Appendix: Instructions for Treatment Index B (Human Opponents, With Recommendations)

This is an experiment in the economics of strategic decision making. Various agencies have provided funds for this research. If you follow the instructions and make appropriate decisions, you can earn an appreciable amount of money. The currency used in the experiment is francs. All trading will be in terms of francs. Your francs will be converted to dollars at a rate of _____ francs to one dollar. At the end of today's session, you will be paid in private and in cash.

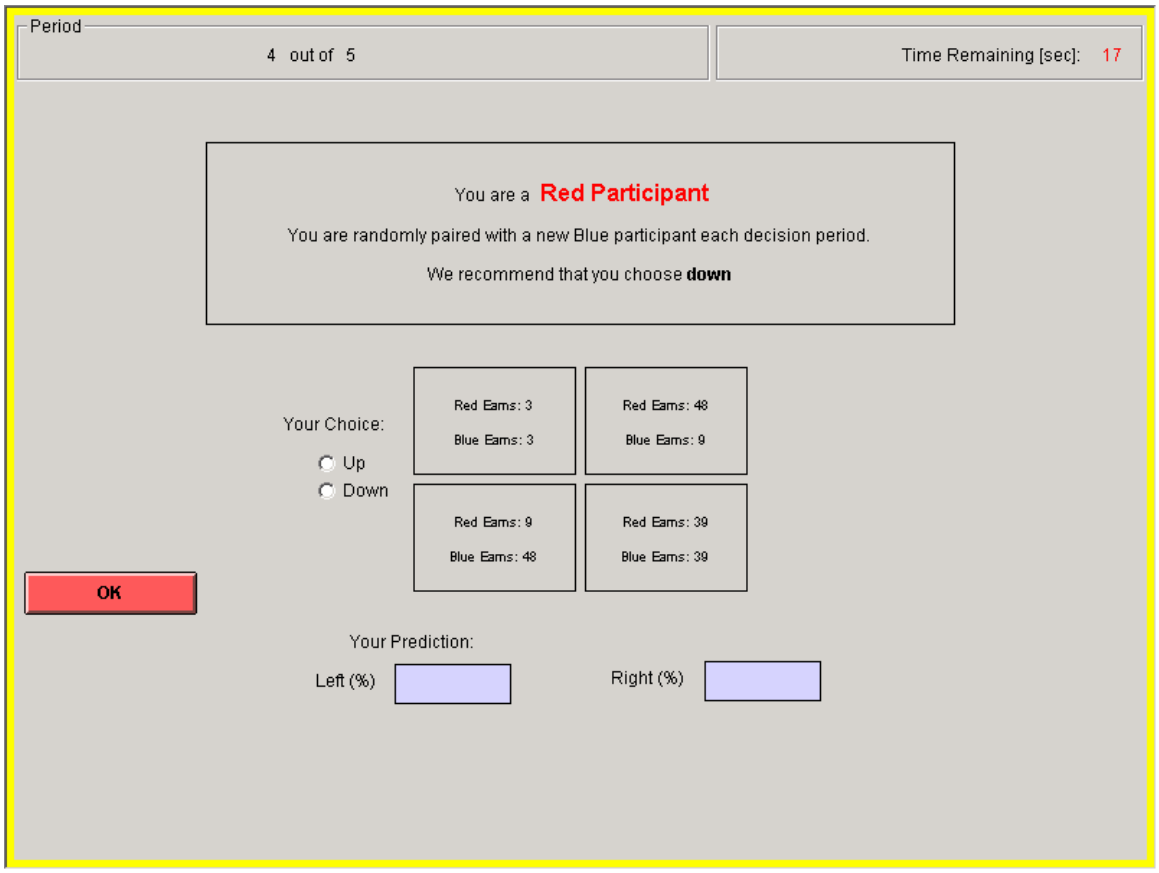
It is important that you remain silent and do not look at other people's work. If you have any questions, or need assistance of any kind, please raise your hand and an experimenter will come to you. If you talk, laugh, exclaim out loud, etc., you will be asked to leave and you will not be paid. We expect and appreciate your cooperation.

The experiment consists of 60 separate decision making periods. The ____ participants in today's experiment will be randomly split between two equal-sized groups, designated as **Blue** and **Red** groups. Your color designation remains unchanged throughout the experiment.

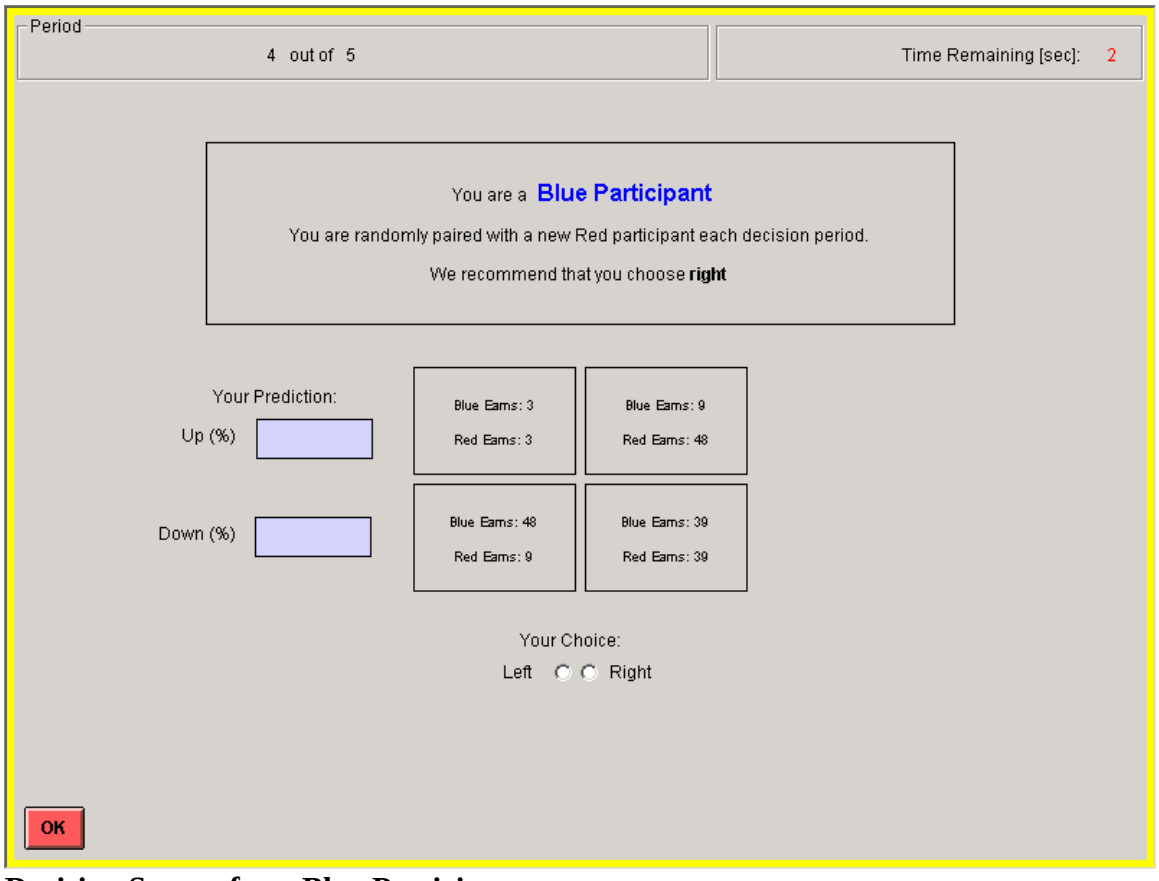
At the beginning of each decision making period you will be randomly re-paired with another participant in the other color group. Hence, at the beginning of each decision making period, you will have a one in _____ chance of being matched with any one of the _____ participants in the other group.

At the beginning of each period, you and all other participants will choose an action. An earnings table is provided on the decision screen that tells you the earnings you receive given the action you and your currently paired participant chose. See the decision screens on the next page. If you are a Red participant then you may choose either Up or Down, which determines the earnings row. If you are a Blue participant then you may choose either Left or Right, which determines the earnings column. To make your decision you will use your mouse to click on the Up or Down (or Left or Right) buttons under *Your Choice:* and then click on the OK button.

Your earnings from the action choices each period are found in the box determined by your action and the action of the participant that you are paired with for the current decision making period. The values in the box determined by the intersection of the row and column chosen are the amounts of money (in experimental francs) that you earn in the current period. For example, if the Red participant chooses **Up** and the Blue participant chooses **Right**, then the Red participant earns 48 francs and the Blue participant earns 9 francs for this period.



Decision Screen for a Red Participant



Decision Screen for a Blue Participant

Action Recommendations

In today's experiment your computer will make recommendations for which action to choose. For each pair of participants, in each decision making period the central server computer will randomly choose between three outcomes to recommend: Up-Right, Down-Left, or Down-Right. The computer never recommends the "worst" outcome Up-Left in which both participants earn only 3 francs. It recommends Down-Right (where both participants earn 39 francs) with a one-fifth (20 percent) probability. It recommends Up-Right (where Red earns 48 and Blue earns 9) with a two-fifths (40 percent) probability, and it recommends Down-Left (where Red earns 9 and Blue earns 48) with a two-fifths (40 percent) probability. The following table summarizes these recommendations and their likelihoods.

		Blue Choice: Left	Blue Choice: Right
Red Choice	Up	Never Recommended Red Earns 3 Blue Earns 3	Recommended with $\frac{2}{5}$ (40 percent) probability Red Earns 48 Blue Earns 9
	Down	Recommended with $\frac{2}{5}$ (40 percent) probability Red Earns 9 Blue Earns 48	Recommended with $\frac{1}{5}$ (20 percent) probability Red Earns 39 Blue Earns 39

You can understand these probabilities by viewing the five large balls I am holding, and imagining that they are drawn from a bingo cage or "urn." The **two yellow** balls are labeled Up-Right, the **two green** balls are labeled Down-Left, and the **one red** ball is labeled Down-Right. The computer draws a single ball out separately for each pair of participants, in each period, and always replaces the drawn ball before drawing another ball for the next pair of participants or the next period. The drawn ball determines the outcome recommendation.

After the computer determines the outcome to recommend for a particular pair for the current period, it displays a recommended action to each individual participant. These recommendations are displayed on your decision screen (see the illustrations on the previous page). You will learn only the recommended action for your color role to implement the computer's chosen outcome. The participant you are paired with for this round receives the

corresponding action recommendation to implement the computer's chosen outcome. It is up to you to decide whether or not you wish to follow these recommendations.

Why you should follow the recommendations

You should follow the recommendation given by the computer, because as long as the person you are paired with also follows his or her recommendation then you earn more on average by following the recommendation. Here is why:

1. First, remember that if both you and the participant you are paired with follow the recommendations, you will never have the worst Up-Left outcome (in which both participants earn only 3), because that outcome is **never** recommended.
2. Next, if you are a Red participant and you receive the recommendation to choose **Up**, then you know that the Blue participant you are paired with has received the recommendation to choose **Right**, since the outcome Up-Left is never recommended. [You know that a green or red ball was not drawn, since they recommend Down.] If this Blue participant follows his recommendation and chooses Right, then you earn more by following your recommendation to choose **Up** (48) than by not following your recommendation and choosing **Down** (39).
3. The same logic applies if you are a Blue participant and you receive the recommendation to choose **Left**, because that means the computer drew a green ball—the only one with a Left recommendation.. If the Red participant you are paired with follows her recommendation (which must be to choose **Down**), you earn more by following your recommendation to choose **Left** (48) than by not following your recommendation and choosing **Right** (39).
4. Finally, if you are a Red participant and you receive the recommendation to choose **Down**, then you know that the Blue participant you are paired with is twice as likely to have received the recommendation to choose **Left** than **Right**. This is because you know that a yellow ball (labeled Up) was not drawn, leaving two green balls and one red ball as possible recommendation draws. The green (Down-Left) draw is twice as likely as the red (Down-Right) draw. If the Blue participant follows his recommendation, then if you follow your recommendation to choose **Down** you can expect to earn on average a two-thirds chance of 9 (if Down-Left is the recommendation) and a one-third chance of 39 (if Down-Right is the recommendation), which mathematically is

   $(\frac{2}{3} \times 9) + (\frac{1}{3} \times 39) = 6 + 13 = 19.$

If instead you do not follow your recommendation and choose **Up** you can expect to earn on average a two-thirds chance of 3 (if Down-Left is the recommendation) and a one-third chance of 48 (if Down-Right is the recommendation), which mathematically is

$(\frac{2}{3} \times 3) + (\frac{1}{3} \times 48) = 2 + 16 = 18.$

Note that you earn more (19 on average) if you follow your recommendation and choose **Down** than if you don't (18 on average).

5. The payoffs are symmetric, so identical calculations show that if you are a Blue participant and you receive the recommendation to choose **Right**, if the Red participant you are paired with follows her recommendation you earn more (19 on average) if you follow your recommendation and choose **Right** than if you don't (18 on average).

To reiterate: you always earn more by following your recommendation as long as the participant you are paired with also follows his or her recommendation.

Predictions

When you make your action choice each period you will also enter your prediction about how likely the person you are paired with makes each of his or her action choices. In addition to your earnings from your action choices we will pay you an extra amount depending upon how good your prediction is.

For example, if you are a Red participant (so you choose either Up or Down), you will predict the probability that you think the Blue participant you are paired with will choose Left or Right. To make this prediction you need to fill in the boxes under *Your Prediction:* on the Decision Screen, indicating what the chances are that the Blue participant you are paired with will make these choices. For example, suppose you think there is a 10% chance that this other person will choose Left, and hence a 90% chance that he or she will choose Right. This indicates that you believe that Right is nine times more likely to be chosen than Left. [The probability percentages must be whole numbers (no decimals) and sum to 100% or the computer won't accept them.]

At the end of the period, we will look at the choice actually made by the person you are paired with and compare his or her choice to your prediction. We will then pay you for your prediction as follows:

Suppose you predict that the person you are paired with will choose Right with a 90% chance and Left with a 10% chance (as in the example above). Suppose further that this person actually chooses Left. In that case your earnings from your prediction are

Prediction Payoff = $10 - 5(1\text{-}0.1)^2 - 5(0.90)^2 =$ 1.9 francs.

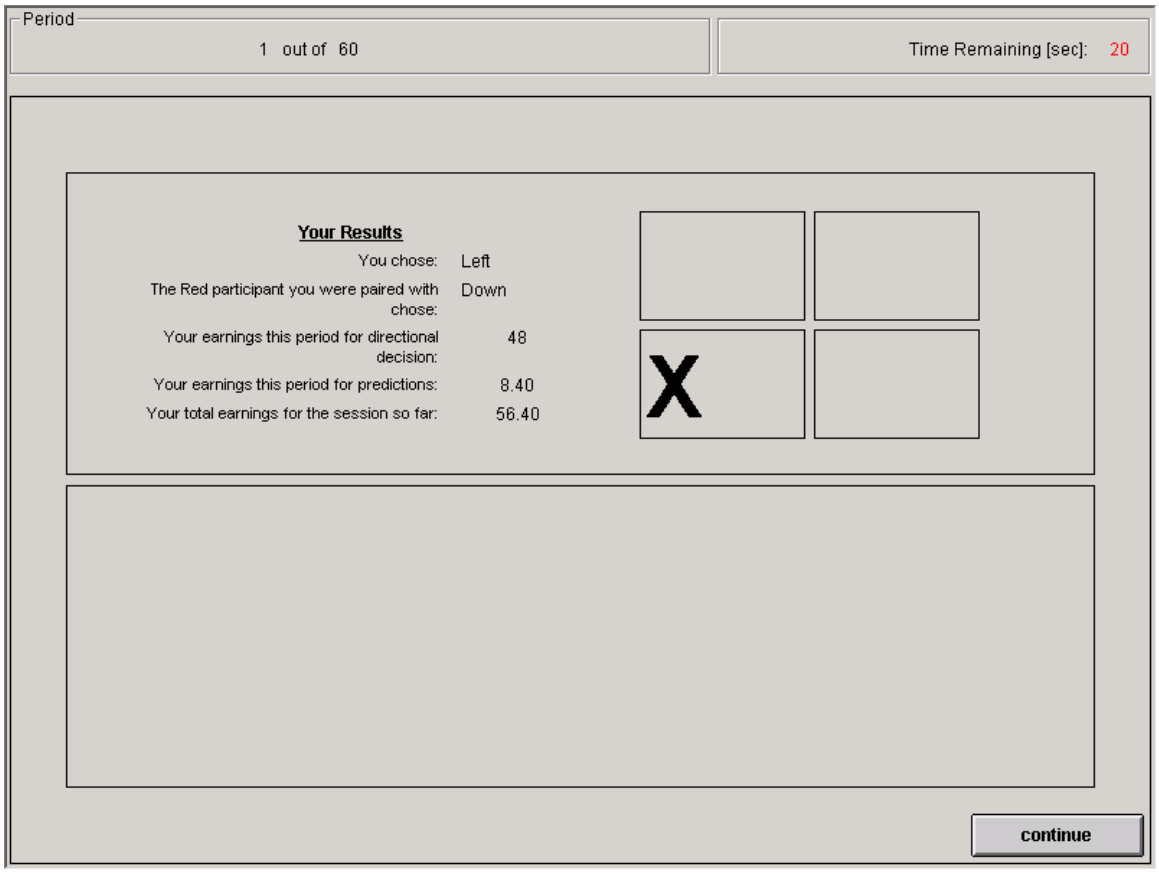
In other words, we will give you a fixed amount of 10 francs from which we will subtract an amount that depends on how inaccurate your prediction was. To do this when we find out what choice the person you are paired with has made we will take the probability you assigned to that choice, in this case 10% on Left, subtract it from 100% and square it. We will then take the probability you assigned to the choice not made by the person you are paired with, in this case the 90% you assigned to Right, and square it also. These two squared numbers will then be multiplied by 5 and subtracted from the 10 francs that we initially gave you, to determine your final prediction payoff.

Note that the worst you can do under this payoff procedure is to state that you believe that there is a 100% chance that a particular action is going to be taken when it turns out that the other choice is made. In this case your prediction payoff would be 0, so you can never lose earnings from inaccurate predictions. The best you can do is to predict correctly and assign 100% to the choice that turns out to the actual choice made by the person you are paired with; in this case your prediction payoff would be 10 francs.

> **Note that since your prediction is made before you know which action is chosen by the person you are paired with, you maximize the expected size of your prediction payoff by simply stating your true beliefs about what you think this other person will do. Any other prediction will decrease the amount you can expect to earn from your prediction payoff.**

<u>The End of the Period</u>

When all participants have made choices for the current period you will be automatically switched to the outcome screen, as shown below. The upper part of this screen displays your choice as well as the choice of the person you are paired with for the current decision making period. The chosen box is highlighted with a large **X**. It also shows your earnings for this period for your action choice (directional decision) and prediction, and your earnings for the experiment so far.



Example Outcome Screen (Shown for a Blue Participant)

Once the outcome screen is displayed you should record your choice and the choice of the participant you were paired with on your Personal Record Sheet. Also record your earnings. Then click on the *continue* button on the lower right of your screen. Remember, at the start of the next period you are randomly re-paired with a participant from the other color group, and you are randomly re-paired each and every period of the experiment.

We will now pass out a questionnaire to make sure that all participants understand how to read the earnings table and understand other important features of the instructions. Please fill it out now. Raise your hand when you are finished and we will collect it. If there are any mistakes on any questionnaire, I will go over the relevant part of the instructions again. Do not put your name on the questionnaire.

Questionnaire

1. If the **Red** participant chooses **Up** and the **Blue** participant chooses **Right**, then the **Red** participant earns ____ and the **Blue** participant earns _____.
2. If the **Red** participant chooses **Down** and the **Blue** participant chooses **Right**, then the **Red** participant earns _____ and the **Blue** participant earns _____.
3. If the **Red** participant chooses **Up** and the **Blue** participant chooses **Left**, then the **Red** participant earns ____ and the **Blue** participant earns _____.
4. If the **Red** participant chooses **Down** and the **Blue** participant chooses **Left**, then the **Red** participant earns ____ and the **Blue** participant earns _____.
5. You remain paired with the same other participant in all decision making periods (circle one): TRUE FALSE
6. Your role (either Red or Blue) remains unchanged throughout the experiment (circle one): TRUE FALSE
7. You are required to follow the computer's recommendations for your action choices (circle one): TRUE FALSE
8. If both you and the person you are paired with follow the computer's recommendations, you cannot obtain the Up-Left outcome (circle one): TRUE FALSE
9. You earn the highest expected payoff from your prediction if you simply state your best estimate of what you think the other person will do (circle one): TRUE FALSE

Personal Record Sheet for a Red Participant

Period	Your Action (circle one)	Blue Participant's Action (circle one)	Your earnings this period for directional decision	Your earnings this period for prediction	Total earnings this session
1	Up Down	Left Right			
2	Up Down	Left Right			
3	Up Down	Left Right			
4	Up Down	Left Right			
5	Up Down	Left Right			
6	Up Down	Left Right			
7	Up Down	Left Right			
8	Up Down	Left Right			
9	Up Down	Left Right			
10	Up Down	Left Right			
…	…	…			
49	Up Down	Left Right			
50	Up Down	Left Right			
51	Up Down	Left Right			
52	Up Down	Left Right			
53	Up Down	Left Right			
54	Up Down	Left Right			
55	Up Down	Left Right			
56	Up Down	Left Right			
57	Up Down	Left Right			
58	Up Down	Left Right			
59	Up Down	Left Right			
60	Up Down	Left Right			

Divide total earnings by conversion rate: ÷ _____

Total earnings in dollars: $ _____