoff-dominant or risk-dominant equilibrium. While in the Action-Message treatment, 8% of the time subjects chose not to send any message, in Type-Message

[13]The truth in action-message treatment means that the message about announced action is the same as chosen action. Nevertheless, the truth in type-message treatment means that the message about subject's risk group is the same as the group elicited by Holt-Laury method. Hence, action message is about future, while type message is about past.

treatment this percentage is 20%. The jump in the frequency of "no messages" in Type-Message treatment may stem from the belief about not being able to affect the opponent's beliefs through such messages. Büyükboyacı (2014) shows that there is a group of subjects who believes their opponents' action choices are not affected from their risk aversion levels. Such subjects may choose not to send a message about their types or may choose to send unstrategic (truthful) messages about their types.

4 Conclusion

The literature about lie aversion confirms that there is a cost of lying for agents (Erat and Gneezy, 2012; Serra-Garcia-van Damme-Potters, 2012; Agranov and Schotter, 2012). The results in this paper may stem from the fact that the cost of lying may be higher than the difference between the payoff from the payoff-dominant equilibrium and the payoff from the safe action. In that case, instead of telling a strategic lie through an indirect message, agents may choose telling the truth and coordinate on the risk-dominant equilibrium rather than telling a lie (saying that they are in Group 1) and coordinating on the payoff-dominant equilibrium.

Second reason why we did not see much effect of type messages on coordination is that since the type message is signalling the likelihood of the risky-action choice and there may be heterogeneity among agents about the effect of such a message on their beliefs about the opponents' risky action choice (Büyükboyacı, 2014). Hence, agents may best respond to these beliefs differently.

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5 Appendix: Instructions

Welcome and thank you for participating in our experiment.

We will read the instructions together. Please do not touch the keyboard for now and listen to these instructions carefully.

This is an experiment about economic decision making. All participants will earn some money during the experiment. The money you earn might be different from the other participants earnings. This amount is dependent on your decisions as well as the decisions of other participants. Please do not talk with each other during the experiment. We will have to terminate the experiment if you violate this rule. We will now describe the experimental procedures. It is very important that you understand all the parts. Please raise your hand if you have a question.

There will be two parts in our experiment. You will learn about these parts right before they start. Your aim in both parts is to earn as much money as possible. At the end of the experiment, you will learn about your total earnings from each part. Your earnings will be in tokens. 100 tokens = 1 TL. Your total earnings will be rounded to the nearest 25 kurus. In addition to your earnings in the experiment, you will be paid a 5TL participation fee.

PART 1

You will see a table something like this in stage 1. In this part, you will face 10 different rows.

Each row provides two options, Option A and Option B. You will slide the bar in the middle to show which option you chose for that situation. These options are basically lotteries that indicate

Option A:	Use the slider to choose between options A and B.	Option B:
400 tokens with probability 10%, 320 tokens with probability 90%	A B	770 tokens with probability 10%, 20 tokens with probability 90%
400 tokens with probability 20%, 320 tokens with probability 80%	A B	770 tokens with probability 20%, 20 tokens with probability 80%
400 tokens with probability 30%, 320 tokens with probability 70%	A B	770 tokens with probability 30%, 20 tokens with probability 70%
400 tokens with probability 40%, 320 tokens with probability 60%	A B	770 tokens with probability 40%, 20 tokens with probability 60%
400 tokens with probability 50%, 320 tokens with probability 50%	A B	770 tokens with probability 50%, 20 tokens with probability 50%
400 tokens with probability 60%, 320 tokens with probability 40%	A B	770 tokens with probability 60%, 20 tokens with probability 40%
400 tokens with probability 70%, 320 tokens with probability 30%	A B	770 tokens with probability 70%, 20 tokens with probability 30%
400 tokens with probability 80%, 320 tokens with probability 20%	A B	770 tokens with probability 80%, 20 tokens with probability 20%
400 tokens with probability 90%, 320 tokens with probability 10%	A B	770 tokens with probability 90%, 20 tokens with probability 10%
400 tokens with probability 100%, 320 tokens with probability 0%	A B	770 tokens with probability 100%, 20 tokens with probability 0%

Figure 2: Instructions Part 1

your chances of winning a certain payoff. For each row, you will be asked to choose one among option A and option B. If you choose Option B for one row, you will have to choose this option for the remaining rows.

For instance, consider row 1. In Row 1 Option A offers 400 tokens with probability 1/10 and 320 tokens with probability 9/10. In Row 1 Option B offers 770 tokens with probability 1/10 and 20 tokens with probability 9/10. Your earnings from this part will be determined as follows: First the system will pick a number between 1 and 10. This number will tell us the row that will be used in determining your earnings from this part.

Suppose that this number turns out to be 7 and that you have chosen option A for row 7. The system will choose another number between 1 and 10. If this number is 7 or smaller (with probability 7/10), you will earn 400 tokens. If this number is 8 or larger (with probability 3/10), you will earn 320 tokens.

PART 2

You will be grouped into three according to your choices in the first stage: Group 1: You belong to this group if you have switched from Option A to Option B in situations 1, 2, 3, or 4 in the first stage, Group 2: You belong to this group if you have switched from Option A to Option B in situations 5, 6, or 7 in the first stage, Group 3: You belong to this group if you have switched from

Option A to Option B in situations 8, 9, or 10 in the first stage.

In this stage, there will be 12 periods that are similar to each other. In each period some of you will be sender; some of you will be receiver. Each of you will keep your roles as sender or receiver during the experiment. On the top of the screen you can see whether you will be sender or receiver during the whole stage. In each period senders will be matched to receivers randomly. You will not be informed about whom you were matched with at any time.

Senders can send one of the following messages before playing the game: "I belong to Group 1"; "I belong to Group 2"; "I belong to Group 3" or "I do not want to send a message." Senders are allowed to send any message they want regardless of in which group they are. Afterwards, You play the following game.

	Action A	Action B
Action A	$570, 570$	$570, 70$
Action B	$70, 570$	$770, 770$

Your and other person's period earnings will be determined by the actions you chose in the described game: If both you and the other person chose Action A, both of you will earn 570 tokens. If you chose Action A but the other person chose Action B; then you will earn 570 tokens and the other person will earn 70 tokens. If you chose Action B but the other person chose Action A; then you will earn 70 tokens and the other person will earn 570 tokens. If both you and the other person chose Action B, both of you will earn 770 tokens.

You will see the following information on the screen after you made your action choices. Your and the other person's action choices,the announcement made by reds and which group actually s/he belongs to, your earnings at that period.

Then you will start new period as explained and will be matched someone else in the new period. At the end of the experiment, one of 12 periods will be drawn and your earnings at that period will be counted as your earnings from the second stage. Since each period has an equal chance in drawing, you should make your decision in each period carefully.