For Online Publication

Appendices

A Supplementary analyses

A.1 Task 2: Remaining dimensions

Treatment	Rank 1	Rank 2	Rank 3
B	(31, 31, 31, 1, 1, 25)	(1, 34, 29, 29, 26, 1)	(1, 1, 35, 24, 24, 35)
BT	(1, 1, 25, 31, 31, 31)	(1, 1, 30, 30, 29, 29)	(0, 27, 31, 31, 31, 0)
BTS	(23, 23, 23, 23, 23, 5)	(22, 22, 22, 22, 22, 10)	(25, 24, 23, 22, 21, 5)
BTSM	(11, 21, 22, 22, 21, 23)	(10, 22, 22, 22, 22, 22)	(3, 28, 28, 2, 31, 28)
BTS-R	(1, 1, 33, 33, 32, 20)	(1, 31, 1, 25, 41, 21)	(23, 23, 23, 23, 23, 5)
BTSM-R	(1, 21, 22, 24, 27, 25)	(6, 27, 6, 27, 27, 27)	(10, 22, 22, 22, 22, 22)

Table 6: Winning strategies in the Blotto game.

Table 6 presents for each treatment separately the three best performing strategies observed in our implementation of the Blotto game. The features observed in the winning strategies of our current data resemble the discussed patterns of previous implementations of the Blotto game quite closely. The best performing strategies in the Blotto game usually (i) reinforce between 3 and 5 battlefields, (ii) make frequent use of the unit digit assignments 1, 2 and 3, and (iii) assign relatively fewer troops to battlefields located on the edges of the distribution as opposed to the center. We used these patterns as our benchmark for sophisticated play in the Blotto game and included an analysis of dimension 1 in the main body of our paper. Here, we report an analysis of the remaining two dimensions.

Dimension 2: Unit Digit Assignments

Table 7 presents the distribution of unit digits in all single-field assignments. The majority of single-field assignments have the unit digits 0 and 5. It is also evident that unit digit assignments on the lower values (1, 2 and 3) are more frequently used than unit digit assignments on the higher values (7, 8 and 9).

The higher frequency of lower value unit digit assignments is compatible with a strategic process of best-responding to a belief that participants would try to trump one another by one pivotal unit assignment, anchoring the iterative reasoning in the unit digit 0; we therefore refer to this

Treatment	0	1	2	3	4	5	6	7	8	9
B	57%	8%	3%	2%	5%	16%	1%	1%	2%	3%
BT	64%	8%	2%	1%	3%	13%	2%	2%	2%	3%
BTS	64%	6%	3%	3%	1%	18%	1%	1%	1%	1%
BTSM	57%	8%	5%	2%	4%	17%	1%	1%	2%	3%
BTS-R	59%	8%	5%	3%	2%	17%	2%	2%	1%	2%
BTSM-R	58%	8%	4%	1%	4%	16%	1%	1%	3%	4%

Table 7: Distribution of unit digits in all single-field assignments.

	Treatment					
Strategies	B	BT	BTS	BTSM	BTS-R	BTSM-R
Some assignments have unit digits 1, 2, 3	32%	30%	26%	32%	33%	33%
The rest of the strategies	68%	70%	74%	68%	67%	67%
n	191	182	172	171	172	171

Table 8: Types of troop assignments.

	B	BT	BTS	BTSM	BTS-R	BTSM-R
B	.	.	.	.	.	.
BT	0.657	.	.	.	.	.
BTS	0.206	0.411	.	.	.	.
BTSM	1.000	0.731	0.236	.	.	.
BTS-R	0.911	0.569	0.194	0.908	.	.
BTSM-R	1.000	0.647	0.194	1.000	1.000	.

Note: Reported are two-sided p-values resulting from Fisher's exact tests in between-subject comparisons. *(**, ***): comparison statistically significant at the 10% (5%, 1%) level.

Table 9: Statistical tests for task 2 – dimension 2.

group of allocations as 'strategic allocations'. Table 8 reports the results of a categorization of subjects' strategies, broken down by treatment condition. Summarized in Table 9, we tested whether the proportion of strategic allocations (coded as 1 if some assignments hold unit digits 1, 2 or 3, and coded as 0 otherwise) differs across treatment conditions and found no significant differences in joint or pairwise tests (χ^2 test, p = 0.727).[16]

[16]We performed two additional tests to detect differences in this dimension. The first compares the proportion of the following three categories of strategies across the treatment conditions: "all assignments have unit digit 0", "some assignments have unit digits 1, 2, or 3", and "the rest". The second looks more closely at sophisticated assignments (unit digits 1, 2, 3) on abandoned battlefields, i.e. fields with fewer than 6 assignments (because in these fields, an assignment of zero is particularly salient). These analyses are reported in Appendix B.2 and likewise suggest that our treatment manipulations do not alter decision sophistication.

Dimension 3: Location

We finally consider how subjects allocated their potentially different-sized troop divisions among the six battlefields. According to standard game-theoretic analysis, there is no reason to believe that subjects would treat any of the six battlefields differently. However, the best performing strategies as well as the studies previously cited indicate that subjects have a tendency to reinforce battlefields closer to the center and to assign fewer troops to battlefields located on the edges.

We created two binary indicators stating (i) whether or not a particular battlefield was reinforced (i.e. holds more than 20 troops), and (ii) whether or not a particular battlefield was abandoned (i.e. holds fewer than 6 troops). Figure 7 depicts for each treatment condition the distribution of reinforced and abandoned battlefields across the six possible locations. The results reveal a consistent pattern across all six of our conditions: abandoned battlefields are much more frequently located on the edges as opposed to the center whereas the opposite (albeit less pronounced) can

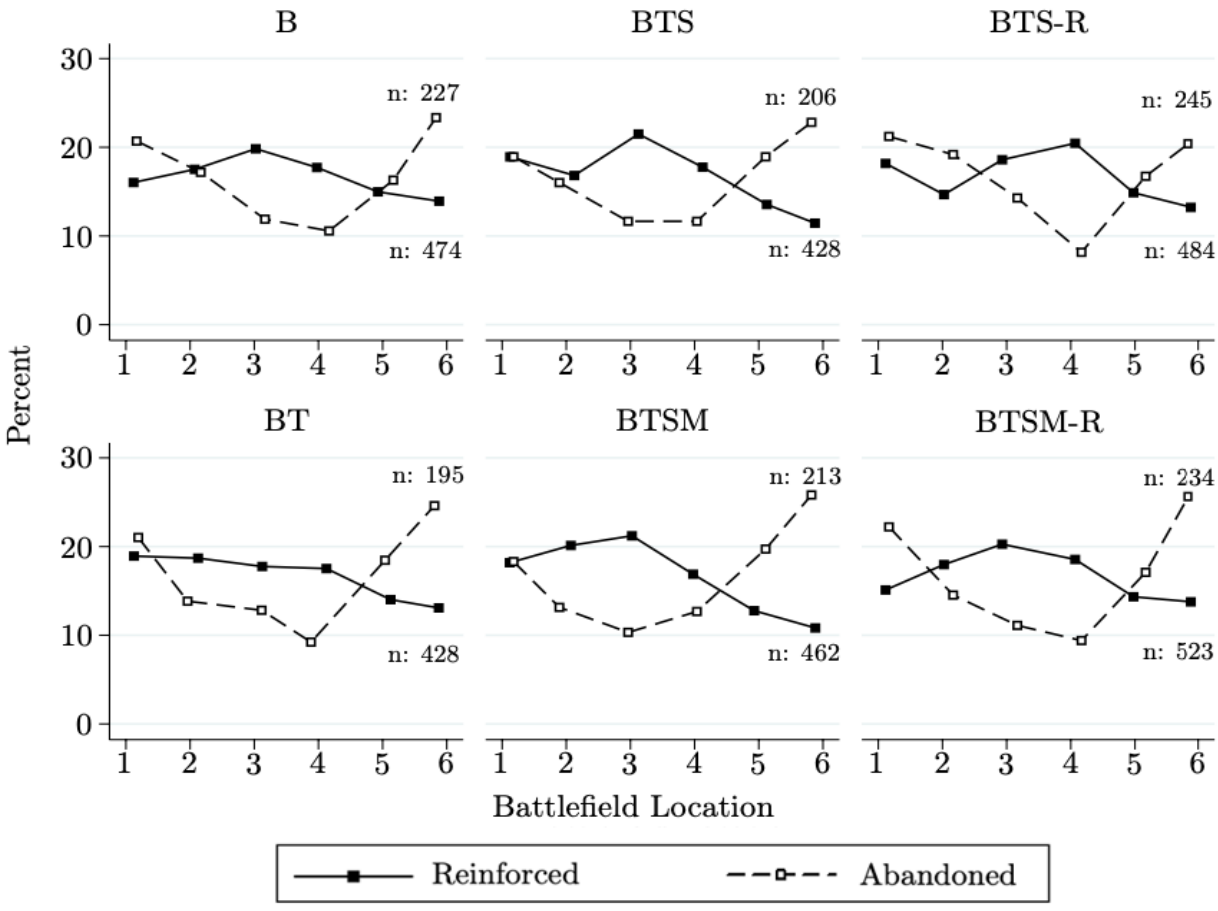


Figure 7: Location of reinforced and abandoned battlefields.

(a) Tests of Reinforced Battlefields

	B	BT	BTS	BTSM	BTS-R	BTSM-R
B	.	.	.	.	.	.
BT	0.845	.	.	.	.	.
BTS	0.724	0.784	.	.	.	.
BTSM	0.489	0.712	0.893	.	.	.
BTS-R	0.690	0.621	0.636	0.137	.	.
BTSM-R	0.996	0.682	0.613	0.460	0.543	.

(b) Tests of Abandoned Battlefields

	B	BT	BTS	BTSM	BTS-R	BTSM-R
B	.	.	.	.	.	.
BT	0.928	.	.	.	.	.
BTS	0.976	0.929	.	.	.	.
BTSM	0.677	0.820	0.935	.	.	.
BTS-R	0.849	0.669	0.621	0.120	.	.
BTSM-R	0.950	0.991	0.869	0.766	0.524	.

Note: Reported are two-sided p-values resulting from χ^2 tests in between-subject comparisons. *(**, ***): comparison statistically significant at the 10% (5%, 1%) level.

Table 10: Statistical tests for task 2 – dimension 3.

be said about reinforced battlefields. Table 10 presents the results of a battery of χ^2 tests which confirm the absence of statistical differences across our treatment conditions.[17]

[17]For robustness, we also considered how far average troop assignments to each battlefield cluster in the center as opposed to the edges using a centering indicator. The results which are reported in Appendix B.2 support our conclusion of no significant differences.

A.2 Simulation results

To narrow down the scale of detectable effects in our B-BTSM treatment comparisons, we conducted simulations for each of our three tasks which identify the required number of subjects who would need to be shifted from the *least sophisticated* to the *most sophisticated* category of the task in order to generate a detectable difference between the original data and our simulated data at the 5%-level. Table 11 summarizes our results.[18]

	Mean (original data)	Mean (simulated data)	Number of shifted subjects	Number of observations
Task 1:				
Number of greens				
B	2.92	3.19	13	191
BT	2.86	3.16	13	184
BTS	2.88	3.15	12	175
BTSM	2.95	3.25	13	175
Task 2:				
Expected scores				
B	2.75	2.88	18	191
BT	2.74	2.88	19	182
BTS	2.77	2.90	17	172
BTSM	2.81	2.92	18	171
Sophistication of reinforcements				
B	51.8%	62.3%	20	191
BT	50.5%	61.5%	20	182
BTS	52.9%	63.9%	19	172
BTSM	59.1%	70.2%	19	171
Task 3:				
Categorized bids[†]				
B	3.47	3.28	11	171
BT	3.44	3.17	16	181
BTS	3.22	2.94	16	170
BTSM	3.46	3.21	14	168

[†]Relative bids fall into 4 categories, coded as: **1**=[-8]; **2**=(-8,-5]; **3**=(-5,-3]; **4**=(-3, 8]. Means relate to these categories.

Table 11: Simulation results.

[18]Similar results with respect to the required number of shifts are obtained if we instead shifted subjects from the most sophisticated category to the least sophisticated category.

A.3 Randomization Tests

Treatment	Statistic	Gender	Age
B	N	194	196
	Mean	0.37	22.78
	Std. dev.	0.48	4.61
BT	N	190	190
	Mean	0.36	22.74
	Std. dev.	0.48	5.12
BTS	N	182	184
	Mean	0.41	22.45
	Std. dev.	0.49	4.93
BTSM	N	177	180
	Mean	0.37	22.62
	Std. dev.	0.48	4.36
Total	N	743	750
	Mean	0.38	22.65
	Std. dev.	0.49	4.76

Note: Gender is coded as 1 for male and 0 for female. 7 subjects selected 'other' as their gender.

Table 12: Demographic data.

	B	BT	BTS	BTSM
B	.	.	.	.
BT	1.000	.	.	.
BTS	0.397	0.340	.	.
BTSM	0.915	0.914	0.452	.

Note: Reported are two-sided p-values resulting from Fisher's exact tests in between-subject comparisons. *(**, ***): comparison statistically significant at the 10% (5%, 1%) level.

Table 13: Randomization test for gender.

	B	BT	BTS	BTSM
B	.	.	.	.
BT	0.356	.	.	.
BTS	0.186	0.664	.	.
BTSM	0.524	0.826	0.486	.

Note: Reported are two-sided p-values resulting from ranksum tests in between-subject comparisons. *(**, ***): comparison statistically significant at the 10% (5%, 1%) level.

Table 14: Randomization test for age.

B Robustness Checks

B.1 Task 1

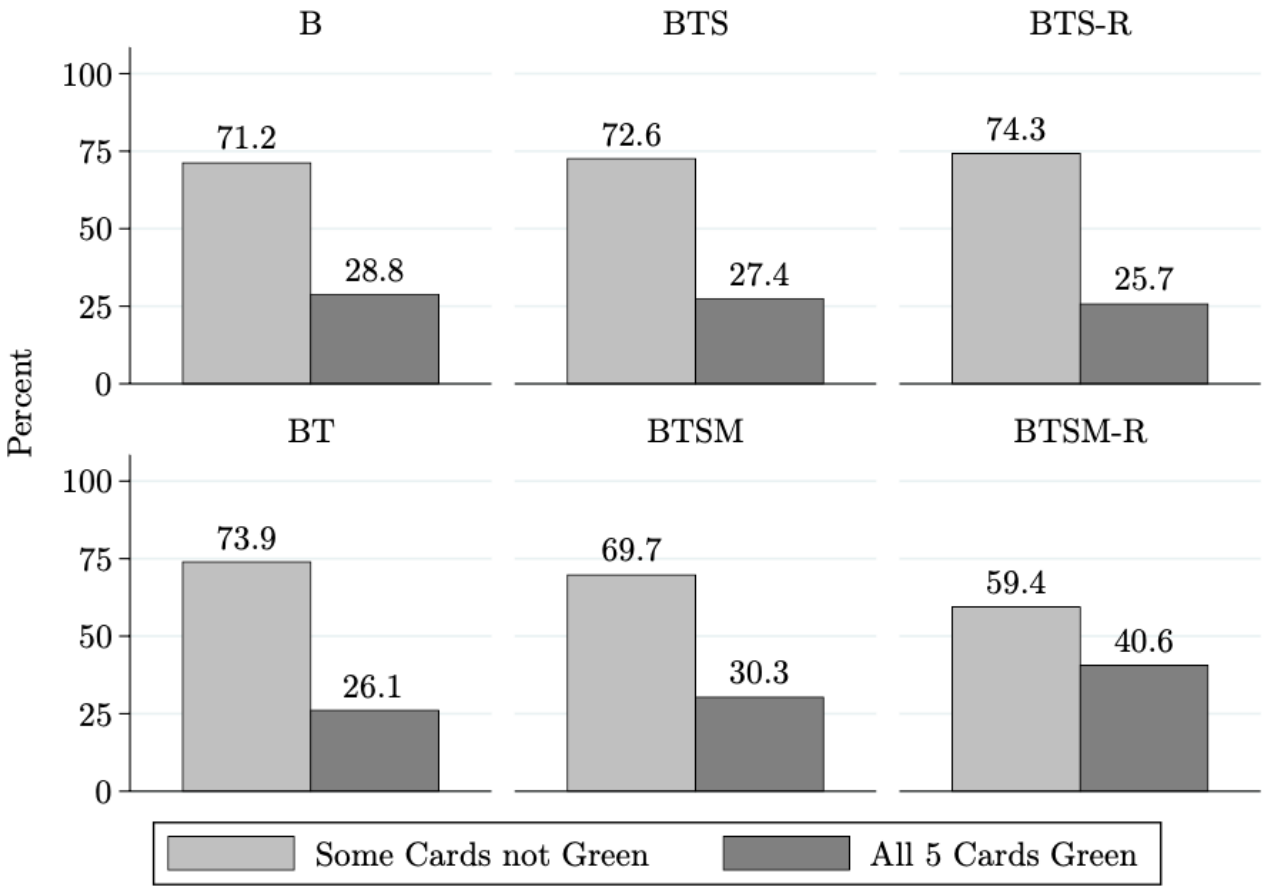


Figure 8: Green card guesses.

	B	BT	BTS	BTSM	BTS-R	BTSM-R
B	.	.	.	.	.	.
BT	0.565	.	.	.	.	.
BTS	0.816	0.812	.	.	.	.
BTSM	0.819	0.412	0.637	.	.	.
BTS-R	0.558	1.000	0.809	0.405	.	.
BTSM-R	0.021**	0.005***	0.013**	0.057*	0.002***	.

Note: Reported are two-sided p-values resulting from Fisher's exact tests in between-subject comparisons. *(**, ***): comparison statistically significant at the 10% (5%, 1%) level.

Table 15: Statistical tests for Figure 8.

B.2 Task 2

Dimension 1: Number of Reinforced Battlefields

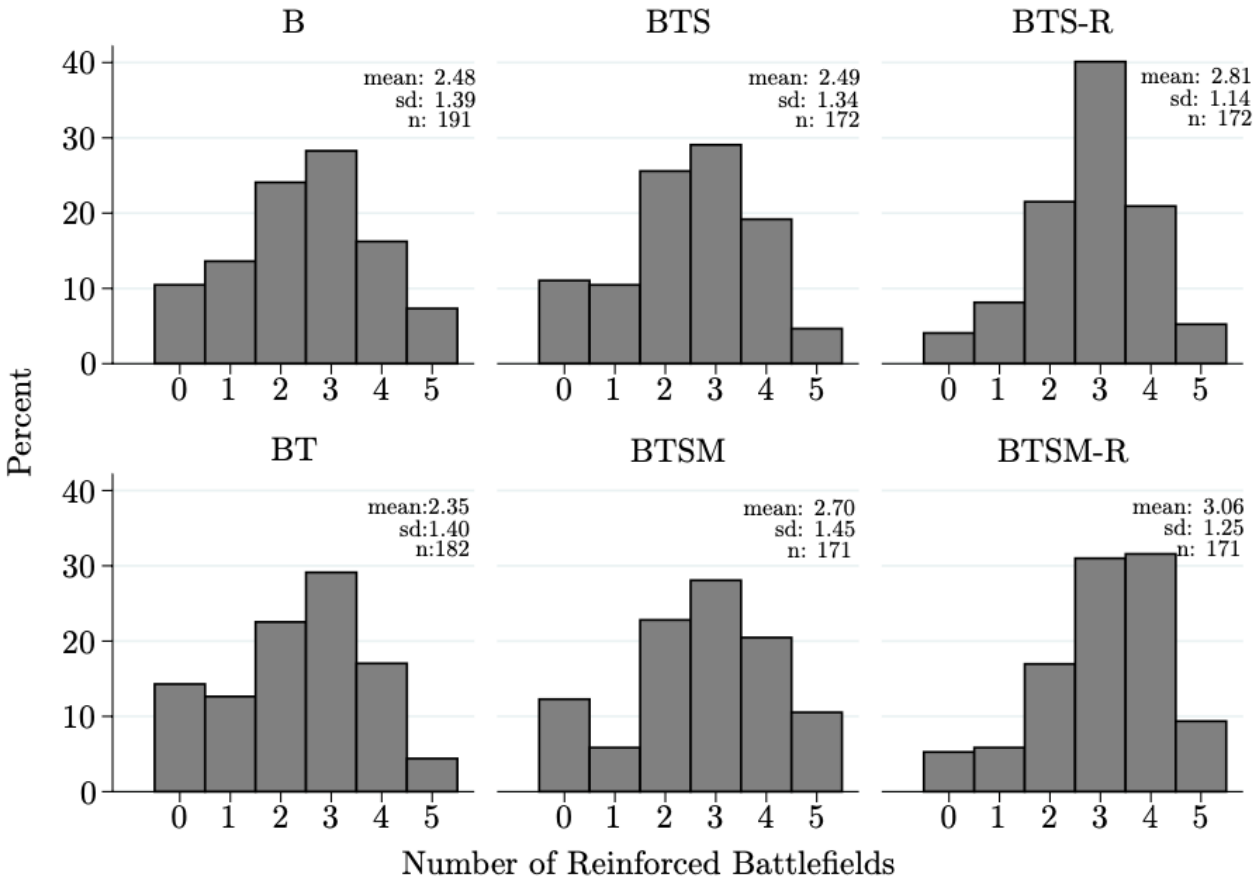


Figure 9: Distribution of reinforced battlefields.

	B	BT	BTS	BTSM	BTS-R	BTSM-R
B	.	.	.	.	.	.
BT	0.462	.	.	.	.	.
BTS	0.881	0.390	.	.	.	.
BTSM	0.105	0.022**	0.132	.	.	.
BTS-R	0.016**	0.002***	0.026**	0.635	.	.
BTSM-R	0.000***	0.000***	0.000**	0.019**	0.022**	.

Note: Reported are two-sided p-values resulting from ranksum tests in between-subject comparisons. *(**, ***): comparison statistically significant at the 10% (5%, 1%) level.

Table 16: Statistical tests for Figure 9.

Dimension 2: Unit Digit Assignment

[Note: main analysis featured in Appendix A.1.]

	Treatment					
Strategies	B	BT	BTS	BTSM	BTS-R	BTSM-R
Some assignments have unit digits 1, 2, 3	32%	30%	26%	32%	33%	33%
All assignments have the unit digit 0	33%	45%	42%	39%	40%	39%
The rest of the strategies	35%	25%	31%	29%	27%	28%
n	191	182	172	171	172	171

Table 17: Types of troop assignments.

	B	BT	BTS	BTSM	BTS-R	BTSM-R
B	.	.	.	.	.	.
BT	0.036**	.	.	.	.	.
BTS	0.160	0.367	.	.	.	.
BTSM	0.455	0.434	0.481	.	.	.
BTS-R	0.276	0.579	0.363	0.934	.	.
BTSM-R	0.337	0.530	0.415	0.981	1.000	.

Note: Reported are two-sided p-values resulting from Fisher's exact tests in between-subject comparisons. *(**, ***): comparison statistically significant at the 10% (5%, 1%) level.

Table 18: Statistical tests for Table 17.

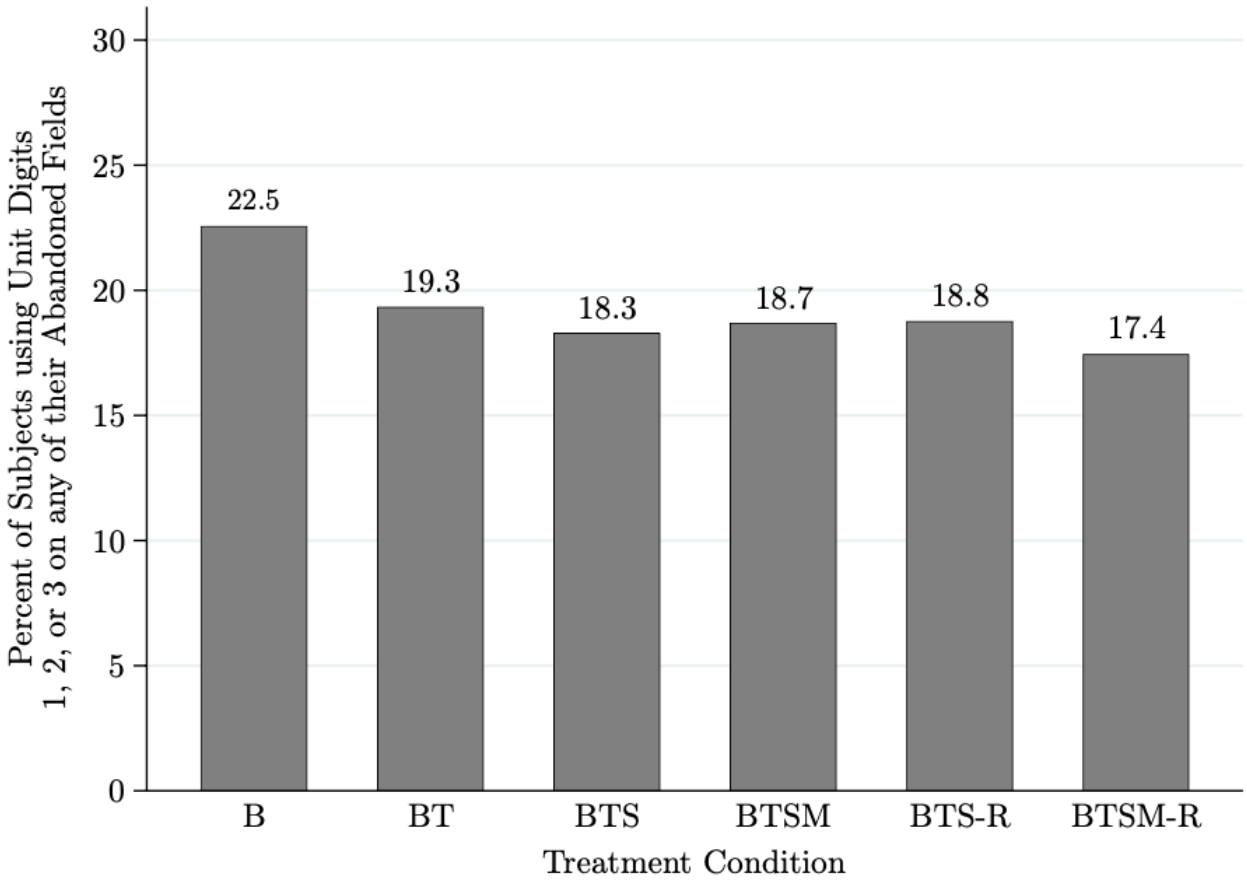


Figure 10: Unit digits 1, 2, 3 on abandoned battlefields.

	B	BT	BTS	BTSM	BTS-R	BTSM-R
B	.	.	.	.	.	.
BT	0.587	.	.	.	.	.
BTS	0.462	0.859	.	.	.	.
BTSM	0.509	0.914	0.944	.	.	.
BTS-R	0.493	0.919	0.931	0.990	.	.
BTSM-R	0.353	0.734	0.876	0.819	0.800	.

Note: Reported are two-sided p-values resulting from Fisher's exact tests in between-subject comparisons. *(**, ***): comparison statistically significant at the 10% (5%, 1%) level.

Table 19: Statistical tests for Figure 10.

Dimension 3: Location

[Note: main analysis featured in Appendix A.1.]

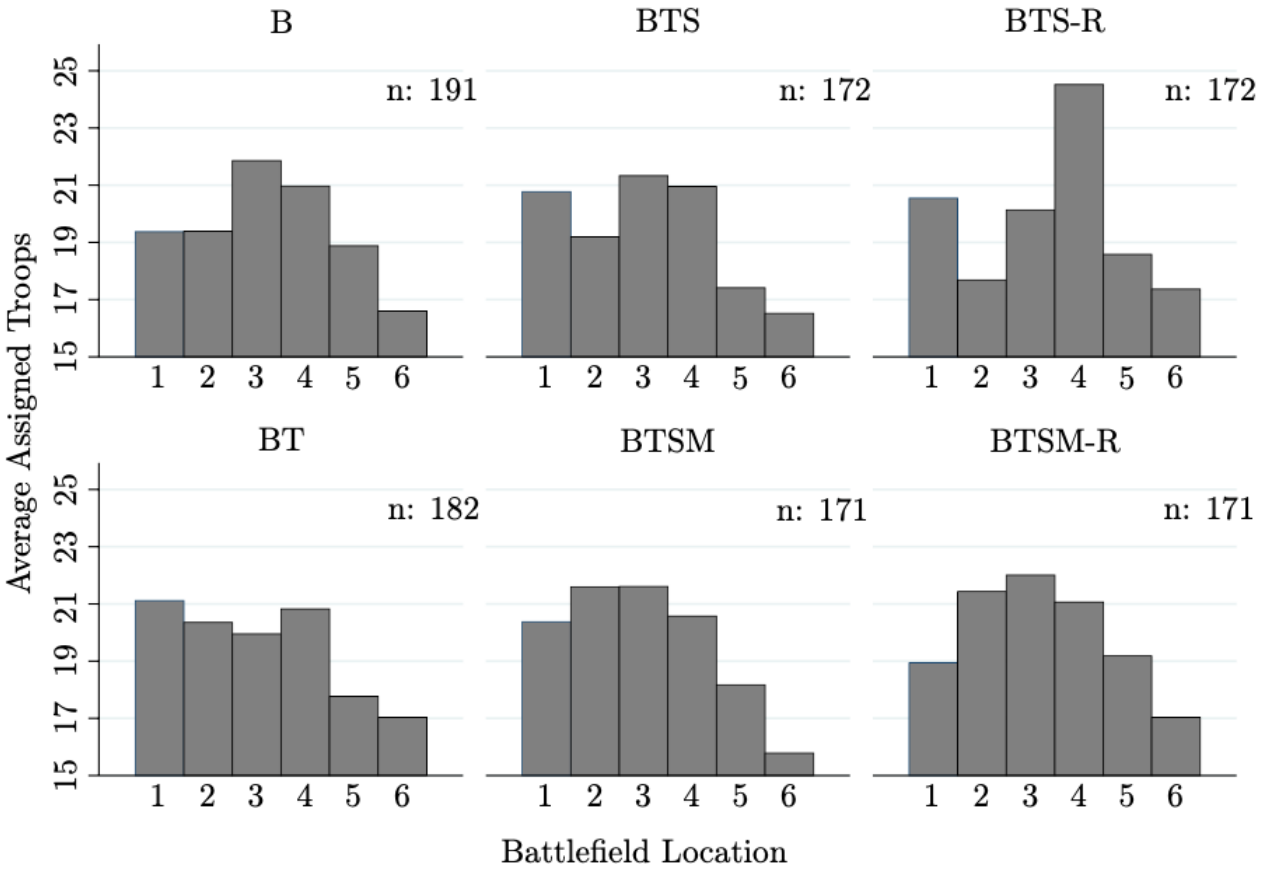


Figure 11: Average assignments of troops to each battlefield.

	B	BT	BTS	BTSM	BTS-R	BTSM-R
B	.	.	.	.	.	.
BT	0.450	.	.	.	.	.
BTS	0.463	0.686	.	.	.	.
BTSM	0.137	0.932	0.693	.	.	.
BTS-R	0.075**	0.064*	0.535	0.068*	.	.
BTSM-R	0.298	0.422	0.288	0.372	0.674	.

Note: Reported are two-sided p-values resulting from Fisher's exact tests in between-subject comparisons. *(**, ***): comparison statistically significant at the 10% (5%, 1%) level. The centering statistic indicates how far the center of gravity is located away from the centre battlefield location 3.5 based on the individual troop allocation.

Table 20: Statistical tests for centering in Figure 11.

B.3 Task 3

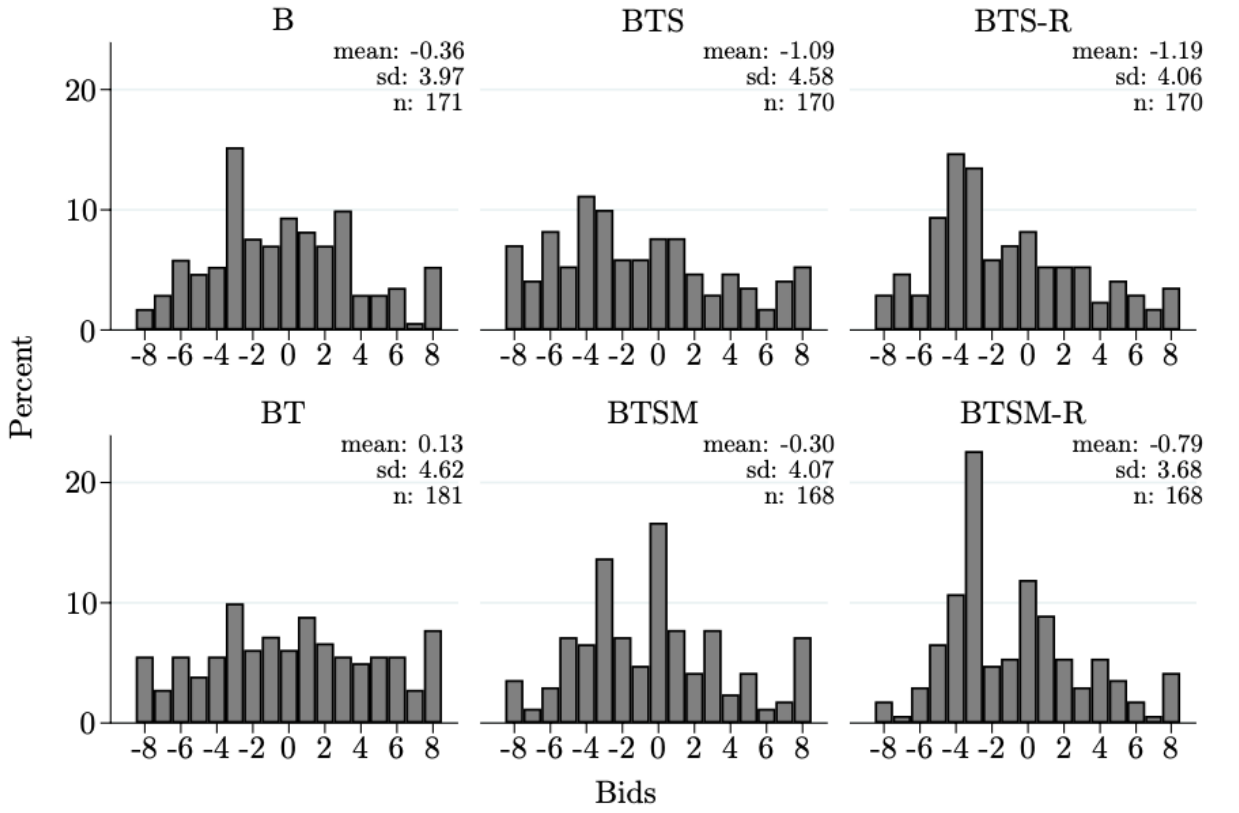


Figure 12: Relative bids.

	B	BT	BTS	BTSM	BTS-R	BTSM-R
B	.	.	.	.	.	.
BT	0.303	.	.	.	.	.
BTS	0.056*	0.010***	.	.	.	.
BTSM	0.993	0.328	0.053*	.	.	.
BTS-R	0.027**	0.004***	0.978	0.024**	.	.
BTSM-R	0.231	0.040**	0.277	0.242	0.186	.

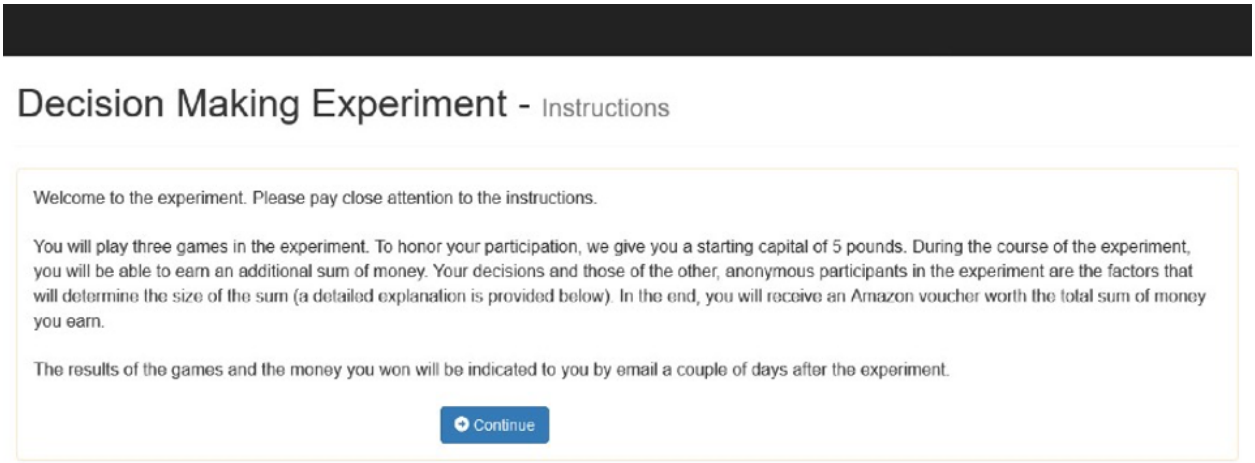
Note: Reported are two-sided p-values resulting from ranksum tests in between-subject comparisons. *(**, ***): comparison statistically significant at the 10% (5%, 1%) level.

Table 21: Statistical tests for Figure 12.

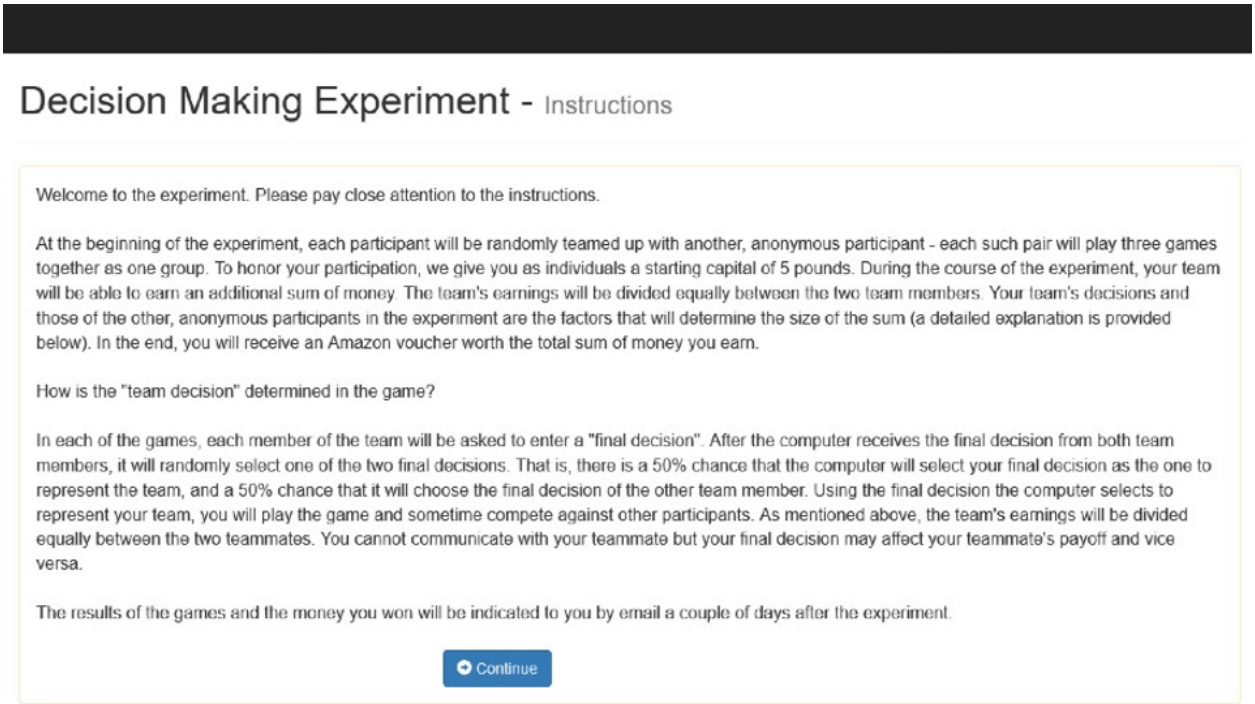
C Experimental instructions and screens

The following are the general instructions for each of the four treatments:

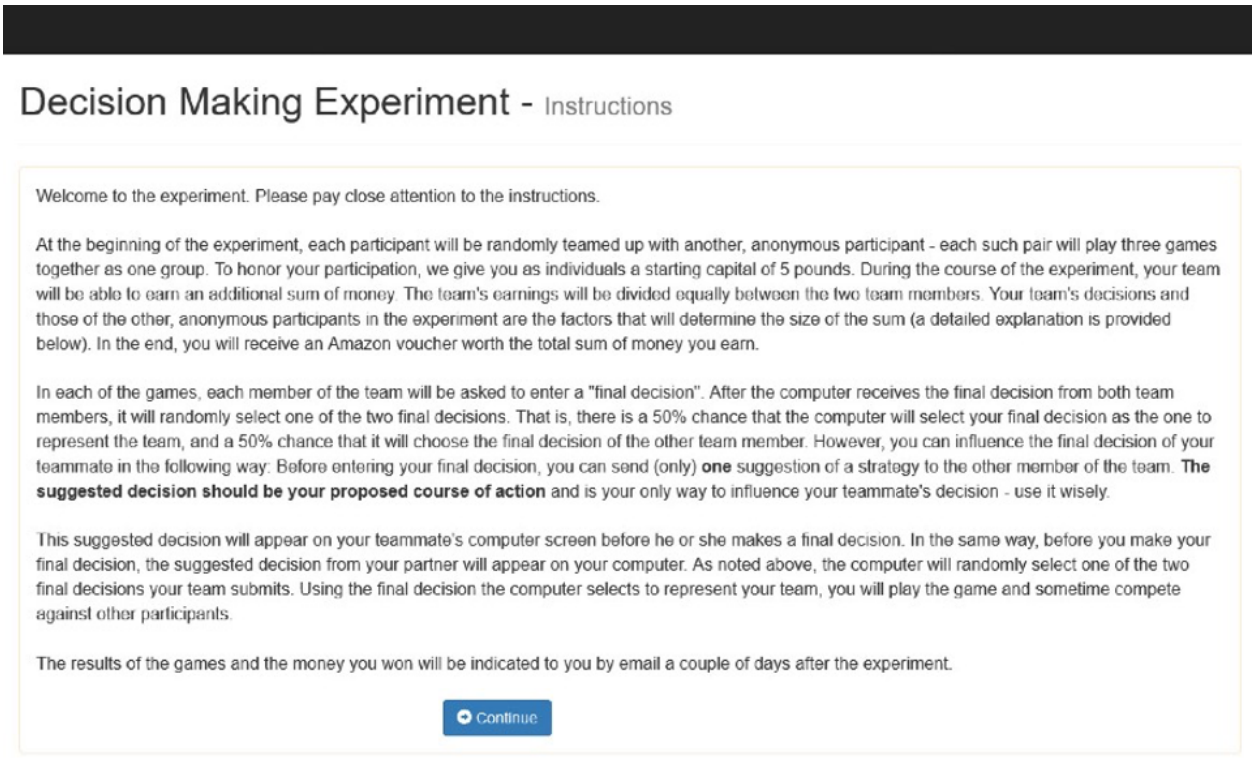
Treatment B - General Instructions



Treatment BT - General Instructions



Treatment BTS - General Instructions



Decision Making Experiment - Instructions

Welcome to the experiment. Please pay close attention to the instructions.

At the beginning of the experiment, each participant will be randomly teamed up with another, anonymous participant - each such pair will play three games together as one group. To honor your participation, we give you as individuals a starting capital of 5 pounds. During the course of the experiment, your team will be able to earn an additional sum of money. The team's earnings will be divided equally between the two team members. Your team's decisions and those of the other, anonymous participants in the experiment are the factors that will determine the size of the sum (a detailed explanation is provided below). In the end, you will receive an Amazon voucher worth the total sum of money you earn.

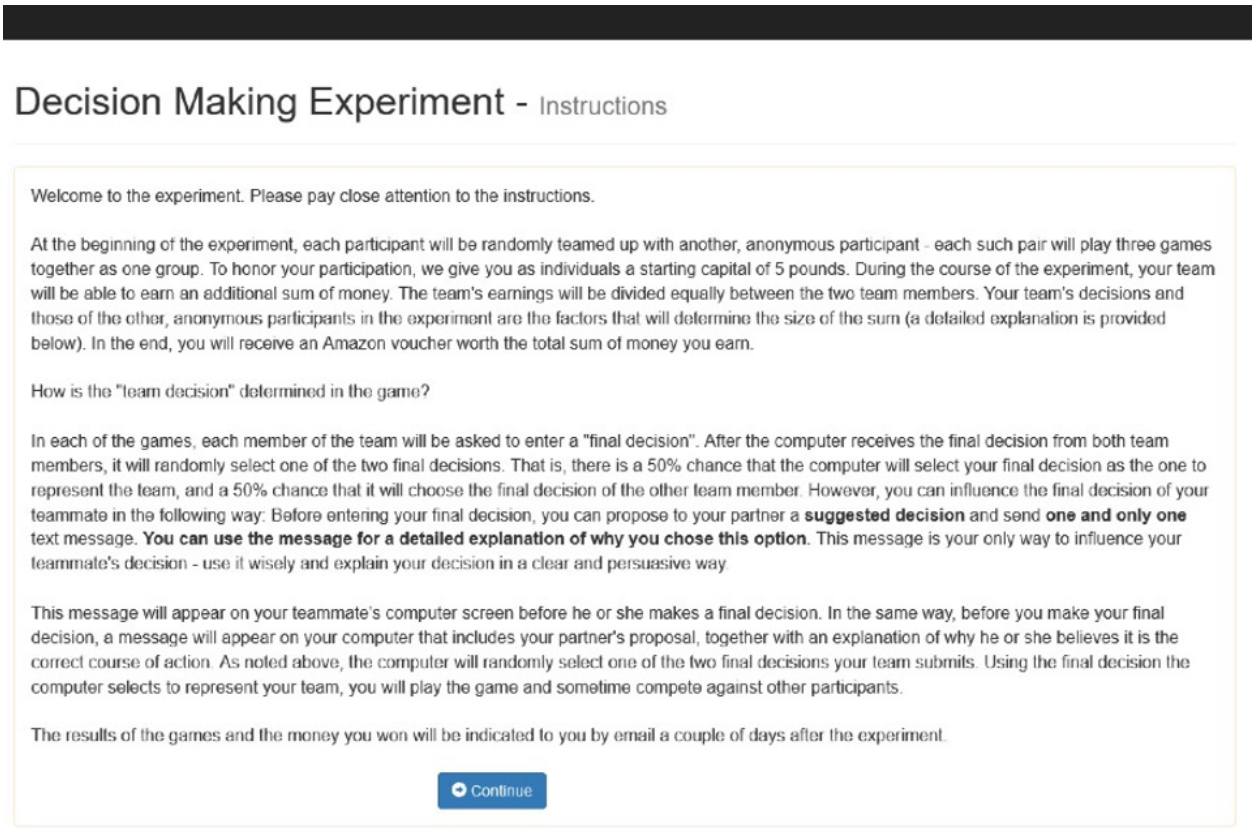
In each of the games, each member of the team will be asked to enter a "final decision". After the computer receives the final decision from both team members, it will randomly select one of the two final decisions. That is, there is a 50% chance that the computer will select your final decision as the one to represent the team, and a 50% chance that it will choose the final decision of the other team member. However, you can influence the final decision of your teammate in the following way: Before entering your final decision, you can send (only) **one** suggestion of a strategy to the other member of the team. **The suggested decision should be your proposed course of action** and is your only way to influence your teammate's decision - use it wisely.

This suggested decision will appear on your teammate's computer screen before he or she makes a final decision. In the same way, before you make your final decision, the suggested decision from your partner will appear on your computer. As noted above, the computer will randomly select one of the two final decisions your team submits. Using the final decision the computer selects to represent your team, you will play the game and sometime compete against other participants.

The results of the games and the money you won will be indicated to you by email a couple of days after the experiment.

Continue

Treatment BTSM - General Instructions



Decision Making Experiment - Instructions

Welcome to the experiment. Please pay close attention to the instructions.

At the beginning of the experiment, each participant will be randomly teamed up with another, anonymous participant - each such pair will play three games together as one group. To honor your participation, we give you as individuals a starting capital of 5 pounds. During the course of the experiment, your team will be able to earn an additional sum of money. The team's earnings will be divided equally between the two team members. Your team's decisions and those of the other, anonymous participants in the experiment are the factors that will determine the size of the sum (a detailed explanation is provided below). In the end, you will receive an Amazon voucher worth the total sum of money you earn.

How is the "team decision" determined in the game?

In each of the games, each member of the team will be asked to enter a "final decision". After the computer receives the final decision from both team members, it will randomly select one of the two final decisions. That is, there is a 50% chance that the computer will select your final decision as the one to represent the team, and a 50% chance that it will choose the final decision of the other team member. However, you can influence the final decision of your teammate in the following way: Before entering your final decision, you can propose to your partner a **suggested decision** and send **one and only one** text message. **You can use the message for a detailed explanation of why you chose this option.** This message is your only way to influence your teammate's decision - use it wisely and explain your decision in a clear and persuasive way.

This message will appear on your teammate's computer screen before he or she makes a final decision. In the same way, before you make your final decision, a message will appear on your computer that includes your partner's proposal, together with an explanation of why he or she believes it is the correct course of action. As noted above, the computer will randomly select one of the two final decisions your team submits. Using the final decision the computer selects to represent your team, you will play the game and sometime compete against other participants.

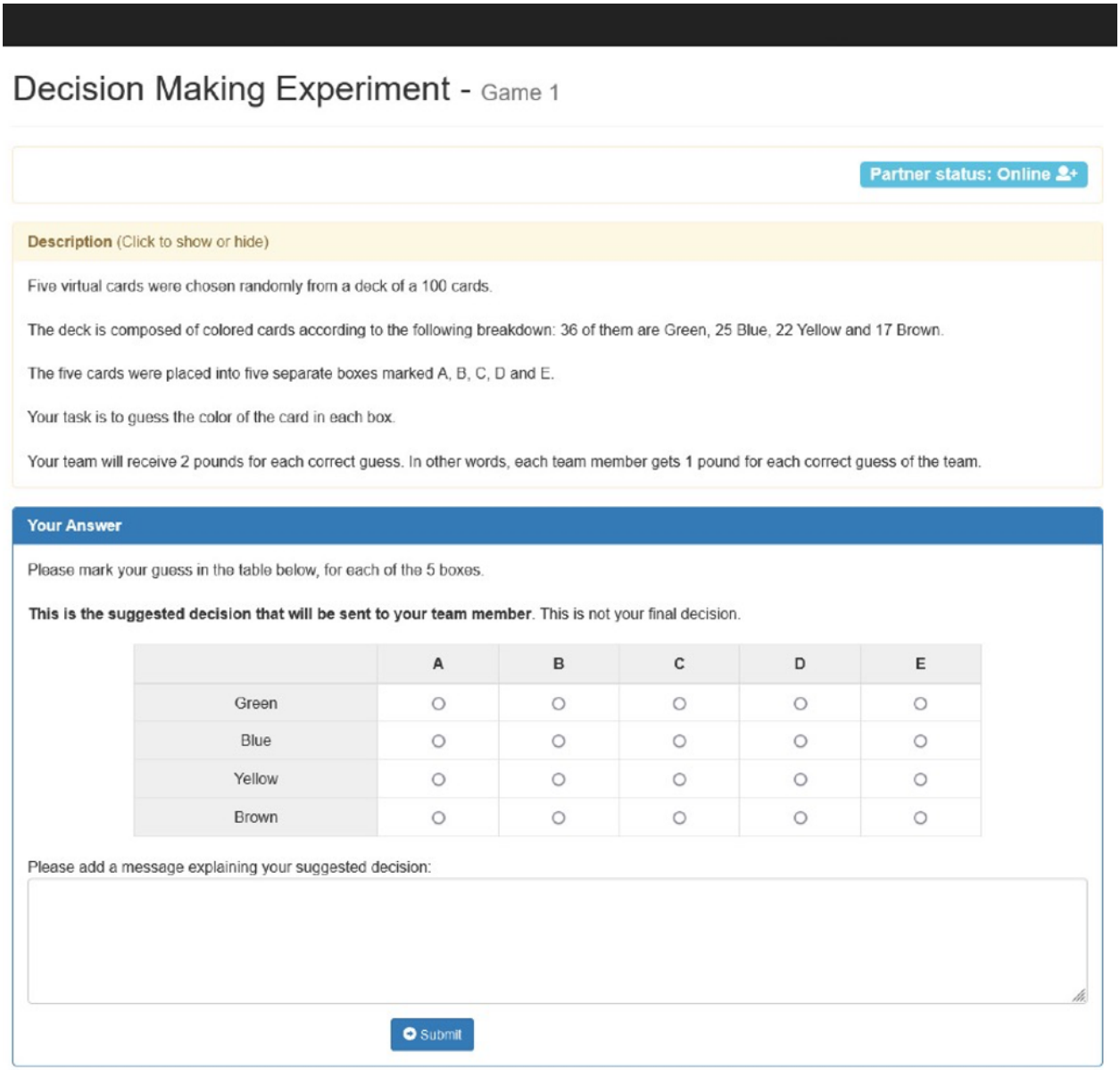
The results of the games and the money you won will be indicated to you by email a couple of days after the experiment.

Continue

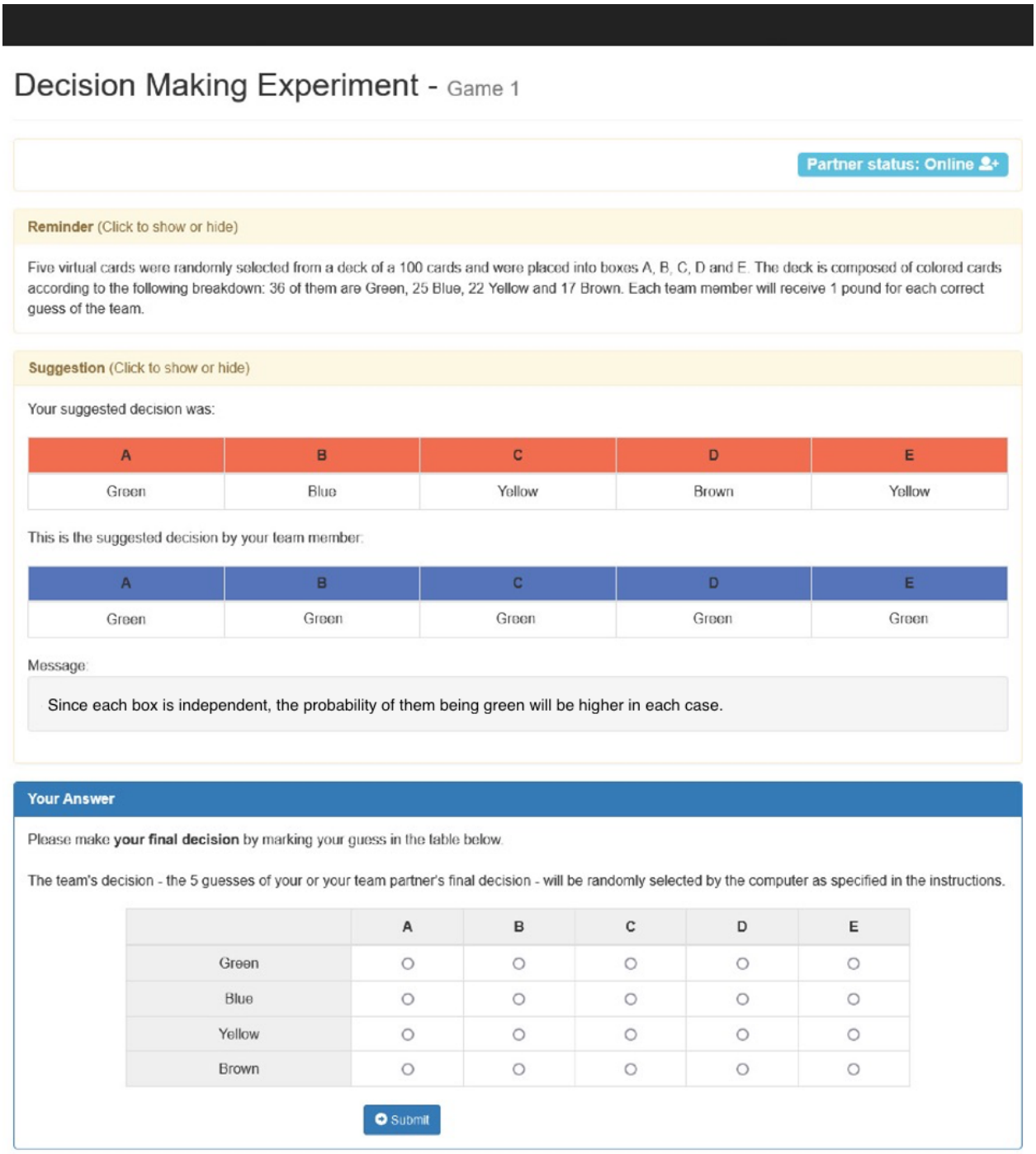
Decision Screens

In what follows, we present the three tasks as they appear in treatment BTSM. Treatment BTS is similar to BTSM, but without the option to write a message accompanying the suggested decision. In BT, the team does not communicate and the decision made by each member is not a "suggested decision" but rather the team member's chosen decision. In treatment B, each game is played individually.

Treatment BTSM - Task 1 (Suggesting a decision and writing a message)



Treatment BTSM - Task 1 (Receiving the team partner's suggested decision and message)



Decision Making Experiment - Game 1

Partner status: Online

Reminder (Click to show or hide)

Five virtual cards were randomly selected from a deck of a 100 cards and were placed into boxes A, B, C, D and E. The deck is composed of colored cards according to the following breakdown: 36 of them are Green, 25 Blue, 22 Yellow and 17 Brown. Each team member will receive 1 pound for each correct guess of the team.

Suggestion (Click to show or hide)

Your suggested decision was:

A	B	C	D	E
Green	Blue	Yellow	Brown	Yellow

This is the suggested decision by your team member:

A	B	C	D	E
Green	Green	Green	Green	Green

Message:

Since each box is independent, the probability of them being green will be higher in each case.

Your Answer

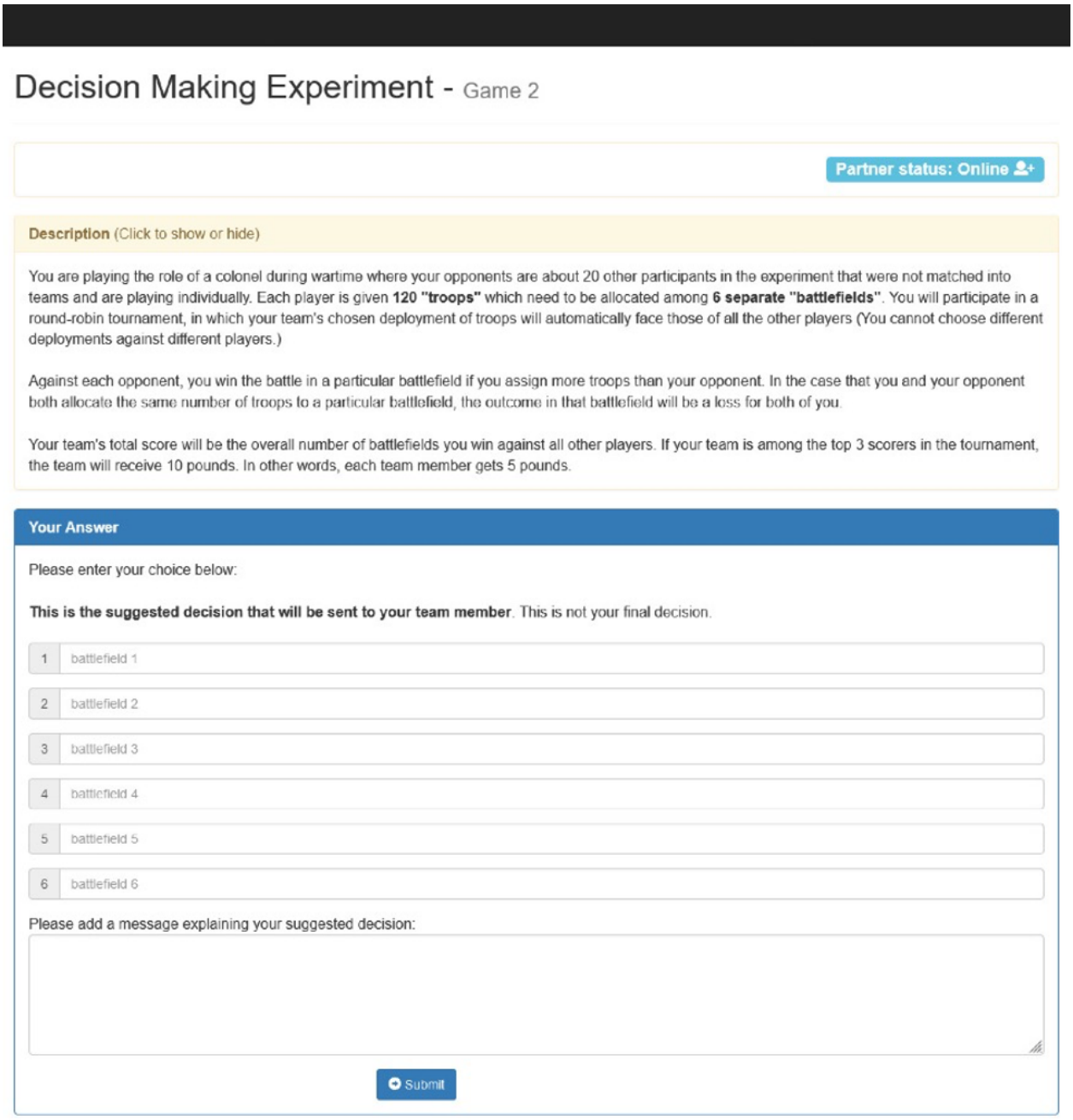
Please make **your final decision** by marking your guess in the table below.

The team's decision - the 5 guesses of your or your team partner's final decision - will be randomly selected by the computer as specified in the instructions.

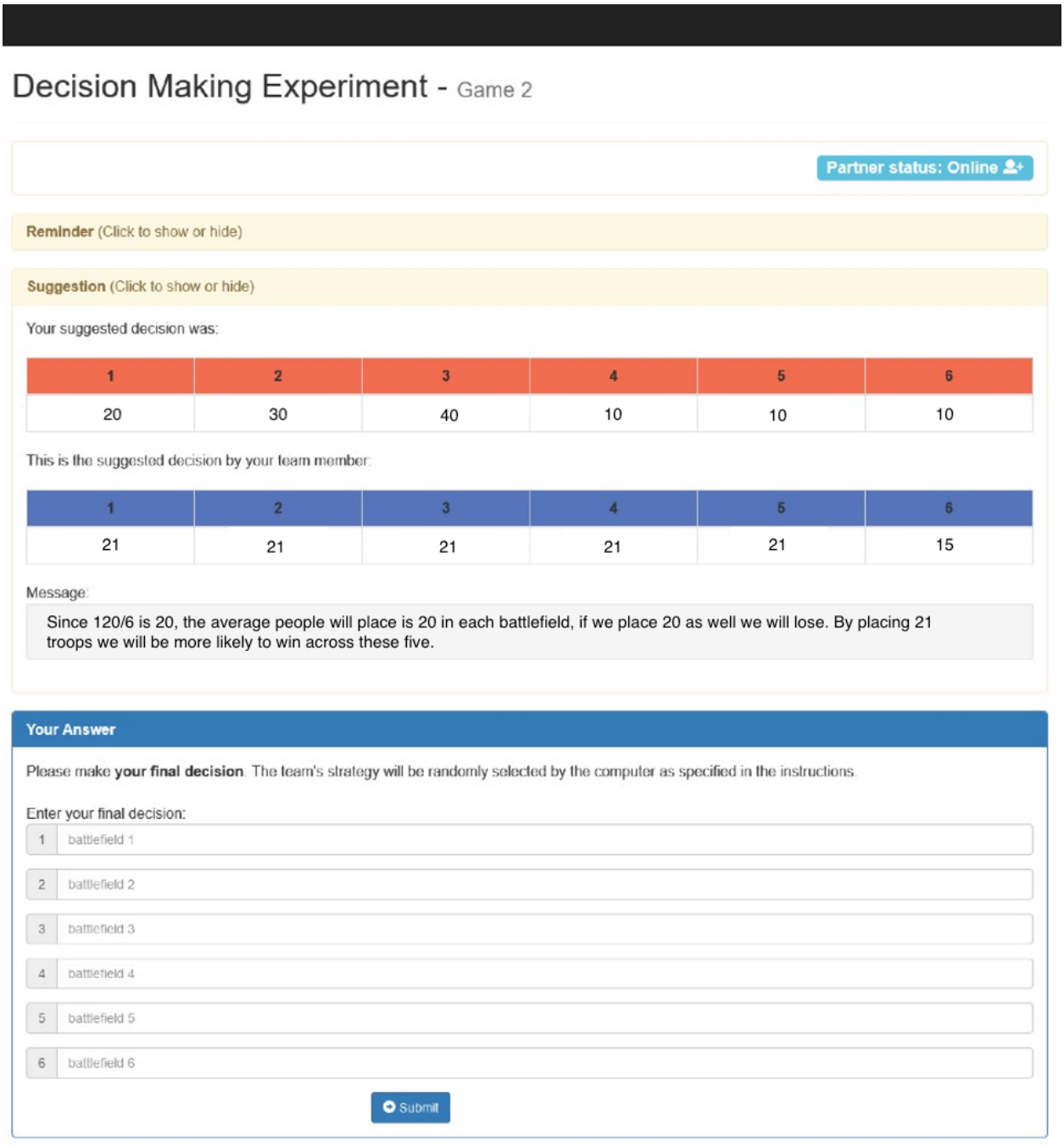
	A	B	C	D	E
Green	○	○	○	○	○
Blue	○	○	○	○	○
Yellow	○	○	○	○	○
Brown	○	○	○	○	○

Submit

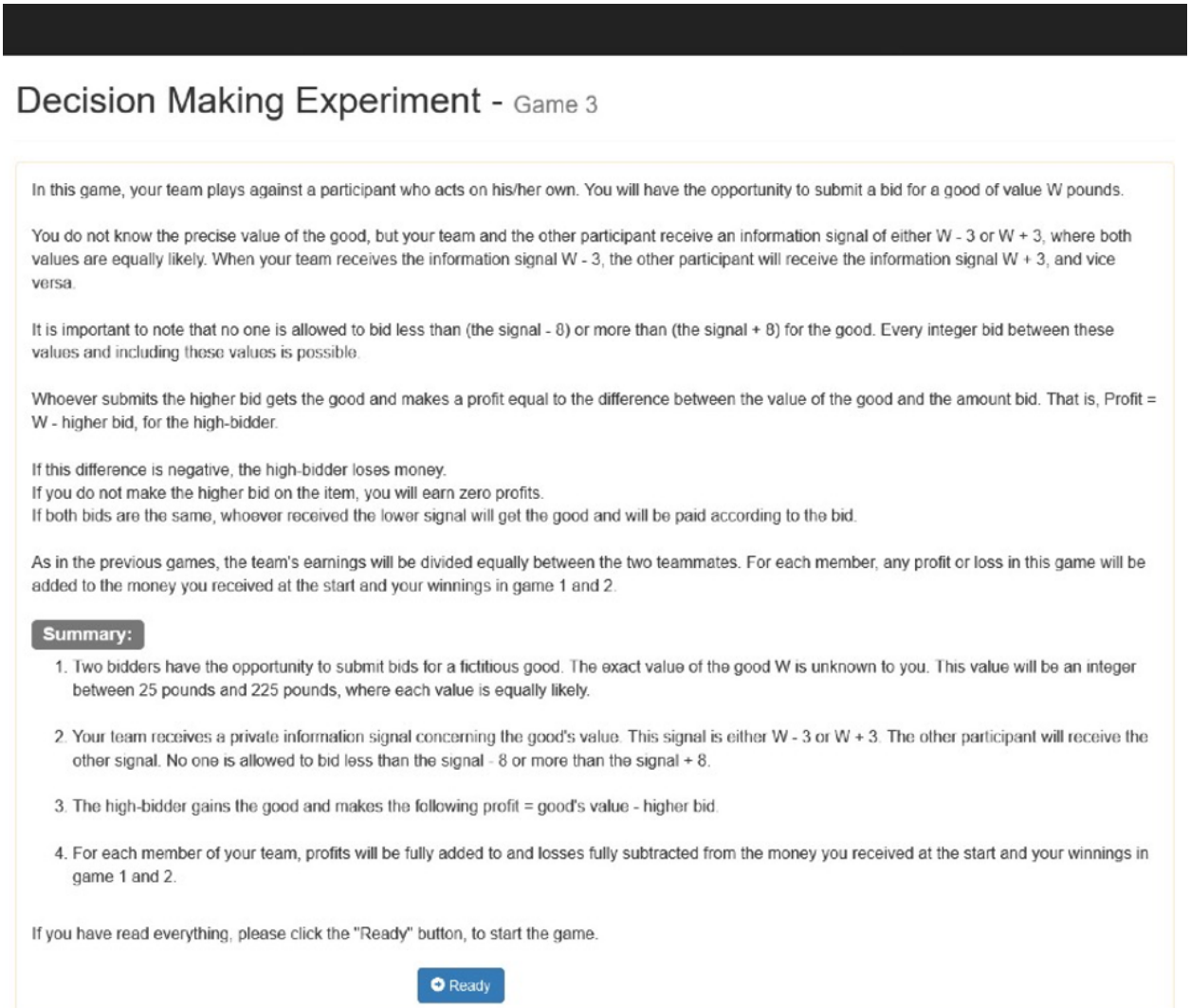
Treatment BTSM - Task 2 (Suggesting a decision and writing a message)



Treatment BTSM - Task 2 (Receiving the team partner's suggested decision and message)



Treatment BTSM - Task 3



Decision Making Experiment - Game 3

In this game, your team plays against a participant who acts on his/her own. You will have the opportunity to submit a bid for a good of value W pounds.

You do not know the precise value of the good, but your team and the other participant receive an information signal of either W - 3 or W + 3, where both values are equally likely. When your team receives the information signal W - 3, the other participant will receive the information signal W + 3, and vice versa.

It is important to note that no one is allowed to bid less than (the signal - 8) or more than (the signal + 8) for the good. Every integer bid between these values and including these values is possible.

Whoever submits the higher bid gets the good and makes a profit equal to the difference between the value of the good and the amount bid. That is, Profit = W - higher bid, for the high-bidder.

If this difference is negative, the high-bidder loses money.
If you do not make the higher bid on the item, you will earn zero profits.
If both bids are the same, whoever received the lower signal will get the good and will be paid according to the bid.

As in the previous games, the team's earnings will be divided equally between the two teammates. For each member, any profit or loss in this game will be added to the money you received at the start and your winnings in game 1 and 2.

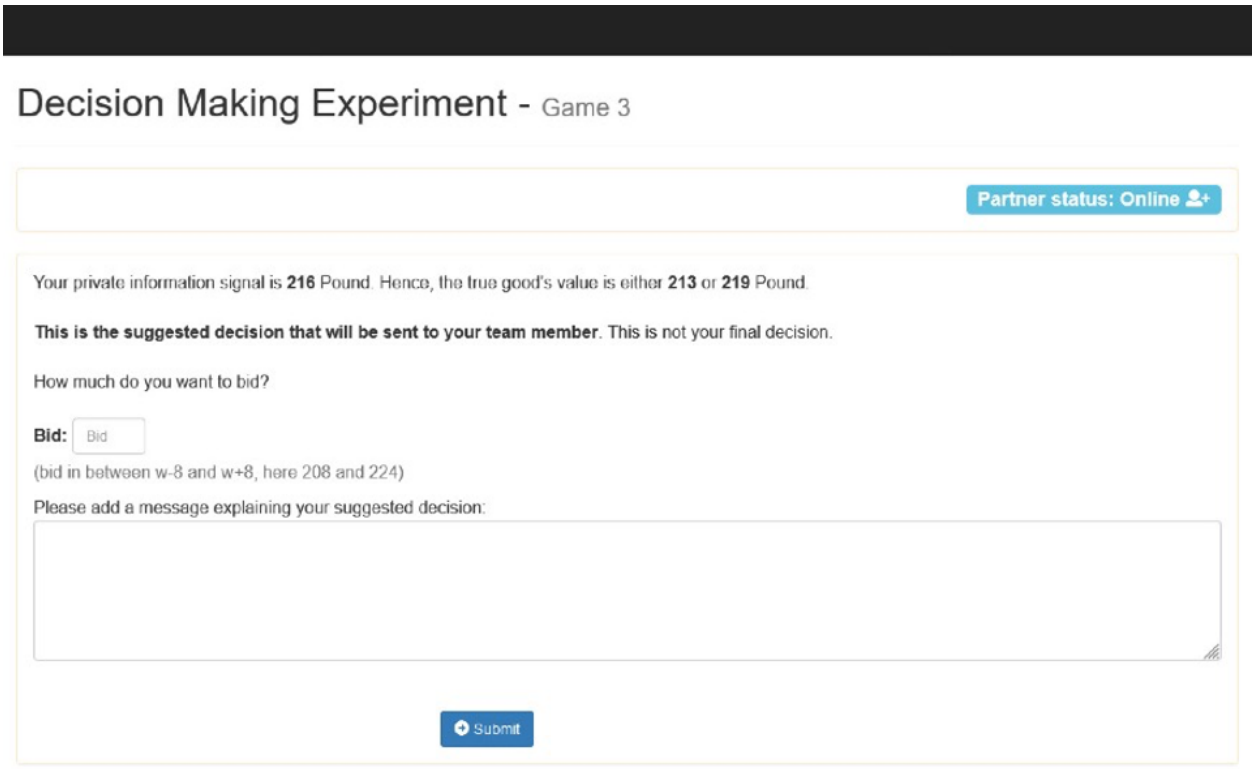
Summary:

1. Two bidders have the opportunity to submit bids for a fictitious good. The exact value of the good W is unknown to you. This value will be an integer between 25 pounds and 225 pounds, where each value is equally likely.
2. Your team receives a private information signal concerning the good's value. This signal is either W - 3 or W + 3. The other participant will receive the other signal. No one is allowed to bid less than the signal - 8 or more than the signal + 8.
3. The high-bidder gains the good and makes the following profit = good's value - higher bid.
4. For each member of your team, profits will be fully added to and losses fully subtracted from the money you received at the start and your winnings in game 1 and 2.

If you have read everything, please click the "Ready" button, to start the game.

Ready

Treatment BTSM - Task 3 (Suggesting a decision and writing a message)



Treatment BTSM - Task 3 (Receiving the team partner's suggested decision and message)