Making the Tough Choices: Delegation and Team Selection in Organizations Appendix

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February 24, 2016

A Mathematical appendix

A.1 Proposition 1

Proof. The manager's problem in a centralized organization depends on the accuracy of her information, p. She faces different probabilities to exchange tasks given the realizations and observability of the state of the world, (t_1^0, t_2^0). The different probabilities are presented in Figure 1. In order to calculate the manager's expected cost in a centralized organization and given the linear structure of the utility function - $U(\theta_i, t_i) = |\theta_i - t_i|$ - we have divided the possible realizations (t_1^0, t_2^0) in four subregions of equal size using the established domain of the tasks, one per quadrant. Summing up by quadrant, we obtain a total expected cost equal to:

$$\begin{aligned}\mathbb{E}[C_C(\theta_1, \theta_2, p)] = 1 + (-1+\theta_1)\theta_1 + (-1+\theta_2)\theta_2 + p(\frac{1}{2} + \theta_1^2 + (-2+\theta_2)\theta_2) \\ - \frac{1}{6}p^2(3 + 4\theta_1^3 - 4\theta_2(3 + (-3+\theta_2)\theta_2))\end{aligned} \tag{4}$$

Then, minimizing the expected cost with respect to θ_1 and θ_2, we find the following first order conditions:

$$-1 + 2\theta_1(1 + p - p^2\theta_1) = 0 \tag{5}$$

$$-1 + 2p(1 + p(-1+\theta_2))(-1+\theta_2) + 2\theta_2 = 0 \tag{6}$$

Rewriting equation (5) as $-1 + 2(1-\theta_2)(1 + p - p^2(1-\theta_2)) = 0$, and comparing it with equation 6, we have $\theta_1 = 1 - \theta_2$ or $\theta_1 + \theta_2 = 1$. Thus, any equilibrium (θ_1^*, θ_2^*) of the cost minimization problem with centralized reallocation is symmetric around the center. In other words, $\left|\frac{1}{2} - \theta_1^*\right| = \left|\theta_2^* - \frac{1}{2}\right|$. Moreover, the optimal positions of the workers are:

$$\theta_1^*(p) = \frac{1 + p - \sqrt{(1 + 2p - p^2)}}{2p^2} \tag{7}$$

$$\theta_2^*(p) = 1 - \theta_1^*(p) \tag{8}$$

To prove that in equilibrium there is a degree of specialization, we need to prove that $0 \leq \theta_1^*(p) \leq \frac{1}{2} \leq \theta_2^*(p) \leq 1$. Given $0 \leq p \leq 1$ and taking the limits of the optimal positions, we get:

$$\lim_{p\to 1} \theta_1^*(p) = 1 - \frac{\sqrt{2}}{2} \approx 0.29$$

$$\lim_{p\to 0} \theta_1^*(p) \approx \frac{1}{2}$$

By symmetry, we know that $\lim_{p\to 1} \theta_2^*(p) \approx 0.71$ and $\lim_{p\to 0} \theta_2^*(p) \approx \frac{1}{2}$. Also, notice that $\frac{\partial \theta_1^*(p)}{\partial p} < 0$. By

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symmetry again, we can define $\delta^*(p) = \frac{1}{2} - \theta_1^*(p)$ and $\frac{\partial \delta^*(p)}{\partial p} = -\frac{\partial \theta_1^*(p)}{\partial p} \geq 0$.

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A.2 Proposition 3

Proof. The manager's problem in a decentralized organization is to find the positions of the workers that minimize her expected cost. We divide the minimization problem of the manager in four subproblems given the different constraints on the positions of the workers. In each case, we calculate the optimal positions and we compare them in order to determine the global minimum. The cases we have identify are the following:

- Case I: $2\theta_1 \leq \theta_2$ and $2\theta_2 - 1 \geq \theta_1$. After some calculations, we write the minimization of the expected cost subject to this constraints as:

$$\begin{gathered} Min.[\mathbb{E}[C_{1D}(\theta_1, \theta_2)] = \frac{1}{3}(4 - \theta_1(3 + (-6 + \theta_1)\theta_1) + \theta_2(-6 + \theta_2(3 + \theta_2))) \\ s.t.\ 2\theta_1 \leq \theta_2\ and\ 2\theta_2 - 1 \geq \theta_1 \end{gathered} \tag{9}$$

  The first order conditions obtained over the associated Lagrangian $L_1(\theta_1, \theta_2)$ are:

$$\theta_1(\frac{\partial L_1}{\partial \theta_1}) = \theta_1 \left(-1 + 4\theta_1 - \theta_1^2 - 2\lambda_1 - \lambda_2\right) = 0$$

$$\theta_2(\frac{\partial L_1}{\partial \theta_2}) = \theta_2 \left(-2 + 2\theta_2 + \theta_2^2 + \lambda_1 + 2\lambda_2\right) = 0$$

  Assuming that the constraints are not binding, the local minimum of L_1 are the positions $(0.27, 0.73)$. With both constraints binding, the unique solution is $(1/3, 2/3)$. In the case where only the first constraint holds with equality, the optimal position for the leader are $(0, 1/2)$ and finally if only the second constraint is binding the optimal positions are $(0.34, 0.69)$. Comparing the total expected cost in each of this optimal points we show that the interior solution $(0.27, 0.73)$ is the minimum among them.

- Case II: $2\theta_1 > \theta_2$ and $2\theta_2 - 1 < \theta_1$. After some calculations, the minimization of the expected cost becomes:

$$\begin{gathered} Min.[\mathbb{E}[C_{2D}(\theta_1, \theta_2)] = 1 - 2\theta_1 + \theta_1^2 - (10\theta_1^3)/3 + 2\theta_1(2 + 3\theta_1)\theta_2 - 3(1 + 2\theta_1)\theta_2^2 + (10\theta_2^3)/3 \\ s.t.\ 2\theta_1 > \theta_2\ and\ 2\theta_2 - 1 < \theta_1 \end{gathered} \tag{10}$$

  The first order conditions obtained over the associated Lagrangian $L_2(\theta_1, \theta_2)$ are:

$$\theta_1(\frac{\partial L_2}{\partial \theta_1}) = \theta_1 \left(-2 + 4\theta_2 + 2(\theta_1 - 5\theta_1^2 + 6\theta_1\theta_2 - 3\theta_2^2) + 2\lambda_1 + \lambda_2\right) = 0$$

$$\theta_2(\frac{\partial L_2}{\partial \theta_2}) = \theta_2 \left(6\theta_1^2 + \theta_1(4 - 12\theta_2) + 2\theta_2(-3 + 5\theta_2) - \lambda_1 - 2\lambda_2\right) = 0$$

  The interior solution in this case is $(1/2, 1/2)$. There are also other corner solutions but again all these solutions are dominated by the interior solution of L_1.

- Case III: $2\theta_1 \leq \theta_2$ and $2\theta_2 - 1 < \theta_1$. After some calculations, the minimization of the expected cost becomes:

$$\begin{gathered} Min.[\mathbb{E}[C_{3D}(\theta_1, \theta_2)] = 1 - 2\theta_1 + \theta_1^2 - (2\theta_1^3)/3 + 2\theta_1(2 + \theta_1)\theta_2 - (3 + 4\theta_1)\theta_2^2 + 3\theta_2^3 \\ s.t.\ 2\theta_1 \leq \theta_2\ and\ 2\theta_2 - 1 < \theta_1 \end{gathered} \tag{11}$$

  The first order conditions obtained over the associated Lagrangian $L_3(\theta_1, \theta_2)$ are:

$$\theta_1(\frac{\partial L_3}{\partial \theta_1}) = \theta_1 \left(-2(1 + \theta_1^2 + 2(-1 + \theta_2)\theta_2 - \theta_1(1 + 2\theta_2) + \lambda_1) + \lambda_2\right) = 0$$

$$\theta_2(\frac{\partial L_3}{\partial \theta_2}) = \theta_2 \left(2\theta_1(2 + \theta_1) - 6\theta_2 - 8\theta_1\theta_2 + 9\theta_2^2 + \lambda_1 - 2\lambda_2\right) = 0$$

  The interior solution in this case $(0.27, 0.71)$. There are also other corner solutions but again all these solutions are dominated by the interior solution of L_1.

- Case IV: $2\theta_1 > \theta_2$ and $2\theta_2 - 1 \geq \theta_1$. After some calculations, the minimization of the expected cost becomes:

$$Min.[\mathbb{E}[C_{4D}(\theta_1,\theta_2)] = \frac{4}{3} - 3\theta_1^3 - 2\theta_2 + \theta_2^2 + (2\theta_2^3)/3 + \theta_1^2(2+4\theta_2) - \theta_1(1+2\theta_2^2)$$
$$s.t.\ 2\theta_1 > \theta_2\ and\ 2\theta_2 - 1 \geq \theta_1 \tag{12}$$

The first order conditions obtained over the associated Lagrangian $L_4(\theta_1,\theta_2)$ are:

$$\theta_1(\frac{\partial L_4}{\partial \theta_1}) = \theta_1\left(-1 - 9\theta_1^2 - 2\theta_2^2 + \theta_1(4+8\theta_2) + 2\lambda_1 - \lambda_2\right) = 0$$

$$\theta_2(\frac{\partial L_4}{\partial \theta_2}) = \theta_2\left(-2 + 4\theta_1^2 - 4\theta_1\theta_2 + 2\theta_2(1+\theta_2) - \lambda_1 + 2\lambda_2\right) = 0$$

There are no interior solutions in this case. There are corner solutions but again all these solutions are dominated by the interior solution of L_1.

Then, the first order conditions of the problem that minimize the expected total cost are the following:

$$-1 + 4\theta_1 - \theta_1^2 = 0 \implies \theta_1^D = 2 - \sqrt{3} \approx 0.27$$
$$-2 + 2\theta_2 - \theta_2^2 = 0 \implies \theta_2^D = -1 + \sqrt{3} \approx 0.73$$

This result also implies a symmetric solution, where $1/2 - \theta_1^D = \theta_2^D - 1/2$. Also, notice that the cases with symmetric assigned positions are captured by case I and II. Case I covers all the situations where $\theta_1 \leq 1/3$ and $\theta_2 = 1 - \theta_1$; and, Case II covers all the situation where $\theta_1 > 1/3$ and $\theta_2 = 1 - \theta_1$. This would be important for subsection 3.2.

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A.3 Proposition 4

Proof. Given the optimal positions in the decentralized organization - $(0.27, 0.73)$ - the expected cost of the manager is $\mathbb{E}[C_D] \approx 0.4051$ for any p. Comparing this result with the expected cost the manager would obtain in the centralized organization $\mathbb{E}[C_C(\theta_1^*(p), \theta_2^*(p), p)]$, we obtained that they are equal at the level of information $p^* \approx 0.82$. Moreover, $\frac{\partial \mathbb{E}[C_C(p)]}{\partial p} < 0$, so we can conclude that there is a p^* such that for values of $p \geq p^*$ there exists some $(\theta_1^*(p), \theta_2^*(p))$ that gives us a lower expected cost in the centralized organizational structure than in the decentralized organizational structure. Additionally, for values of $p < p^*$, there does not exist any $(\theta_1^*(p), \theta_2^*(p))$ that gives us a lower expected cost in the centralized organization than under delegation.
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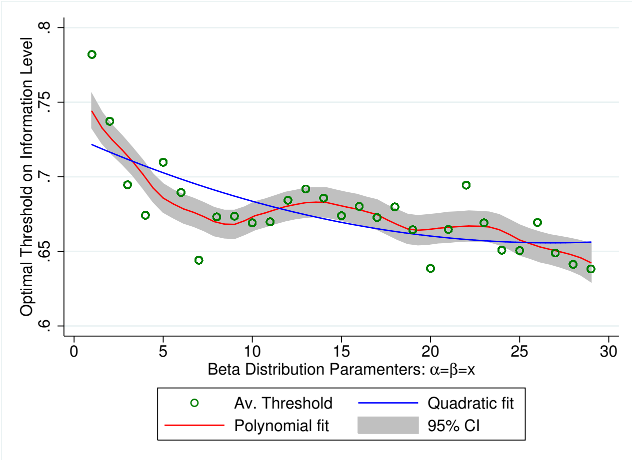
A.4 Solution to the model with fixed positions

Comparing the timing of the game in the original model with the timing in the model with fixed positions, notice that the last two stages are the same. Thus, we depart minimally from the original model solution to find the solution of the model with fixed positions. We again focus on symmetric positions assuming tasks are uniformly distributed. In the model with fixed positions, equation 4 captures the expected cost of a centralized organization for all (θ_1, θ_2) under different values of p. In a decentralized organization, the expected cost for symmetric teams is represented by equations 9 and 10 for $\theta_1 \leq 1/3$ and $\theta_1 \geq 1/3$ respectively. We can then compute and compare the expected cost under both organizational structures. After computing those values for different team compositions and information levels, we obtain Figure 10.

A.5 Are the results exclusively driven by the assumption of a uniform distribution of tasks?

Our results are qualitatively similar for any unimodal symmetric distribution for which the mode is equal to the ex ante expected task. However, a more concentrated distribution around the mode will reduce the manager's information threshold that determines the optimal organizational structure.[1] To analyze how the threshold is affected by the concentration of the distribution, we run a Monte-Carlo simulations with 100 repetitions of 500 rounds for a group of symmetric beta distributions. In order to have symmetric beta distributions, we equalize the shape parameters $\alpha = \beta = x$. Figure 12 plots the results of the simulation. We set our beta parameter value to integers in the interval from $[0, 30]$. As expected we observe that the value of the threshold (at which centralization is optimal) drops as the distribution becomes more concentrated.

Figure 12: Average payoff on the Decentralized Organization: Fixed Positions



Notes. Plots of the average profits of a Monte Carlo simulation with 100 repetitions of 500 rounds given different team composition and levels of task uncertainty in a decentralized organization.

[1]By a more concentrated distribution, we refer to the "peakedness" of the distribution, captured by the excess kurtosis.

B Country level analysis

Here we present our country level analysis. Our evidence suggests that the country of origin affects the participants decisions particularly for situations with intermediate levels of the manager's information. Table 5 presents the results of our baseline regression from section 5.1 by country. Columns (2) and (4) show the estimated coefficients for the American participants. The most striking result is that the estimated coefficient of $50\%_i$ is not significant anymore. The Eckel-Grossman risk aversion test and age have positive and significant coefficients. On the other hand, columns (1) and (3) show the estimated coefficients for the Spanish participants. The treatments have a similar effect to the results of section 5.1 but the control variables are not significant anymore.

Table 5: Organizational Structure Decision by Country
CLUSTERED BY SUBJECT

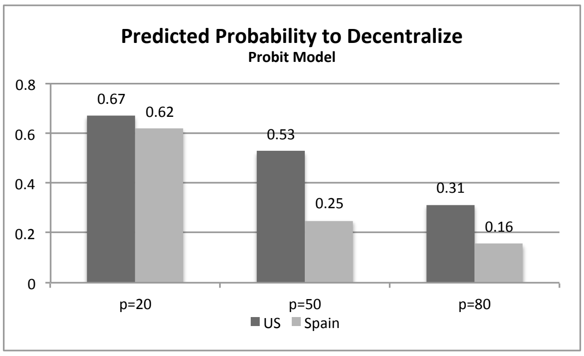
	Spain (1)	US (2)	Spain (3)	US (4)
$50\%_i$	-0.871***	-0.068	-0.975***	-0.374
	(0.32)	(0.30)	(0.30)	(0.32)
$80\%_i$	-1.313***	-0.673*	-1.312***	-0.929***
	(0.30)	(0.34)	(0.32)	(0.34)
EG_i			0.098	0.266***
			(0.12)	(0.09)
CRT_i			0.214	-0.164
			(0.15)	(0.14)
$Male_i$			-0.326	0.371
			(0.30)	(0.29)
Age_i			0.040	0.409*
			(0.15)	(0.25)
$Constant$	0.390	0.109	-0.049	-1.561***
	(0.26)	(0.26)	(0.49)	(0.60)
$RoundDummies$	Yes	Yes	Yes	Yes
N	672	752	672	752

Notes. * p-value< 0.1; ** p-value<0.05; *** p-value<0.01. The table provides baseline estimates of the main identification equation with and without controls by country. Standard Errors are clustered by subject. All the regressions are probit models.

In Figure 13, we calculate the predicted probability to delegate taking the other variables at their mean values. First, notice that the predicted probability to delegate has the same decreasing pattern as in Figure 5 for both countries. However, the biggest reduction on this probability takes place in different points in the two countries. In US the main reduction is in the comparison between the 50% and 80% treatment. Whereas in Spain the main reduction is in the comparison between the 20% and 50% treatment. The American participants decentralize more than the Spanish participants in the 50% treatment. This evidence suggest that cultural differences can affect the threshold levels determining the selection of an organizational structure. Bloom et. al. (2012) found that social capital proxied by trust increases aggregate productivity of countries affecting the organization of the firms. In particular, they found that countries with more trust have more decentralized firms. Other than the fact that they do not have Spain in their sample, US has higher level of trust than other Mediterranean European countries as Portugal, France, Greece and Italy.

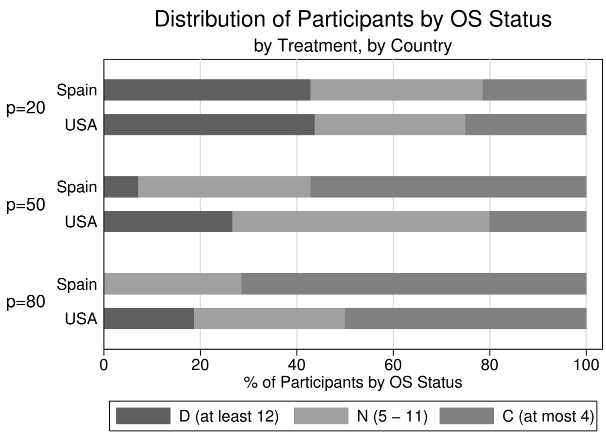
Finally in Figure 14 we obtain a graphical comparison by treatment and country of the proportions of centralizers, neutral players and delegators following the classification made on Section 5.1. We reach similar conclusions to those explained before in the regressions by country. We observe a reduction in the number of delegators as the level of information improves in both countries with higher values in US in all the treatments. There is a smoother reduction in US than in Spain where we observe a big decline between the 20% and 50% treatments. On the other hand, the number of centralizers shows us a mirror pattern except that we observe a big increment in the number of centralizers in US between the 50% and 80% treatments given the large amount of neutral players in the US in the 50% treatment.

Figure 13: Predicted Probability to Delegate



Notes. The figure plots the predicted probability to delegate by treatment in each country. The predicted effect is based on the probit estimation controlling by different characteristics of each participant and clustered by subject. The results are similar using other specifications.

Figure 14: Distribution of Participants by Organizational Structure Status

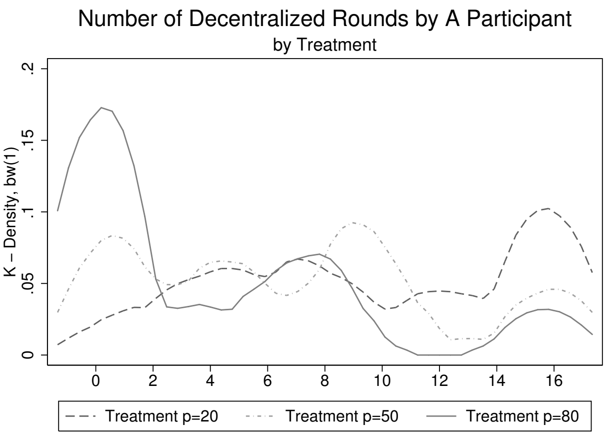


Notes. The figure plots the percentage of participants in the different Organizational Structure Status that we have defined as delegators, random players and centralizers. The definition is based on the number of rounds that each participant decided to use an organizational structure in the Selector Stage. Each A participant played 16 rounds in the Selector stage.

C Stability on organizational structure: An alternative classification

Figure 15 plots, for each treatment, a smoothed distribution of managers' delegation choices in "x" rounds. Where "x" is the variable in the axis.

Figure 15: Number of Decentralized Rounds by Managers



Notes. Kernel density approximation of the density of managers by number of rounds out of sixteen they chose to delegate in the Selector stage.

On the left hand side, we have the participants that choose to centralize in (nearly) every round. The highest concentration of participants in the 80% treatment is here. The number of participants on the left decreases as the level of information decreases. On the right hand side, where we find the participants that delegate in almost all rounds, the order of the treatments is reversed. The highest concentration of the participants delegating in almost all rounds is in the 20% treatment and it decreases as the level of information increases. Notice as well that in the 50% treatment we have different modes and the participants are divided more equally among all of them.

We use the modes in Figure 15 to classify managers into 3 different types based on how often they delegate. For simplicity, we classify a manager as a centralizer (C) if she decides to delegate in no more than four rounds of the "Selector" Stage. She is a neutral player (N) if she decided to delegate between 5 and 11 rounds and any manager decentralizing in at least 12 rounds is classified as a delegator (D). Table 2 shows the distribution of types by treatment on section 5.1.

Table 6: Participants distribution by Stability on Organizational Structure

Classification/Treatment	p=20	p=50	p=80	Total
SD	10	4	3	17
WD	4	1	0	5
N	8	10	7	25
WC	5	6	3	14
SC	3	8	17	28

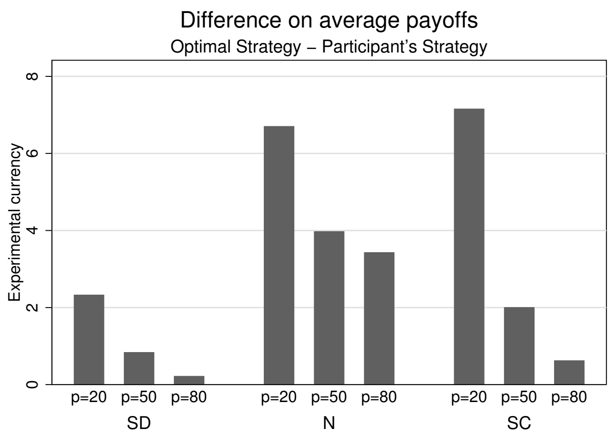
Notes. The figure plots the number of participants given their classification on the stability on organizational structure.

Using the pattern around the modes in Figure 15 we could also create a different classification of the participants to the one presented on section 5.1. This new classification considers 5 instead of 3 different categories in terms of their stability in the selection of an organizational structure. We consider that a manager is a strong centralizer (SC) if she decides to centralize in at least 14 rounds of the "Selector" Stage. A manager is a weak centralizer (WC) if she decides to centralize between 11 and 13 rounds. She is a neutral player (N) if she decided to centralize between 6 and 10 rounds. A Manager is weak delegator (WD) is she decides to centralize between 3 and 5 rounds and she is a strong delegator if she centralize in at most 2 rounds. Table 6 shows us the distribution of participants by treatment given this classification.

Notice that there is a concentration of participants in the diagonal of the table. There are more strong delegators in the 20% treatment, more neutral players in the 50% treatments and more strong centralizers in the 80% treatment. We observe how the mass of participants concentrated in each category shift by treatment. Fisher's exact test gives us a p-value of 0.004. The treatment is important to determine the proportion of participants in each of the SOS_5 categories.

Also, we can replicate the analysis of the payoffs from section 5.3. using this new classification. The main patterns we observed are still present in Figure 16. This graph plots the average difference per round per participant in the payoffs obtained playing the optimal decentralized strategy and the real payoffs obtained by the participants during the experiment on the selector stage. We separate the sample according to the classification of the participants depending on their stability on the organizational structure decision of Table 6. We consider only the participants on the managerial role in one of the following categories: strong centralizers, strong decentralizers or random players.

Figure 16: Difference in average payoffs: Optimal strategy - participant's strategy



D Team heterogeneity

Table 7: Average positions in centralized rounds

		C. Stage		S. Stage		Opt. Pos.	
Treat.	Stats.	Pos 1	Pos2	Pos1	Pos 2	Pos1	Pos 2
20%	Mean	35.40	63.39	35.53	61.72	42	58
	SD	14.34	13.84	17.56	15.37		
	N	300	300	191	191		
50%	Mean	32.93	65.49	33.15	64.83	35	65
	SD	12.57	13.15	11.14	11.15		
	N	290	290	265	265		
80%	Mean	35.04	64.11	35.32	65.03	29	71
	SD	12.45	12.99	10.94	10.61		
	N	300	300	360	360		

Notes This table reports the mean, standard deviation and sample size of the positions selected by managers in the centralized stage and in the centralized rounds of the selector stage. The last two columns indicate the optimal worker positions for a centralized organization by treatment.

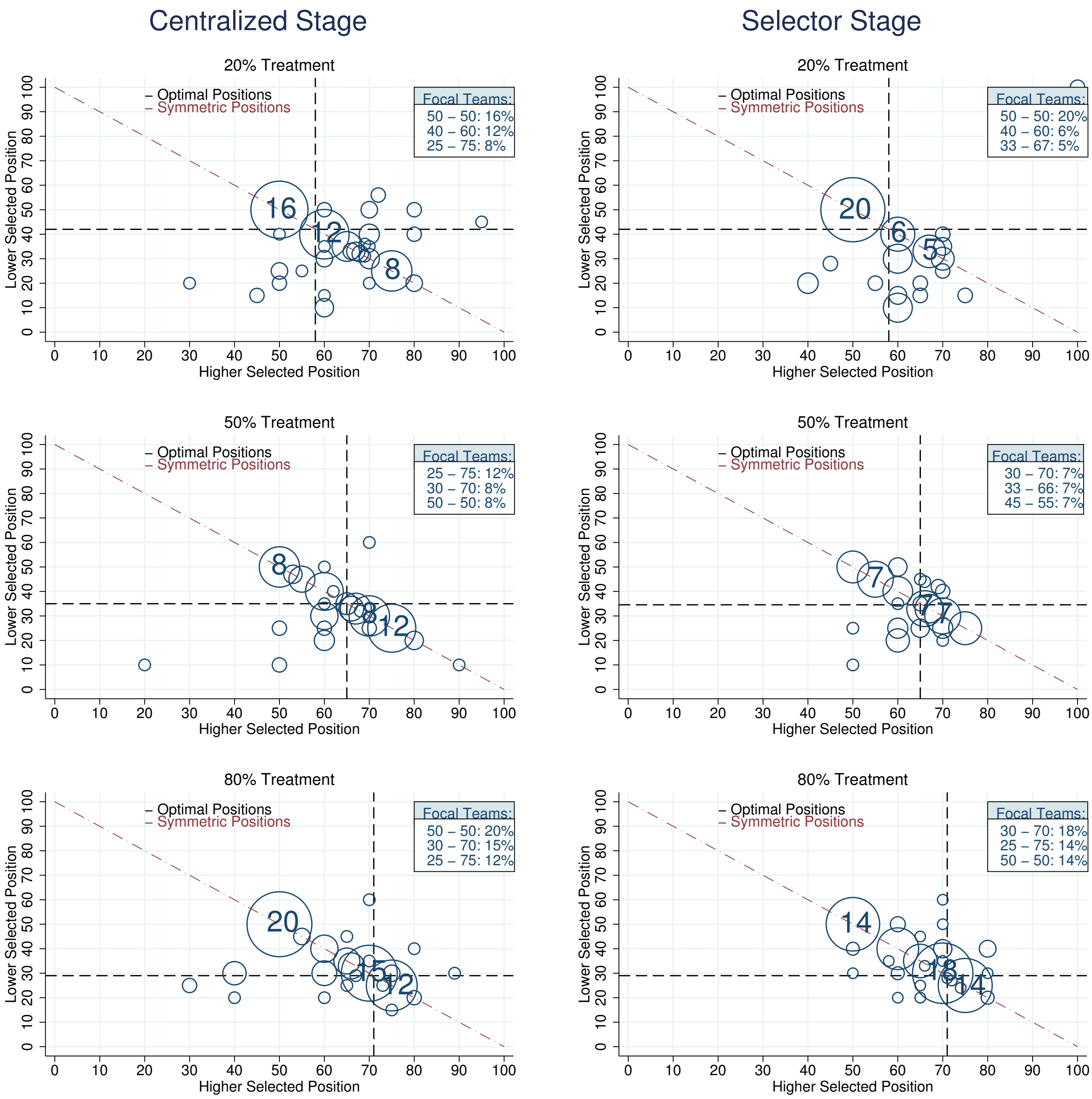
Table 8: Average positions in decentralized rounds

		D. Stage		S. Stage		Opt. Pos.	
Treat.	Stats.	Pos 1	Pos2	Pos1	Pos 2	Pos1	Pos 2
20%	Mean	33.80	66.23	33.47	68.04	27	73
	SD	14.56	14.56	14.52	12.73		
	N	300	300	289	289		
50%	Mean	33.28	62.46	32.94	64.20	27	73
	SD	14.66	17.15	10.16	11.59		
	N	290	290	199	199		
80%	Mean	36.63	63.22	33.06	65.98	27	73
	SD	13.38	14.04	11.33	12.18		
	N	300	300	120	120		

Notes. This table reports the mean, standard deviation and sample size of the positions selected by managers in the decentralized stage and in the decentralized rounds of the selector stage. The last two columns indicate the optimal worker positions for a decentralized organization by treatment.

Figure 17: Team Composition on the Centralized Rounds

(a) Panel A (b) Panel B

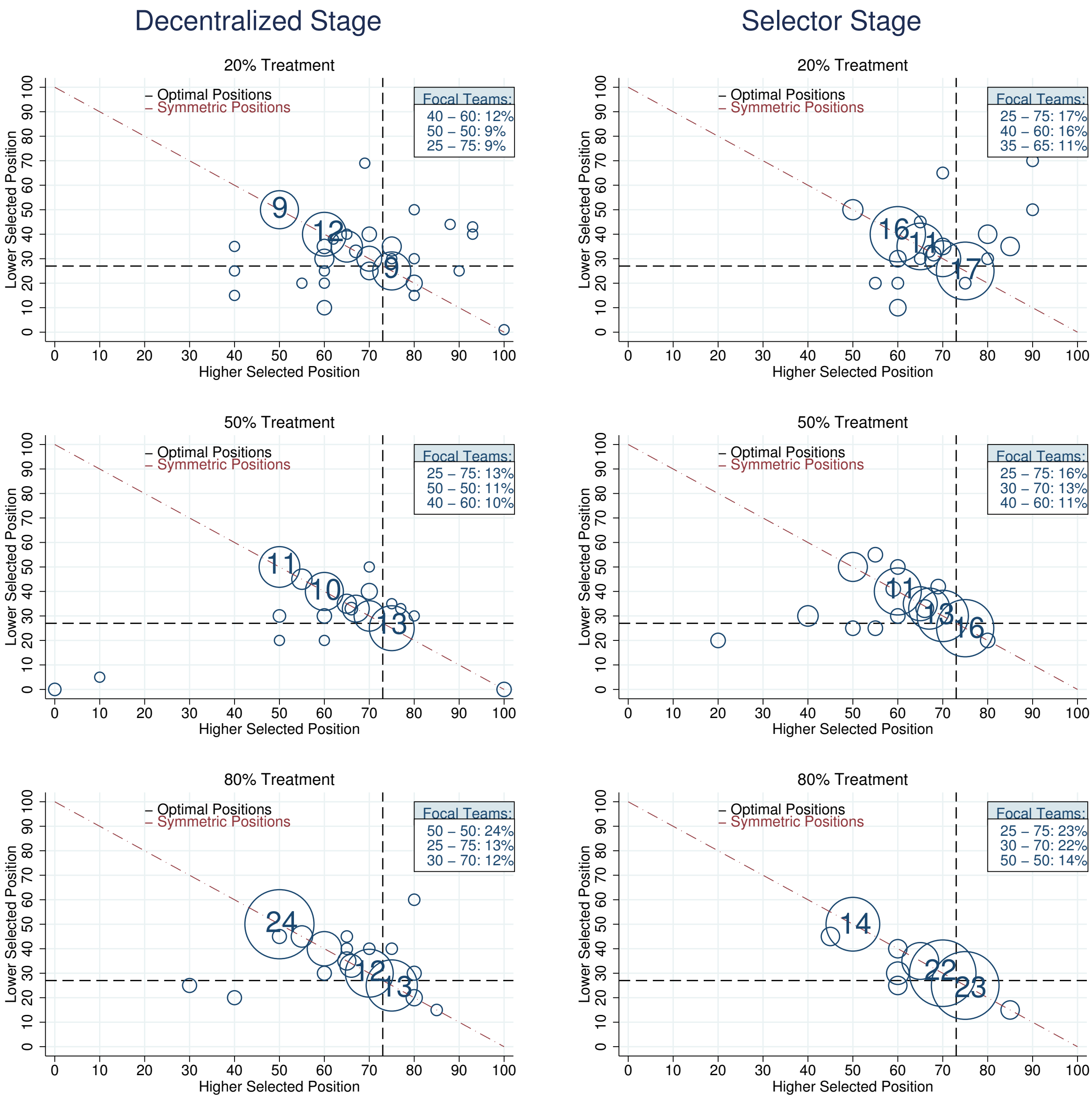


Notes. Plot the team composition selected on the centralized rounds played by stage and treatment. The x-axis represents the right-most worker, while the y-axis represents the left-most worker per team. The size of the bubble are determined by the weight that team composition have on each treatment-stage subgroup. The dotted black lines are the optimal positions predicted by the model on centralized organizations given the level of information. The inverse red dash-dot diagonal represents the team compositions that are symmetric around the expected ex-ante task. For visual clarity, we omit bubbles for single observations.

Figure 18: Team Composition on the Decentralized Rounds

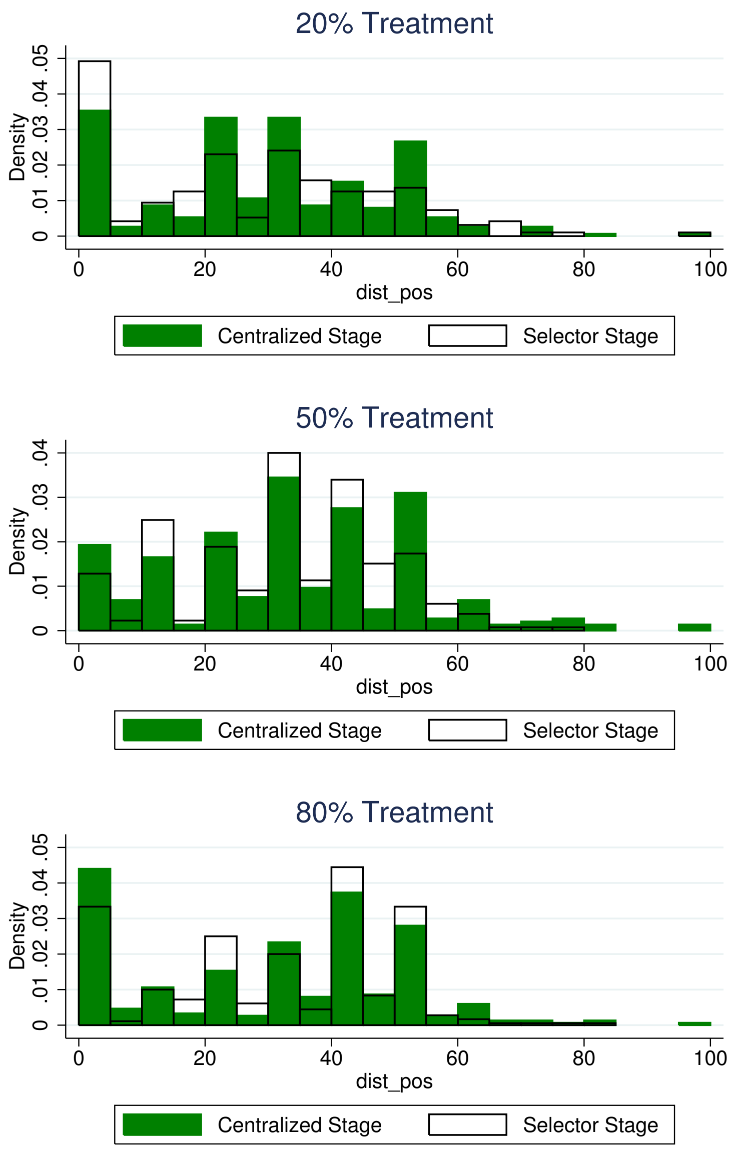
(c) Panel A

(d) Panel B



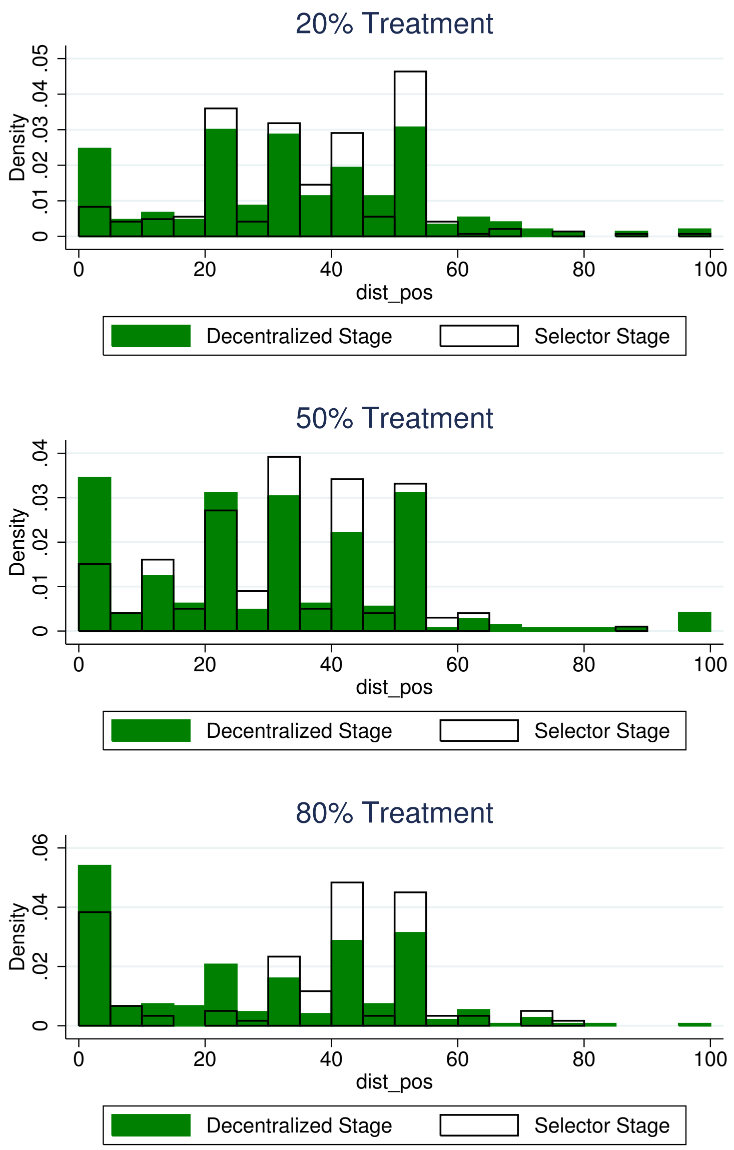
Notes. Plot the team composition selected on the decentralized rounds played by stage and treatment. The x-axis represents the right-most worker, while the y-axis represents the left-most worker per team. The size of the bubble are determined by the weight that team composition have on each treatment-stage subgroup. The dotted black lines are the optimal positions predicted by the model on decentralized organizations given the level of information. The inverse red dash-dot diagonal represents the team compositions that are symmetric around the expected ex-ante task. For visual clarity, we omit bubbles for single observations.

Figure 19: Distribution of the distance between selected positions
Centralized rounds



Notes. This graph plots the distribution of the average distance of the positions selected on the centralized rounds by participant. For each treatment, we calculate the average distance of the centralized rounds on the centralized stage and the centralized rounds on the selector stage.

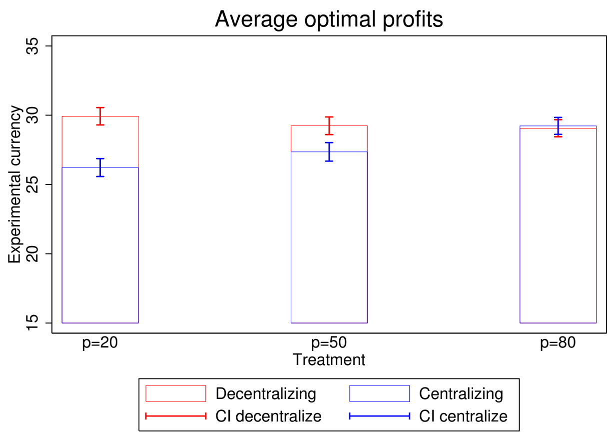
Figure 20: Distribution of the distance between selected positions
Decentralized rounds



Notes. This graph plots the distribution of the average distance of the positions selected on the decentralized rounds by participant. For each treatment, we calculate the average distance of the decentralized rounds on the decentralized stage and the decentralized rounds on the selector stage.

E Optimal decentralized organization versus optimal centralized organization: Simulated Payoffs

Figure 21: Payoffs under the optimal decentralized and centralized strategies



Notes. This graph plots the average payoffs per round that managers could have obtained by following the optimal decentralized strategy (red bars) or a centralized strategy with optimal team selection (blue bars).

F The analysis of the zero distance between positions

Table 9: Clasiffication of the zero distance between positions
CENTRALIZED AND DECENTRALIZED STAGE BY TREATMENT

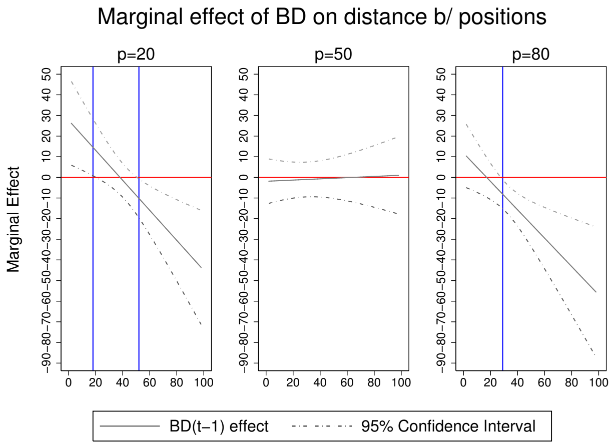
	Cen 20	Dec 20	Cen 50	Dec 50	Cen 80	Dec 80
Number of Observations						
Inmediate LA	10	7	6	7	7	12
Prolonged LA	26	9	8	24	11	16
50 then split	11	10	6	6	5	12
Fix 50	10	10	10	0	40	40
Others	4	3	2	16	9	10
Total	51	32	26	46	65	78
Percentages of the Total						
Immediate LA	20%	22%	23%	15%	11%	15%
Prolonged LA	51%	28%	31%	52%	17%	21%
50 then split	22%	31%	23%	13%	8%	15%
Fix 50	20%	31%	38%	0%	62%	51%
Others	8%	9%	8%	35%	14%	13%
Sub - Total without fix 50	41	22	16	46	25	38
Percentages of the Sub - Total						
Immediate LA	24%	32%	38%	15%	28%	32%
Prolonged LA	63%	41%	50%	52%	44%	42%
50 then split	27%	45%	38%	13%	20%	32%
Others	10%	14%	13%	35%	36%	26%

Notes. In this table we make a classification of the cases where the participants select the same position for their team members. In 90% of the cases they select the expected task, 50. We identify the cases of immediate loss aversion as the situations where the participants choose a complete homogeneous team after a payoffs lower than 25 in the previous round. The observations we included as prolonged loss aversion take under consideration the number of periods the participants keep choosing a complete homogeneous team after experience a loss. The observations counted as prolonged loss aversion includes those in the immediate loss aversion. We also have the participants assigning a 50-50 positions to their members since the first round but then they split the positions in some of the rounds. Finally, we have those participants that always play 50-50 does not matter the results in all the rounds. We present the percentages over all observations and the percentages without considering the participants with a fix strategy.

G 50-50 teams: conflict of interest and mistakes

In this appendix we complement our findings on the existence of perfectly homogeneous teams in section 6.1. The measure representing a bad result for the manager we used before depended on the observed payoffs the previous period but not with the probability to observe the strategies selected by her workers. However, the structure of the game and the informational differences among managers and workers can play a very important role on the reactions of the participants. In particular, in the decentralized stage, workers may have a conflict of interest with their managers leading them to make decision against the managers' objective. Those decisions would be observed by the manager with some probability depending on the treatment - the level of information. How managers react when their workers make a decision against their interest? In Figure 22 we find the answer. In this situation, the dummy capturing the loss take the value of one when the workers make a decision that reduce the managers' payoffs. This type of behavior is observed in 12% of the rounds played in the decentralized stage.

Figure 22: Reduced heterogeneity: Decentralized stage (B against A)

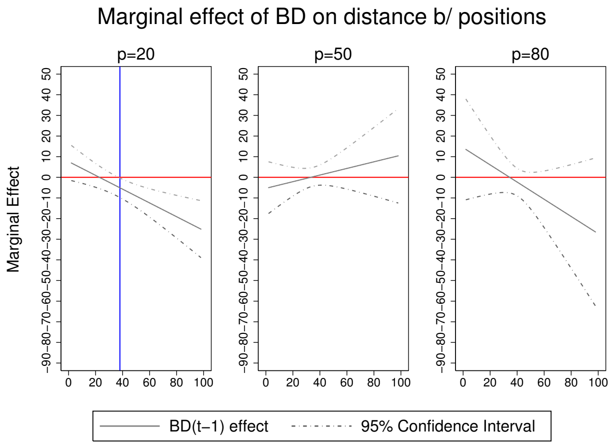


Notes. This graph plots the marginal effect associated with the fact that the switch decision was against the A participant interest in the round $t-1$ when the average distance between the position selected in the previous round was X. There is one graph for the decentralized stage in each treatment. In the decentralized organization the switch decision is an B participant task. In the x-axis we find the average distance between positions played in round $t-1$. In the y-axis we find the marginal effect. For instance, if the marginal effect is -10 in the 20% treatment when the distance played by a participant in round t-1 was 60, it implies that the participant will play a distance of 50 in round t. We also plot the confidence intervals at 95% level. The vertical blue lines specify separate the areas in the graph where we have significance effects from the areas where we do not.

Figure 22 presents some similarities with Figure 9 but they are not exactly the same. Again, we observed the decreasing marginal effect in the 20% and 80% treatments and a no effect on the 50% treatment. However, there are significantly effects in 20% and 80% treatment. The marginal effects of a decision against the managers' interest in the previous round are significant in the 80% treatment for values above 28. It includes 47% of the cases. So, we still have a reduction in the heterogeneity of the team selected when the average distance in the previous period was high enough and the managers experience a loss. But, in this case we have a significance effect as well in the 20% treatment. For values above 52, we have a significant contraction in the distance played by the managers if the workers made a selection against their interest. On the contrary, for values below 19, we have a significant increment in the distance played by the managers if the workers made a selection against their interest. In the 20% treatment, 12% of the cases are below 19 and 10% of the cases are above 52.

Figure 23 repeat the analysis for the centralized stage with a similar measure as that we used in Figure 22. However, this measure have a different interpretation. In the centralized stage, the managers decide positions and tasks reallocation. Then, any decision against the managers' interest is a mistake of the same manager. This type of behavior is observed in 16% of the rounds played in the centralized stage. However, unlike the decentralized stage, this measure is not equally divided between treatments. Those cases are more concentrated in the 20% treatment and then it decreases as the information gets better. The reason is that as the information improves

Figure 23: Reduced heterogeneity: Centralized Stage (A against A)



Notes. This graph plots the marginal effect associated with the fact that the switch decision was against the A participant interest in the round $t-1$ when the average distance between the position selected in the previous round was X. There is one graph for the centralized stage in each treatment. In the centralized organization the switch decision is an A participant task. In the x-axis we find the average distance between positions played in round $t-1$. In the y-axis we find the marginal effect. For instance, if the marginal effect is -10 in the 20% treatment when the distance played by a participant in round t-1 was 60, it implies that the participant will play a distance of 50 in round t. We also plot the confidence intervals at 95% level. The vertical blue line separates the areas in the graph where we have significance effects from the areas where we do not.

the A participants make less mistakes. The marginal effect is only significant in the 20% treatment above 38. Result pretty similar to the results we found with the former loss measure.

H Experimental Materials

Here we include instructions from our 20% treatment along with screenshots of the ztree software. Instructions were presented on the computer screens, with the bold sub-headings denoting a new screen.

H.1 Instructions Sample

General Information[2]

This is an experiment in decision-making. In addition to a $10 participation fee, you will be paid any additional money you accumulate during the experiment at the conclusion of today's session.

All payoffs during the experiment are denominated in an artificial currency, experimental currency units (ECU). At the end of the experiment, ECU will be converted to cash at the rate of $1 per 60 ECU. Upon completion of the experiment, your earnings will be converted to dollars and you will be paid privately, by check. The exact amount you receive will be determined during the experiment and will depend on your decisions and the decisions of others.

The identities of participants will remain confidential, meaning that at no point in time will we identify the role or actions of any individual to other participants. In other words, the actions that you take during this experiment will remain confidential.

If you have any questions during the experiment, please raise your hand and wait for an experimenter to come to you. Please do not talk, exclaim, or try to communicate with other participants during the experiment. Participants intentionally violating these rules or otherwise behaving in a disruptive fashion will be asked to leave the experiment and will not be paid.

Please click "Continue".

Description of Stages, Rounds, and Groups

This experiment will consist of three stages (I, II, and III). Right now we will go through the instructions for Stage I. You will receive new instructions later for Stages II and III.

Stage I will last for 10 rounds. In each round, you will be in a three-person group with two other participants. The participants you are grouped with will be the same for all rounds of Stage I.

Your group will consist of participants in two roles. One of the participants will participate in the experiment in the role of Participant A. The remaining participants in each group will be in the role of Participant B, identified as B1 and B2. All participants will be able to observe the outcomes for their group in each round of Stage I.

You will be informed of your role (A or B) prior to the beginning of Stage I.

Overview of the Tasks in Stage I

Each B participant will be assigned to one of two markers (labeled M1 and M2) at the beginning of every round. These markers will be randomly positioned on a scale with values from 0 to 100, with each position equally likely to occur. Each B participant will always see the position of his or her assigned marker as well as the marker position for the other B participant in his or her group. Specifically, each B participant observes both M1 and M2, regardless of the marker to which he or she is assigned.

In every round of Stage I, the A participant in each group will make two decisions, which we will call the Placement and Switch decisions. We will give an overview of these decisions before describing each of them in detail. Once we finish the detailed descriptions, we will take time to answer any decision-related questions before carefully explaining participants' payoffs.

[2]The horizontal lines divide the instructions on different screenshots viewed by the participants.

Placement Decision

The first decision for A participants is the Placement decision. In this decision, each A participant must position the B participants in his or her group on the same scale used for the markers assigned to the B participants. This is done by choosing a value from 0 to 100 for each B participant. The goal of the A participant is to minimize the distance between the locations of each B participant and that participant's final assigned marker. Once the Placement decision has been made for both B participants, the B participants will know their position on the scale.

When A participants choose the placement for each B participant in their group, they will not know the initial marker position that was randomly assigned to each B participant.

Switch Decision

Once the A participant has positioned both B participants, each initial marker will be revealed to the A participant with a 20% chance.. We will describe this in more detail shortly.

Once the markers have been revealed or not to the A participant, he or she will make the final decision in the round, the Switch decision. This decision gives the A participant the option to change the marker initially assigned to each B participant. Specifically, the A participant will choose whether to switch the initial assigned markers or leave them unchanged. The markers assigned after the Switch decision are the final markers of each B participant.

We will now look at an example of how this will work. Please click "Continue".

Description of the Placement decision in Stage I

In Stage I, the A participant in each group will complete the Placement decision on a scale like the one shown below. If you are an A participant, you will decide the position of each B participant individually. This is done by entering a value into the boxes below with any whole number between 0 and 100. Please take a moment to familiarize yourself with the positioning boxes. Note that when you choose the position values, two colored markers appear on the scale shown below. When you change the position values, the colored markers move as well. Also note that you may choose a different position for each B participant or place both B1 and B2 in the same position.

All A participants will make their decisions at the same time. All B participants will see the decisions made by the A participant in their group.

Once you have finished experimenting with the sample placement decision above, please click Continue.

Description of the Switch Decision in Stage I

After all A participants have made their Placement decision, each marker initially assigned to the B participants will be revealed to the A participant with probability p=0.2. This means that with 20% chance each marker will be revealed to the A participant. In other words, for each marker (M1 and M2), there is a 1 out of 5 chance (20%) that the A participant will see the true marker position initially assigned to the B (B1 or B2) participant, and a 4 out of 5 chance (80%) that he or she will not see the B (B1 or B2) participant's initial assigned marker position. The chance of seeing the position for M1 is separate from the chance of seeing M2's position. This means that the probability of seeing one marker is not affected by seeing the other marker. In each round, the A participant may see the position of one marker, both markers, or no markers. The likelihood of seeing a marker in any round is not affected by whether a marker was seen in the previous round.

Remember that the initial marker positions will always be revealed to the B participants. Each B participant will see the actual initial marker positions and the assignment of each marker, whether the markers are revealed to the A participant or not.

Whether each marker is revealed or not, the A participant may then Switch the markers initially assigned to each B participant in his/her group. This means that the B participant's final marker may be different than his or her initial marker. After that Switch decision has been made, all participants will see the results of the round.

Description of Role A Participant Payoffs

All A participants will begin each round with 50 ECU. If you are an A participant, your payoff will depend on the positions of the B1 and B2 participants in your group (variables B1 and B2, respectively), as well as the value of the two randomly determined markers assigned to each B participant (variables M1 and M2).

Your payoffs will increase when the positions of the B participants are closest to their matched marker. Specifically, your payoffs will be determined by the following equation:

$$A\ Payoff = 50 - 0.5 \times |M1 - B1| - 0.5 \times |M2 - B2|$$

In the above example equation, participant B1 is matched to marker M1 and participant B2 is matched to marker M2. If the A participant chooses to switch markers, the payoffs would then be given by:

$$A\ Payoff = 50 - 0.5 \times |M2 - B1| - 0.5 \times |M1 - B2|$$

Note that the payoffs are determined by each B participant's final assigned marker, not necessarily the initially assigned marker.

Please, take a moment to familiarize yourself with this formula. You can fill out the example boxes below with different position values to understand better how the payoff for each A participant is calculated.

It is, in principle, possible that you make negative earnings in a round. However, you can always avoid this with certainty through your own choices. Remember that your earnings from today's experiment will be accumulated over all rounds. In a given round, your expected payoff, in ECU, is positive.

Description of Player B Payoffs

All B participants will likewise begin each round with 50 ECU. If you are a B participant, your payoffs will depend on your distance from your assigned marker. Specifically, your payoffs will be given by the following equations:

$$\begin{aligned} B1\ Payoff &= 50 - |M1 - B1| \\ B2\ Payoff &= 50 - |M2 - B2| \end{aligned}$$

In the above example equation, participant B1 is matched to marker M1 and participant B2 is matched to marker M2. If the A participant chooses to switch markers, the payoffs would then be given by:

$$\begin{aligned} B1\ Payoff &= 50 - |M2 - B1| \\ B2\ Payoff &= 50 - |M1 - B2| \end{aligned}$$

Note again that the payoffs are determined by each B participant's final assigned marker, not necessarily the marker that was initially assigned.

Please, take a moment to familiarize yourself with this formula. You can fill out the boxes below with different position values to understand better how the payoffs for B participants are calculated.

It is, in principle, possible that you make negative earnings in a round. Remember that your earnings from today's experiment are accumulated over all rounds of the game. In a given round, your expected payoff, in ECU, is positive.

Results of Each Round

At the end of each round, all participants will see the results of the round and the results of the previous rounds played on Stage I.

If you are an A participant, you will see the position of the B participants in your group. You will also see which markers, if any, were revealed to you in the round. Lastly, you will see your payoffs for the round, in ECU, as well as the payoffs of the B participants in your group.

If you are a B participant, you will see your assigned position, the position of the other B participant, and the actual marker values. You will again see to which marker you have been assigned, as well as your payoffs for the round. You will also see the payoffs of the other B participant and your group's A participant. B participants will also see if the A participant decided to switch the markers or not.

Quiz: Payoffs

To make sure that everyone understands the payoffs for Stage I, please take a moment to complete the following example. The numbers used in this example were randomly drawn from the same 0 - 100 scale described previously. Click Continue once you have completed the example.

Imagine the A participant positions B1 at 10 and B2 at 80. The marker M1 is at 50 and the marker M2 is at 30. Initially, B1 is matched to M1 and B2 is matched with M2.

If the A participant does not switch markers, enter the payoffs for each participant:

- B1 participant (use entry boxes)
- B2 participant
- A participant

If the A participant instead chooses to switch markers, enter the payoffs for each participant:

- B1 participant
- B2 participant
- A participant

Quiz: Stage I Information

To make sure that everyone understands the instructions for Stage I, please take a moment to answer the following questions. Once everyone has responded correctly, we will proceed to the first round of Stage I.

(use radio True/False buttons)

1. The three members of your group will be fixed for all rounds of Stage I. (TRUE)
2. The B participants will never see their randomly initial assigned markers. (FALSE)
3. The A participants will see each marker position assigned to the B participants with a 20
4. The B participants will know where their A participant has positioned them. (TRUE)
5. The A participants will never see both marker positions assigned to participants B in a round. (FALSE)
6. The A participant will make both the Placement and Switch decisions in each round. (TRUE)

Placement Decision (A Participant)

Select the positions of the B participants. Remember, you have to minimize the distance between the final marker assigned to each B participant (the assigned marker after the Switch decision) and the position selected. Notice, you can assign the same position for both B participants. Remember that there is a 1 in 5 chance that you will observe each of the initial markers assigned to the B participants, and then you will complete the Switch decision.

After you have chosen the positions that you prefer, press the “Select” button. Then, press “Continue”.

Hypothetical Placement Decision (B Participants)

Please complete this hypothetical decision while the A participant in your group is completing the Placement decision.

Imagine that you are the A participant. Using the boxes, select the hypothetical positions of the B participants in your group. This will not affect your payment from today’s experiment, but we are interested in your answers. Remember, the A participant’s goal is to minimize the distance between the final marker assigned to each B participant (the assigned marker after the Switch decision) and the position selected. Notice, you can assign the same position for both B participants. Remember, the A participant knows he or she will observe each of the initial markers assigned to the B participants with a 1 in 5 chance and then he or she will complete the Switch decision.

After you have chosen the positions that you prefer, press the Select button. Then, press “Continue”.

Stage II

We have now concluded Stage I of the experiment. Stage II will consist of 10 rounds.

Your group in Stage II is composed of yourself and two different participants than your Stage I group, but all participants will play the same roles that they played in Stage I. In other words, your Stage II role (A, B1 and B2) will be the same as your role in Stage I. In Stage II, the A participants will again complete the Placement decision by choosing a position for each B participant in his or her group. The possible positions will be identical to Stage I. Once again, the B participants will be assigned randomly an initial marker and each marker will once again be revealed to the A participant with a 20% chance, just as in Stage I. As in Stage I, seeing one marker does not raise or lower the A participant’s chance of seeing the other marker. Also, the A participant seeing a marker in one round does not affect the likelihood of seeing a marker in the next round. All B participants will see the initial marker values in every round, just as in Stage I. Payoffs in Stage II will be calculated exactly as they were in Stage I using the same payoff functions.

However, in Stage II the A participant will no longer complete the Switch decision. In each round of this stage, participants B1 and B2 will complete the Switch decision. To make their decision, B participants will vote on whether or not to switch their initial assigned markers. The markers will only be switched if both B1 and B2 choose to switch. If only one B participant chooses to switch, no switch will occur. Therefore, a switch will only occur if it is unanimously agreed upon by the B participants.

Please click “Continue”.

Results of Each Round

At the end of each round of Stage II, A participants will see the same information they saw in Stage I, and they will now also see whether the B participants chose to switch markers or not.

Each B participant will see all the information they saw in Stage I, and will now see whether they unanimously chose to switch markers.

This means that all participants will see the same information they saw in Stage I, including their decisions, the decisions of other members of their group, their payoffs, and the payoffs of his/her group members.

Quiz: Stage II Information

To make sure that everyone understands the instructions for Stage II, please take a moment to answer the following questions. Once everyone has responded correctly, we will proceed to the first round of Stage II.

(use radio True/False buttons)

1. The three members of your group will be fixed for all rounds of Stage II. (TRUE)
2. Your group members are the same three participants from Stage I. (FALSE)
3. The A participant will make both the Placement and Switch decisions in each round. (FALSE)

Placement Decision (A Participant)

Select the positions of the B participants. Remember, you have to minimize the distance between the final marker assigned to each B participant (the assigned marker after the Switch decision) and the position selected. Notice, you can assign the same position for both B participants. Remember that there is a 1 in 5 chance that you will observe each of the initial markers assigned to the B participants, and then the B participants will complete the Switch decision.

After you have chosen the positions that you prefer, press the "Select" button. Then, press "Continue".

Hypothetical Placement Decision

Please complete this hypothetical decision while the A participant in your group is completing the Placement decision.

Imagine that you are the A participant. Using the boxes, select the hypothetical positions of the B participants in your group. This will not affect your payment from today's experiment, but we are interested in your answers. Remember, the A participant's goal is to minimize the distance between the final marker assigned to each B participant (the assigned marker after the Switch decision) and the position selected. Notice, you can assign the same position for both B participants. Remember, the A participant knows he or she will observe each of the initial markers assigned to the B participants with a 1 in 5 chance, and then the B participants will complete the Switch decision.

After you have chosen the positions that you prefer, press the Select button. Then, press "Continue".

Stage III

We have now concluded Stage II of the experiment. Stage III will consist of 16 rounds.

Your group in Stage III is composed of yourself and two different participants than your Stage I or II group, but all participants will play the same roles that they played in Stage I and II. In other words, your Stage III role (A, B1 and B2) will be the same as your role in Stages I and II.

Before assigning positions B1 and B2, the A participant will now make a new decision. At the beginning of each round of Stage III, the A participant will choose who will complete the Switch decision - the A participant (as in Stage I) or the B participants (by vote, as in Stage II). We will refer to this new decision as the Selector decision.

If the A participant chooses to make the Switch decision himself or herself, then that round will be identical to the rounds in Stage I. If the A participant chooses to have the B participants make the Switch decision, the round will be identical to the rounds in Stage II. Therefore, each round of Stage III will be identical to a round from one of the first two stages of the experiment, as selected by the A participant.

All participants in your group will learn who will make the Switch decision in each round.

Results of Each Round

At the end of each round of Stage III, A and B participants will see the same information they saw in previous Stages.

This means that all participants will see their decisions, the decisions of other members of their group, their payoffs, and the payoffs of group members.

Selector Decision (A participant)

In Stage III, you choose which group members make the Switch decision in each round. You may choose to make this decision yourself or let the B participants make this decision.

Who do you prefer to make the Switch decision in this round?

1. You, the A participant
2. The B participants

Hypothetical Selector Decision (B participants)

Please complete this hypothetical decision while the A participant in your group is completing the Selector decision.

Imagine you are the A participant and choose which group members make the Switch decision in each round. This will not affect your payment from today's experiment, but we are interested in your answers. The A participant may choose to make this decision himself or let the B participants make this decision.

Who do you prefer to make the Switch decision in this round?

1. The A participant
2. The B participants

Placement Decision (A Participant)

Select the positions of the B participants. Remember, you have to minimize the distance between the final marker assigned to each B participant (the assigned marker after the Switch decision) and the position selected. Notice, you can assign the same position for both B participants. Remember that there is a 1 in 5 chance that you will observe each of the initial markers assigned to the B participants, and the Switch decision will be as in Stage I or Stage II depending on your Selector decision.

After you have chosen the positions that you prefer, press the "Select" button. Then, press "Continue".

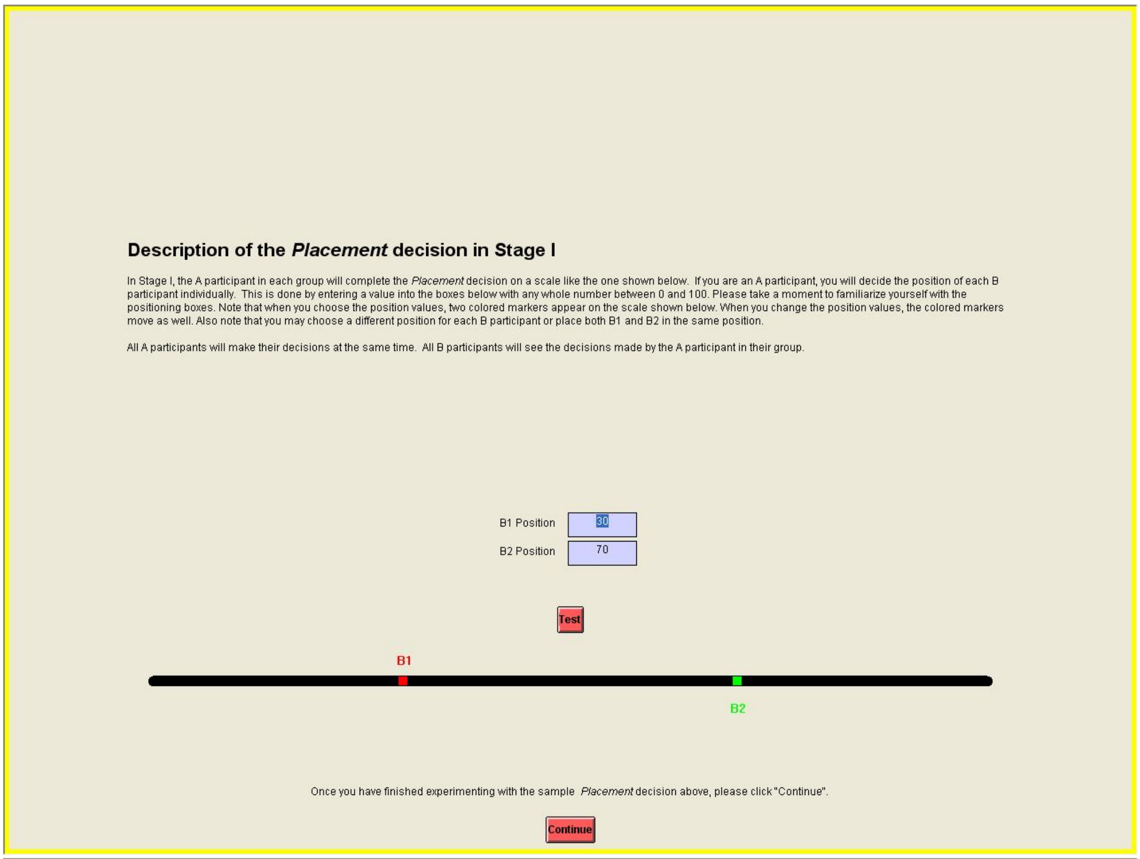
Hypothetical Placement Decision (B Participants)

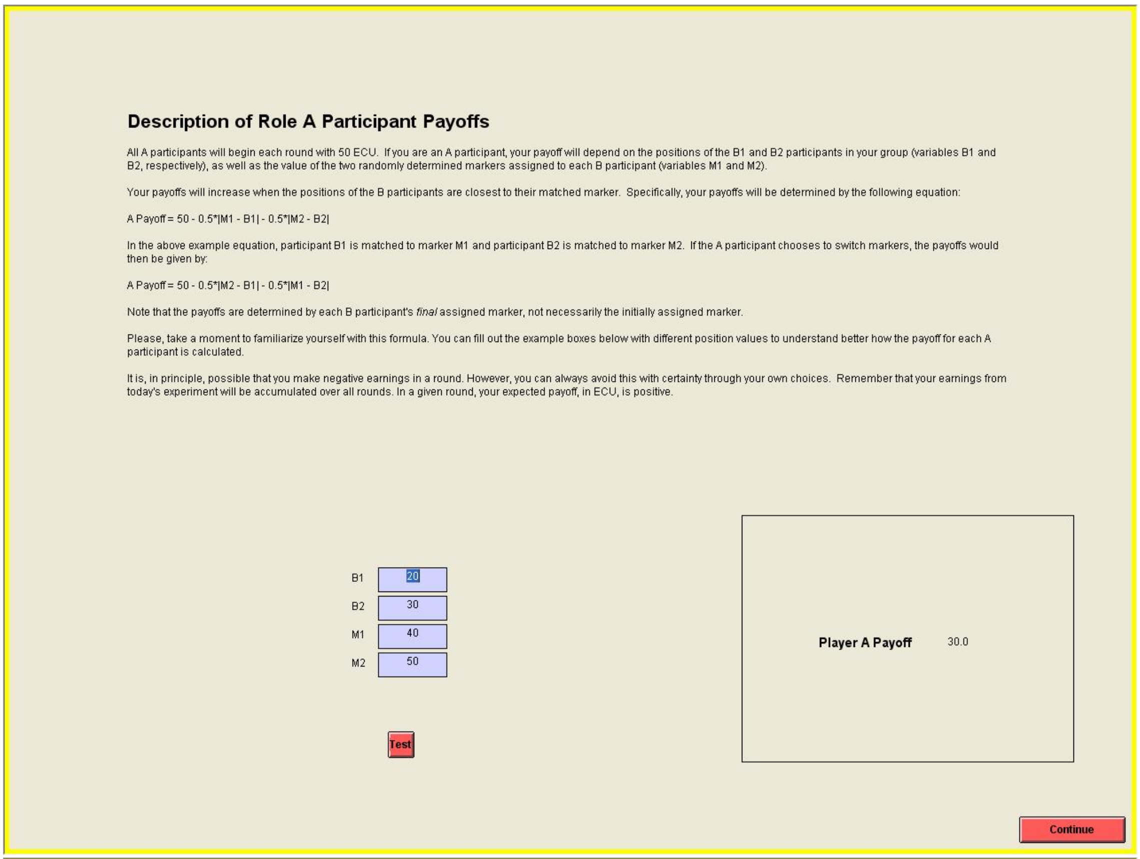
Based on your hypothetical Selector decision on the previous screen, please complete this hypothetical Placement decision. The A participant in your group is currently making the Placement decision that will count for your group.

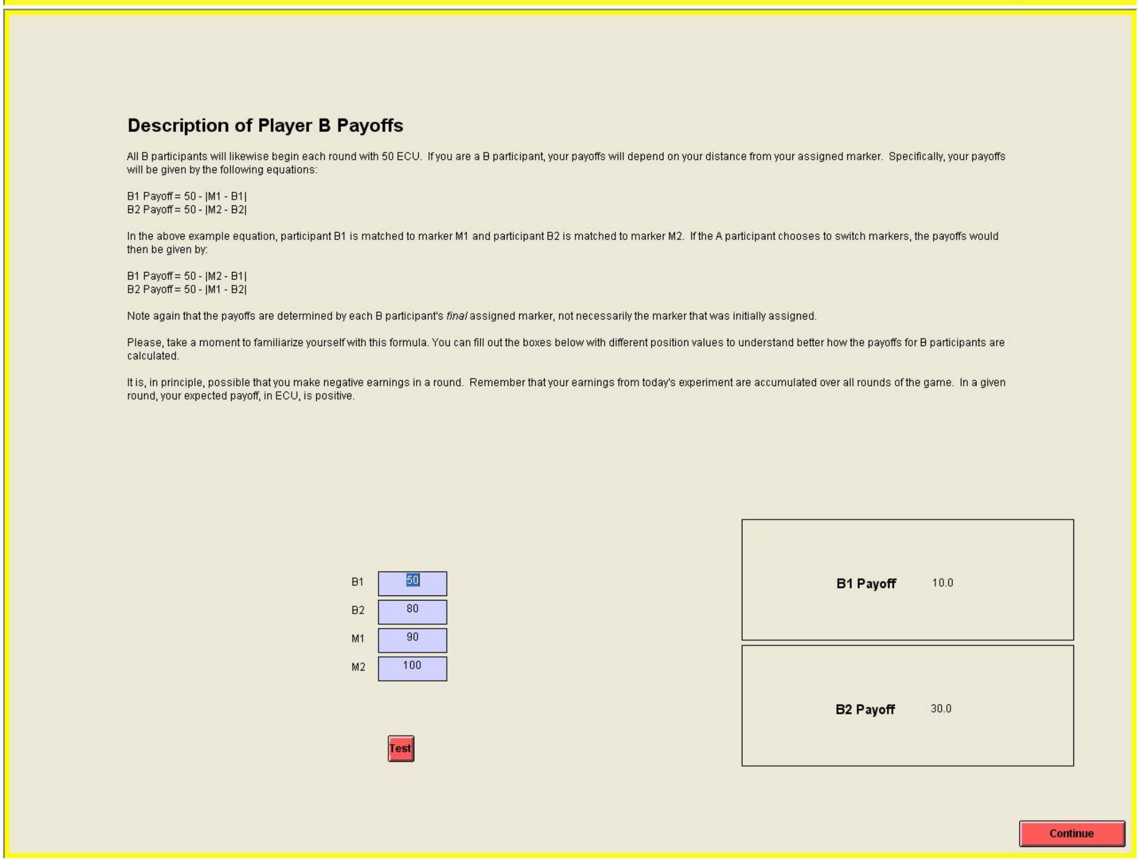
Imagine that you are the A participant. Using the boxes, select the hypothetical positions of the B participants in your group. This will not affect your payment from today's experiment, but we are interested in your answers. Remember, the A participant's goal is to minimize the distance between the final marker assigned to each B participant (the assigned marker after the Switch decision) and the position selected. Notice, you can assign the same position for both B participants. Remember, the A participant knows he or she will observe each of the initial markers assigned to the B participants with a 1 in 5 chance, and the Switch decision would be as in Stage I or Stage II depending on your hypothetical Selector decision.

After you have chosen the positions that you prefer, press the "Select" button. Then, press "Continue".

H.2 Experimental design: Screenshots




Description of Role A Participant Payoffs
All A participants will begin each round with 50 ECU. If you are an A participant, your payoff will depend on the positions of the B1 and B2 participants in your group (variables B1 and B2, respectively), as well as the value of the two randomly determined markers assigned to each B participant (variables M1 and M2).
Your payoffs will increase when the positions of the B participants are closest to their matched marker. Specifically, your payoffs will be determined by the following equation:
A Payoff = 50 - 0.5*|M1 - B1| - 0.5*|M2 - B2|
In the above example equation, participant B1 is matched to marker M1 and participant B2 is matched to marker M2. If the A participant chooses to switch markers, the payoffs would then be given by:
A Payoff = 50 - 0.5*|M2 - B1| - 0.5*|M1 - B2|
Note that the payoffs are determined by each B participant's final assigned marker, not necessarily the initially assigned marker.
Please, take a moment to familiarize yourself with this formula. You can fill out the example boxes below with different position values to understand better how the payoff for each A participant is calculated.
It is, in principle, possible that you make negative earnings in a round. However, you can always avoid this with certainty through your own choices. Remember that your earnings from today's experiment will be accumulated over all rounds. In a given round, your expected payoff, in ECU, is positive.
B1 20
B2 30
M1 40
M2 50
Test
Player A Payoff 30.0
Continue


Description of Player B Payoffs
All B participants will likewise begin each round with 50 ECU. If you are a B participant, your payoffs will depend on your distance from your assigned marker. Specifically, your payoffs will be given by the following equations:
B1 Payoff = 50 - |M1 - B1|
B2 Payoff = 50 - |M2 - B2|
In the above example equation, participant B1 is matched to marker M1 and participant B2 is matched to marker M2. If the A participant chooses to switch markers, the payoffs would then be given by:
B1 Payoff = 50 - |M2 - B1|
B2 Payoff = 50 - |M1 - B2|
Note again that the payoffs are determined by each B participant's final assigned marker, not necessarily the marker that was initially assigned.
Please, take a moment to familiarize yourself with this formula. You can fill out the boxes below with different position values to understand better how the payoffs for B participants are calculated.
It is, in principle, possible that you make negative earnings in a round. Remember that your earnings from today's experiment are accumulated over all rounds of the game. In a given round, your expected payoff, in ECU, is positive.
B1 50
B2 80
M1 90
M2 100
Test
B1 Payoff 10.0
B2 Payoff 30.0
Continue

Quiz: Payoffs

To make sure that everyone understands the payoffs for Stage I, please take a moment to complete the following example. The numbers used in this example were randomly drawn from the same 0 - 100 scale described previously. Click Continue once you have completed the example.

Imagine the A participant positions B1 at 10 and B2 at 80. The marker M1 is at 50 and the marker M2 is at 30. Initially, B1 is matched to M1 and B2 is matched with M2.

Q1. If the A participant does not switch markers, enter the payoffs for each participant:

B1 participant

B2 participant

A participant

Q2. If the A participant instead chooses to switch markers, enter the payoffs for each participant:

B1 participant

B2 participant

A participant

Continue

Quiz: Stage I Information

To make sure that everyone understands the instructions for Stage I, please take a moment to answer the following questions. Once everyone has responded correctly, we will proceed to the first round of Stage I.

1. The three members of your group will be fixed for all rounds of Stage I. ○ False ○ True
2. The B participants will never see their initial randomly assigned markers. ○ False ○ True
3. The A participants will see each marker position with a 20% chance. ○ False ○ True
4. The B participants will know where their A participant has positioned them. ○ False ○ True
5. The A participants will never see both initial marker positions in a round. ○ False ○ True
6. The A participant will make both the *Placement* and *Switch* decisions in each round. ○ False ○ True

Continue