NEIGHBORHOOD INFORMATION EXCHANGE AND VOTER PARTICIPATION: AN EXPERIMENTAL STUDY

BY

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Online Appendix: The NIE Participation Game

This is an extended version of Appendix A.

In this appendix, we formally describe the NIE-participation game and derive quasi-symmetric Nash equilibria for it.

1 THE GAME

The NIE participation game has two stages. We assume an even and equal number of risk neutral players (voters) $N = N_A = N_B$ in each of two groups $i = A, B$. Half of the voters in each group is of the type S (ender), denoted by $j_{i,S}$, $i = A, B$, and the other half of the type R (eceiver), $j_{i,R}$, $i = A, B$. Hence, each group consists of $N_{i,S} = N/2$ senders and $N_{i,R} = N/2$ receivers. Each voter knows her own type.

DEFINITION 1 (neighborhood ϑ)
A neighborhood ϑ is a matched pair of exactly one sender and one receiver.

Denote the neighbor of $j_{i,S}$ by $n(j_{i,S})$ and the neighbor of $j_{i,R}$ by $n(j_{i,R})$. Each voter is member of exactly one neighborhood. Hence, there are *N* neighborhoods in the electorate.

DEFINITION 2 (matching protocol Θ)
We distinguish three matching protocols Θ. The sender and receiver in a neighborhood are either from

1. the same group, $\vartheta \in \Theta_{allies} \Rightarrow [j_{i,S} \in i \Leftrightarrow n(j_{i,S}) \in i] \wedge [j_{i,R} \in i \Leftrightarrow n(j_{i,R}) \in i]$;
2. different groups, $\vartheta \in \Theta_{adversaries} \Rightarrow [j_{i,S} \in i \Leftrightarrow n(j_{i,S}) \quad i] \wedge [j_{i,R} \in i \Leftrightarrow n(j_{i,R}) \quad i]$;
3. an uncertain group, $\vartheta \in \Theta_{uncertain}$, where Θ_{allies} occurs with probability $0 < prob(\Theta_{allies}) < 1$ and $\Theta_{adversaries}$ with $prob(\Theta_{adversaries}) = 1 - prob(\Theta_{allies})$.

All *N* neighborhoods ϑ have the same matching protocol, which is common knowledge. The interpretation of definition 2 is that voters either know with certainty which candidate their neighbor supports (Θ_{allies} and $\Theta_{adversaries}$), or have only probabilistic knowledge ($\Theta_{uncertain}$) about her preferences. In the following, if the matching protocol Θ_m, $m = allies, adversaries, uncertain$, is not explicitly mentioned, a general case valid for all matching protocols will be under consideration.

The following structure and rules of the game are common knowledge to all players. At stage 1 all $N_{A,S} + N_{B,S}$ senders simultaneously decide whether to vote $v^1_{j_{i,S}} = 1$, or abstain, $v^1_{j_{i,S}} = 0$, $i = A, B$, where superscript '1' refers to stage 1. Each receiver $j_{i,R}$ observes (only) the sender $n(j_{i,R})$'s decision and no other voter observes this decision. Senders who turn out to vote at stage

1 have no further decision to make, whereas senders who abstain at stage 1 have to decide again on voting at stage 2.

At stage 2, all $N_{A,R} + N_{B,R}$ receivers and all senders who abstained at stage 1 simultaneously decide whether to vote, $v^2_{j_{i,S}} = 1$; $v_{j_{i,R}} = 1$, or abstain, $v^2_{j_{i,S}} = 0$; $v_{j_{i,R}} = 0$, $i = A, B$, where superscript ‘2’ indicates stage 2 for senders. After all decisions have been made, voters are told the aggregate outcome of the election (the total number of votes cast in each group). No additional information about any other voter’s turnout decision is given.

Aggregate turnout for $i = A, B$, is given by:

$$V_i \equiv \sum\nolimits_{j_{i,S}} \left(v^1_{j_{i,S}} + v^2_{j_{i,S}} \right) + \sum\nolimits_{j_{i,R}} v_{j_{i,R}} \, , \tag{A1}$$

where $v^1_{j_{i,S}} + v^2_{j_{i,S}} \in \{0,1\}$, because senders can cast only one vote. For later use, we define the aggregate turnout of other voters in the same group as sender $j_{i,S}$, or receiver $j_{i,R}$, $i = A, B$, by

$$V_i^{\ j_{i,S}} \equiv V_i - \left(v^1_{j_{i,S}} + v^2_{j_{i,S}} \right); \tag{A2a}$$

$$V_i^{\ j_{i,R}} \equiv V_i - v_{j_{i,R}} \, . \tag{A2b}$$

Revenues (the gross payoff to each member of the winning group) are denoted by w and assumed to be equal for senders and receivers in a group ($w_{j_i} = w_{j_{i,S}} = w_{j_{i,R}}$, $i = A, B$):

$$w_{j_i}\left(V_i, V_{\;i}\right) = \begin{cases} 0 & if \quad V_i < V_{\;i} \\ ½ & if \quad V_i = V_{\;i} \\ 1 & if \quad V_i > V_{\;i} \, , \end{cases} \tag{A3}$$

$i = A, B$, where $-i$ refers to the opposing group. Furthermore, we assume identical participation costs to all voters, independent of type and stage, within the range $c \in (0,1)$, $\forall j_{i,S}$, $\forall j_{i,R}$, $i = A, B$. The common knowledge payoffs (denoted by π) for senders $j_{i,S}$, and receivers $j_{i,R}$, $i = A, B$, are then given by

$$\pi_{j_{i,S}} = w_{j_i}\left(V_i, V_{\;i}\right) - \left(v^1_{j_{i,S}} + v^2_{j_{i,S}} \right) c \, ; \tag{A4a}$$

$$\pi_{j_{i,R}} = w_{j_i}\left(V_i, V_{\;i}\right) - v_{j_{i,R}} c \, . \tag{A4b}$$

In what follows, it will be useful to define the number of senders in group i, who vote at stage 1 by

$$S_i \equiv \sum\nolimits_{j_{i,S}} v^1_{j_{i,S}} \, . \tag{A5}$$

In case of matching protocol Θ_{allies}, S_i is also the number of receivers in i who observe a sender voting at stage 1. For matching protocol $\Theta_{adversaries}$, this number is given by $S_{\;i}$.

2 Nash equilibria

For this game, we derive Nash equilibria. Because of the extensive (but straightforward) computations involved, we only give the general structure of the way in which these are derived.[1] More details are available from the authors. Because notations can become cumbersome, we apply Kuhn's theorem (1953) by analyzing 'behavioral' rather than mixed strategies. This will allow us to consider strategies at each stage separately as opposed to strategies for the complete game.

First, we consider the four situations a voter in group $i = A, B$, facing matching protocol Θ_m, $m = allies,\ adversaries, uncertain$, might be in:

1) a sender deciding on $v^1_{j_{i,S}}(\Theta_m)$ at stage 1;
2) a sender having abstained at stage 1, $v^1_{j_{i,S}}(\Theta_m) = 0$, and deciding on $v^2_{j_{i,S}}(\Theta_m)$ at stage 2;
3a) a receiver deciding on $v_{j_{i,R}}(v^1_{n(j_{i,R})} = 0, \Theta_m)$ at stage 2 after observing her neighbor abstaining at stage 1;
3b) a receiver deciding on $v_{j_{i,R}}(v^1_{n(j_{i,R})} = 1, \Theta_m)$ at stage 2 after observing her neighbor voting at stage 1.

Behavioral strategies for each of these situations are, respectively, the probabilities:

1) $s_{j_{i,S}}(\Theta_m)$ that $v^1_{j_{i,S}}(\Theta_m) = 1$; (A6a)
2) $a_{j_{i,S}}(\Theta_m)$ that $v^2_{j_{i,S}}(\Theta_m) = 1$; (A6b)
3a) $a_{j_{i,R}}(\Theta_m)$ that $v_{j_{i,R}}(v^1_{n(j_{i,R})} = 0, \Theta_m) = 1$; (A6c)
3b) $t_{j_{i,R}}(\Theta_m)$ that $v_{j_{i,R}}(v^1_{n(j_{i,R})} = 1, \Theta_m) = 1$. (A6d)

A voter will vote with probability 1 if the expected benefits minus the costs c are higher than the expected benefits from abstention. She will mix when the two are equal. This yields the following four turnout conditions (A7)-(A10) for the situations distinguished.

CONDITION 1 (senders, stage 1):
Sender $j_{i,S}$ will vote with probability 1 at stage 1 ($s_{j_{i,S}}(\Theta_m) = 1$) iff

$$Exp_{strat_1}\left[Exp_{strat_2}\left[\pi_{j_{i,S}} \middle| v^1_{j_{i,S}}(\Theta_m) = 1\right]\right] \ > \ Exp_{strat_1}\left[Exp_{strat_2}\left[\pi_{j_{i,S}} \middle| v^1_{j_{i,S}}(\Theta_m) = 0\right]\right],$$

where expectation operators are due to (i) strategic uncertainty about others' decisions at stage 1 ($strat_1$); and (ii) strategic uncertainty about others' decisions at stage 2 ($strat_2$), given the number of votes at stage 1 in each group. Elaborating gives:

$$\sum_{S_i=1}^{N/2} \sum_{S_{-i}=0}^{N/2} prob[S_i]prob[S_{-i}] \times \left[prob\left[V_i^{-j_{i,S}} + 1 > V_{-i} \middle| (\Theta_m, S_i, S_{-i})\right] + \frac{1}{2} prob\left[V_i^{-j_{i,S}} + 1 = V_{-i} \middle| (\Theta_m, S_i, S_{-i})\right]\right] - c$$

[1] Given the results in Goeree and Holt (forthcoming) and Cason and Mui (2003), it would also be interesting to derive logit equilibria for this game. The game is too complex to derive these, however.

$$> \sum_{S_i=0}^{N/2-1} \sum_{S_{-i}=0}^{N/2-0} prob[S_i]prob[S_{-i}] \times \left[prob\left[V_i^{-j_{i,S}} > V_i \middle| (\Theta_m, S_i, S_{-i})\right] + \frac{1}{2} prob\left[V_i^{-j_{i,S}} = V_{-i} \middle| (\Theta_m, S_i, S_{-i})\right]\right] - v_{j_{i,S}}^2 c, \qquad \text{(A7)}$$

$i = A, B$, for $m = allies, adversaries$. The $prob[S]$ terms in (A7) refer to the stage 1 votes by senders in the two groups.[2] The first term after the multiplication operator on the left (right) hand side of the inequality describes the probability that this sender's group *i* will win the election if she votes (abstains) and the second term describes the probability that *i* will tie the election if $j_{i,S}$ votes (abstains) at stage 1. Note that, in case of abstention at stage 1, the sender still has to account for possible costs at stage 2.

CONDITION 2 (senders, stage 2): Similarly, sender $j_{i,S}$ will vote with probability 1 at stage 2 iff the expected payoff of turnout is higher than that of abstention:

$$\sum_{S_i=0}^{N/2-1} \sum_{S_{-i}=0}^{N/2-0} prob[S_i]prob[S_{-i}] \times \left[prob\left[V_i^{-j_{i,S}} + 1 > V_{-i} \middle| (\Theta_m, v_{j_{i,S}}^1 = 0, S_i, S_{-i})\right] + \frac{1}{2} prob\left[V_i^{-j_{i,S}} + 1 = V_{-i} \middle| (\Theta_m, v_{j_{i,S}}^1 = 0, S_i, S_{-i})\right]\right] - c$$

$$> \sum_{S_i=0}^{N/2-1} \sum_{S_{-i}=0}^{N/2-0} prob\,[S_i]prob\,[S_{-i}] \times \left[prob\left[V_i^{-j_{i,S}} > V_{-i} \middle| (\Theta_m, v_{j_{i,S}}^1 = 0, S_i, S_{-i})\right] + \frac{1}{2} prob\left[V_i^{-j_{i,S}} = V_{-i} \middle| (\Theta_m, v_{j_{i,S}}^1 = 0, S_i, S_{-i})\right]\right],$$

$i = A, B$, for $m = allies, adversaries$. Rearranging gives

$$\sum_{S_i=0}^{N/2-1} \sum_{S_{-i}=0}^{N/2-0} prob[S_i]prob[S_{-i}] \times \left[prob\left[V_i^{-j_{i,S}} + 1 = V_{-i} \middle| (\Theta_m, v_{j_{i,S}}^1 = 0, S_i, S_{-i})\right] + prob\left[V_i^{-j_{i,S}} = V_{-i} \middle| (\Theta_m, v_{j_{i,S}}^1 = 0, S_i, S_{-i})\right]\right] > 2c. \qquad \text{(A8)}$$

CONDITION 3a (receivers at stage 2 after observing abstention): Given $v_{n(j_{i,R})}^1 = 0$, the expected payoff from voting exceeds that from abstention when:

$$\sum_{S_i=0}^{N/2-x} \sum_{S_{-i}=0}^{N/2-y} prob\,[S_i]prob\,[S_{-i}] \times \left[prob\left[V_i^{-j_{i,R}} + 1 > V_{-i} \middle| (\Theta_m, v_{n(j_{i,R})}^1 = 0, S_i, S_{-i})\right] + \frac{1}{2} prob\left[V_i^{-j_{i,R}} + 1 = V_{-i} \middle| (\Theta_m, v_{n(j_{i,R})}^1 = 0, S_i, S_{-i})\right]\right] - c$$

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[2] Note that $S_i \in \{1,..., N/2\}$ if a sender participates at stage 1 and $S_i \in \{0,..., N/2\}$ if she abstains. This is reflected in the summation in (eq. A7).

$$> \sum_{S_i=0}^{N/2-x} \sum_{S_{-i}=0}^{N/2-y} prob\,[S_i]prob\,[S_{-i}] \times \left[prob\left[V_i^{-j_{i,R}} > V_{-i} \middle| \left(\Theta_m, v^1_{n(j_{i,R})} = 0, S_i, S_{-i}\right) \right] + \frac{1}{2} prob\left[V_i^{-j_{i,R}} = V_{-i} \middle| \left(\Theta_m, v^1_{n(j_{i,R})} = 0, S_i, S_{-i}\right) \right] \right],$$

$i = A, B$, where $x = 1$; $y = 0$ for $m = allies$, and $x = 0$; $y = 1$ for $m = adversaries$.[3] Rearranging gives

$$\sum_{S_i=0}^{N/2-x} \sum_{S_{-i}=0}^{N/2-y} prob[S_i]prob[S_{-i}] \times \left[prob\left[V_i^{-j_{i,R}} + 1 = V_{-i} \middle| \left(\Theta_m, v^1_{n(j_{i,R})} = 0, S_i, S_{-i}\right) \right] + prob\left[V_i^{-j_{i,R}} = V_{-i} \middle| \left(\Theta_m, v^1_{n(j_{i,R})} = 0, S_i, S_{-i}\right) \right] \right] > 2c. \quad \text{(A9)}$$

CONDITION 3b (stage 2): (receivers at stage 2 after observing a vote): Given $v^1_{n(j_{i,R})} = 1$, the expected payoff from voting exceeds that from abstention when:

$$\sum_{S_i=x}^{N/2} \sum_{S_{-i}=y}^{N/2} prob[S_i]prob[S_{-i}] \times \left[prob\left[V_i^{-j_{i,R}} + 1 > V_{-i} \middle| \left(\Theta_m, v^1_{n(j_{i,R})} = 1, S_i, S_{-i}\right) \right] + \frac{1}{2} prob\left[V_i^{-j_{i,R}} + 1 = V_{-i} \middle| \left(\Theta_m, v^1_{n(j_{i,R})} = 1, S_i, S_{-i}\right) \right] \right] - c$$

$$> \sum_{S_i=x}^{N/2} \sum_{S_{-i}=y}^{N/2} prob[S_i]prob[S_{-i}] \times \left[prob\left[V_i^{-j_{i,R}} > V_{-i} \middle| \left(\Theta_m, v^1_{n(j_{i,R})} = 1, S_i, S_{-i}\right) \right] + \frac{1}{2} prob\left[V_i^{-j_{i,R}} = V_{-i} \middle| \left(\Theta_m, v^1_{n(j_{i,R})} = 1, S_i, S_{-i}\right) \right] \right],$$

$i = A, B$, where $x = 1$; $y = 0$ for $m = allies$, and $x = 0$; $y = 1$ for $m = adversaries$.[4] Rearranging gives

$$\sum_{S_i=x}^{N/2} \sum_{S_{-i}=y}^{N/2} prob[S_i]prob[S_{-i}] \times \left[prob\left[V_i^{-jR} + 1 = V_{-i} \middle| \left(\Theta_m, v^1_{n(j_{i,R})} = 1, S_i, S_{-i}\right) \right] + prob\left[V_i^{-j_{i,R}} = V_{-i} \middle| \left(\Theta_m, v^1_{n(j_{i,R})} = 1, S_i, S_{-i}\right) \right] \right] > 2c \quad \text{(A10)}$$

The conditions for $\Theta_{uncertain}$ are a probability mix of the respective conditions with probabilities $prob(\Theta_{allies})$ and $prob(\Theta_{adversaries})$. This gives a game of incomplete information.

Next, we define the equilibria considered for this NIE participation game.[5]

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[3] In *allies*, $S_i \in \{0,...,N/2-1\}$ because i observed a stage 1 abstention in the own group. Similarly $S_{-i} \in \{0,...,N/2-1\}$ in *adversaries*.

[4] Now, i observes a stage 1 vote, so $S_i \in \{1,...,N/2\}$ in *allies* and $S_{-i} \in \{1,...,N/2\}$ in *adversaries*.

[5] It is common to focus on quasi-symmetric equilibria for participation games (*e.g.*, Palfrey and Rosenthal, 1983). Dropping quasi-symmetry yields a plethora of Nash equilibria with no obvious refinements to guide predictions.

DEFINITION 3 (Quasi-symmetric equilibrium)
An equilibrium in behavioral strategies in the NIE participation game is quasi-symmetric if it holds that:

$$s_{j_{i,S}} = s_{h_{k,S}} \equiv s \in [0,1],\ \forall j_{i,S},\ h_{k,S},\quad i,k = A,B,$$
$$a_{j_{i,S}} = a_{h_{k,S}} \equiv a_S \in [0,1],\ \forall j_{i,S},\ h_{k,S},\quad i,k = A,B,$$
$$a_{j_{i,R}} = a_{h_{k,R}} \equiv a_R \in [0,1],\ \forall j_{i,R},\ h_{k,R},\quad i,k = A,B, \text{ and}$$
$$t_{j_{i,R}} = t_{h_{k,R}} \equiv t \in [0,1],\ \forall j_{i,R},\ h_{k,R},\quad i,k = A,B. \qquad \text{(A11)}$$

In words, all voters in any particular decision situation play the same behavioral strategy, independent of the group they are in. This reduces our equilibrium analysis to four strategies. The equilibrium is denoted by 'quasi-symmetric' because strategies are not limited to be symmetric across players in different positions.

PROPOSITION (Quasi-symmetric Nash equilibria in pure strategies):
(*i*) If $c > 1/2$, the only Nash equilibrium is where nobody votes: $v^1_{j_{i,S}}(\Theta_m) = 0$, $v^2_{j_{i,S}}(\Theta_m) = 0$, $v_{j_{i,R}}(v^1_{n(j_{i,R})} = 0, \Theta_m) = 0$, $v_{j_{i,R}}(v^1_{n(j_{i,R})} = 1, \Theta_m) = 0$, $\forall j_{i,S}$, $\forall j_{i,R}$, $i = A,B$, $m = allies, adversaries,\ uncertain$.
(*ii*) If $c < 1/2$, the only Nash equilibria in pure strategies are where everybody votes: $\left[v^1_{j_{i,S}}(\Theta_m) = 1 \wedge v^2_{j_{i,S}}(\Theta_m) = 0\right] \vee \left[v^1_{j_{i,S}}(\Theta_m) = 0 \wedge v^2_{j_{i,S}}(\Theta_m) = 1\right], v_{j_{i,R}}(v^1_{n(j_{i,R})} = 0, \Theta_m) = 1$, and $v_{j_{i,R}}(v^1_{n(j_{i,R})} = 1, \Theta_m) = 1$, $\forall j_{i,S}$, $\forall j_{i,R}$, $i = A,B$, $m = allies, adversaries, uncertain$.

Proof (straightforward application of Palfrey and Rosenthal, 1983, for equal group sizes).

To find quasi-symmetric equilibria in behavioral strategies (separately for the distinct information conditions Θ_m), first the decision at stage 2 is elaborated (backwards induction), using conditions (A8), (A9) and (A10) stated as equalities. The probabilities in these equations are tedious but straightforward combinations of binomials using the probabilities defined in definition 3. This gives three equations for the four probabilities s, a_S, a_R, and t. Senders at stage 1 anticipate the best responses implicit in these equations and will mix with a probability s that equates the expected value of voting and abstaining (eq. A7), once again involving a combination of binomials. This gives a fourth equation for the four probabilities.
For the parameters of our experiments (*cf.* section 2), we can derive these quasi-symmetric Nash equilibria for the stage game. Normalizing revenue to lie between 0 and 1, we have $c = 1/3$. Following the proposition, we conclude that everyone casting a vote (with senders casting it either at stage 1 or at stage 2) is a Nash equilibrium in pure strategies[6]. For $m = allies$ and $m = adversaries$, the quasi-symmetric equilibria in behavioral strategies[7] for the stage game are given in table 2. For $m = uncertain$, no such equilibria exist. Using backwards induction, these equilibria hold for each round, in partners and strangers.[8] Table A1 presents the equilibria in behavioral strategies.

[6] This is easy to confirm for the parameters chosen. A unilateral deviation from 100% turnout saves 1 token but decreases the expected revenue from 2.5 to 1.
[7] In some cases, some voters do not mix in equilibrium.
[8] We abstract from coordination on Pareto dominant equilibria by means of punishment by playing the inefficient pure strategy equilibrium where everybody participates.

Note that there are two equilibria for $m = allies$.[9] Moreover, equilibria are the same for partners and strangers. Table A1 shows that expected overall participation is higher for *adversaries* (.904) than for *allies* (.652 and .848). Uninformed provides the lowest (.107) and a very high (.893) expected turnout, which makes it difficult to formulate comparative statics predictions vis-à-vis the informed cases. For informed, a comparison of equilibria does provide such predictions, however. In the equilibria for *allies*, senders participate at substantially higher rates than receivers in both equilibria (1 *vs*. .303 and 1 *vs*. .697), whereas they participate at equal rates (.904) in the equilibrium for *adversaries*. Also, note that in all cases, in equilibrium, senders participate at higher rates at stage 2 than at stage 1. Note that stage 2 participation rates are defined as the fraction of senders that abstained at stage 1. As a fraction of all senders, participation is higher at stage 1 than at stage 2 in *allies* (.791 *vs*. .209 and .689 *vs*. .311), and higher at stage 2 in *adversaries* (.406 *vs*. .498). Finally, equilibrium participation by receivers is higher after observing abstention than after observing a sender casting a vote. The difference is largest for *allies*.

We use these results in section 2, to derive comparative static predictions for our treatments.

TABLE A1: QUASI-SYMMETRIC NASH EQUILIBRIA IN BEHAVIORAL STRATEGIES

Treatment		***s***	a_S	**Expected turnout senders**	***T***	a_R	**Expected turnout receivers**	**Expected turnout**
Informed	*allies*	.791	1	1	.119	1	.303	.652
		.689	1	1	.560	1	.697	.848
	adversaries	.406	.839	.904	.764	1	.904	.904
	uncertain	–						
Uninformed		.107 or .893*						

Strategies: $s =$ senders at stage 1; $a_S =$ senders at stage 2; $t =$ receivers after observing participation, $a_R =$ receivers after observing abstention.

*Any combination of probabilities s and a_S that yields $s + (1-s)a_S$ = .107 or .893 is an equilibrium.

[9] The two equilibrium strategies for receivers are also a ‘low’ (.303) and ‘high’ (.697) equilibrium in the standard participation game (Palfrey and Rosenthal, 1983) with the same voting costs but two groups of equal size 3. This is intuitive, since all 6 senders vote with probability 1 in allies, hence creating a tie and the remaining receivers play a participation game of three against three.

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Online Appendix: Translation of instructions for treatment IP [*IS*, *US*]

Welcome to our experiment on decision-making. Depending on your *own choices* and the *choices of other participants*, you may earn money today. Your earnings in the experiment are expressed in *tokens*. 4 tokens are worth one Guilder. At the end of the experiment your total earnings in tokens will be exchanged into Guilders and paid to you in cash. The payment will remain *anonymous*. No other participant will be informed about your payment.

Please remain quiet and do not communicate with other participants during the entire experiment. Raise you hand if you have any question. One of us will come to you to answer them.

Rounds, 'your group' and the 'other group'

The experiment consists of *99 rounds*. At the *beginning of the experiment* the computer program will randomly split all participants into two different *populations* of 12 participants. In addition, at the *beginning of the experiment* the computer program will randomly divide the participants in each population into *two groups* of 6 participants [*IS and US: At the beginning of each round (...)*]. The group you are part of will be referred to as *your group* and the group in your population which you are not part of will be called the *other group*. Note that you will remain in the same population *and* group in the whole experiment [*IS and US: Note that you will remain in the same population in the whole experiment. However, in each round participants in your electorate will be reallocated to groups.*]. You will not know which of the participants belongs in the other group and which to your group. You will have nothing to do with participants in the other population in this experiment. [*Additionally in IS and US: No matter what round you are in, the number of participants in the other group is always 6 and the number of participants in your group is also always 6 (12 in total).*]

Types 'sender' and 'receiver'

At the *beginning of the experiment* the computer program will randomly appoint all participants to be either *sender* or *receiver*. Each participant has the same chance of 50% to be a sender and 50% to be a receiver. However, the computer program arranges it such that each population has 6 senders and 6 receivers. You will be told whether you are a sender or a receiver at the start of the experiment. **Your type sender or receiver will not change during the entire experiment.** When groups are formed at the start of the experiment [*IS and US: at the start of a round*] the computer program will also ensure that there are exactly 3 senders and 3 receivers in each group.

The following table shows the number of senders and receivers in each group.

	Number of senders	*Number of receivers*	*Total number*
Other group	**3**	**3**	6
Your group	**3**	**3**	6

Table: *Senders and receivers in the other group and in your group.*

Matching of senders and receivers [*not for US*]

At the start of *each round* the computer program will randomly match *one* sender and *one* receiver to each other. Hence, if you are a sender you will be connected to one receiver and if you are a receiver you will be connected to one sender. **Note that couples will be rematched at the start of each round.**

Three situations [*not for US*]

At the start of *each round* the computer program will randomly determine *one* of the following three *situations* (each situation has the same chance of 1/3 of being chosen):

All senders and receivers who are matched with each other are from the

1. *same* group (the other group *or* your group),
2. *different* groups (the other group *and* your group), or
3. *unknown* groups (with a chance of 50% from the same group and with a chance of 50% from different groups).

The chosen situation in a round applies to *all* participants, senders and receivers, in a population. Hence, within a round it cannot be the case that some participants in a population are in a different situation than other participants in the same population. Which of the three situations applies will be announced to you and all other participants at the *start of each round*.

[A summary is given of the most important points so far]
Part 1 and part 2 of a round and choices

Each round will consist of two parts: *part 1* and *part 2*. In each round choices will have to be made. We now explain the choices, which of the participants will be asked to make choices, and when they are made.

Choices part 1:

In *part 1* of *each* round *only* senders will be asked to make choices. Receivers will not make a choice yet. *Each* sender will face an identical choice problem. They will be asked to make *one choice*. Senders can choose between the following two alternatives:

- '*Choice A*': no costs involved (**0 tokens**).
- '*Choice B*': costs are **1 token**.

After *all* senders have made a choice in *part 1*, *each* receiver will be informed about the choice, however, *only* about the one made by the sender connected to her or him. Only the receiver will receive information about the sender in the same couple. Beyond that, no one gets any information about choices by others. [*This paragraph is not used in US; instead: This choice is private, no other participant is informed about it.*]

Senders choosing choice *B* in part *1* are not asked to make a choice in part *2*. Senders choosing choice *A* in part *1* will be asked to make a choice in part *2* as well.

Choices part 2:

In *part 2* of *each round*, *all* senders choosing *A* in part *1* *and* *all* receivers will be asked to make choices. Each of these participants will face an identical choice problem. They will be asked to make *one choice*. Like in part *1* they will choose between the following two alternatives:

- '*Choice A*': no costs involved (**0 tokens**).
- '*Choice B*': costs are **1 token**.

The choices in part *2* will not be announced to anyone. Hence, in part *2* receivers are *not* informed about the choice of the sender with whom they are connected. **Note that each receiver will only get information in part 1 about the choice of the sender connected to her or him, not in part 2. Senders will never get information about the choices of others.** [*This paragraph is not used in US; instead: the individual choices in part 2 are not announced to anyone either.*]

Earnings

After *all* participants in part *2* have made their choices, the computer program will count the number of *B*-choices per group *in both parts*, part *1 and* part *2*, and will compare the numbers in both groups. There are **3** possible outcomes that are relevant for your *revenue* in the following way. You will receive the revenue irrespective of the choice you made and whether you are a sender or a receiver.

(1) The number of *B*-choices in your group **exceeds** the number of *B*-choices in the other group. In this case *each* participant in your group (inclusive yourself) will get a revenue of **4 tokens**. *Each* participant in the other group will get **1 token**.
(2) The number of *B*-choices in your group **is smaller than** the number of *B*-choices in the other group. In this case *each* participant in your group (inclusive yourself) will get a revenue of **1 token**. *Each* participant in the other group will get **4 tokens**.
(3) The number of *B*-choices in your group **is equal to** the number of *B*-choices in the other group. In this case the computer program will randomly determine the group in which *each* participant gets a revenue of **4 tokens** (each group has the same chance of 50% of being chosen). *Each* participant in the group that is not chosen will get **1 token**.

Your *round earnings* are calculated in the following way: *round earnings = round revenue – round costs*. Your *total earnings* are the sum of all of your round earnings.

The following table gives your possible round earnings:

Your possible round earnings:

Your choice	*Your group has more B-choices*	*Your group has less B-choices*	*Equal number of B-choices in both groups*
Choice *A*	**4 tokens**	**1 token**	**4** *or* **1 token** (50% chance each)
Choice *B*	**3 tokens**	**0 token**	**3** *or* **0 token** (50% chance each)

Computer screen

The computer screen has four main windows.
(1) The *Status* window shows your *type sender or receiver*, the actual *round number*, *part 1 or part 2*, and the *total earnings* up to the previous round.

(2) The ***Previous round*** window depicts the following information about the previous round:

- (a) The *situation*, regarding the matching between sender and receiver [*not for US*].
- (b) If you are a receiver, the *choice in part 1(in the previous round) of the sender who is connected to you* [*not for US*].
- (c) The number of *B-choices in your group*.
- (d) The number of *B-choices in the other group*.
- (e) Your *choice*.
- (f) Your *revenue*.
- (g) Your *costs*.
- (h) Your *round earnings*.

(3) In the ***Choice*** window you will find two *buttons*. Press the button "Choice *A*" or the button "Choice *B*" with the mouse, or press the key "*A*" or "*B*". When you have chosen you will have to wait until all participants have made their choices. If you are a receiver, this window will also inform you about the choice in part *1* in the actual round of the sender you are connected to [*this sentence not for US*].

(4) The ***Result*** window shows the result of the *actual* round (both part *1* and part *2*). This happens after each participant in part *2* has made a choice. Each *yellow* rectangle shown represents one *B*-choice of your group and each *blue* rectangle represents one *B*-choice of the other group. After a few seconds the result will also appear in numbers.

At the upper bound of the screen you will find a ***Menu bar***. You can use this to access the ***Calculator*** and ***History*** functions. The calculator can be handled with the number pad at the right side of your keyboard or with the mouse buttons. The function 'history' shows all information of the last *sixteen* rounds as this had appeared in the window 'Previous round'. At the lower bound of your screen the ***Information bar*** is located. There you are told the actual status of the experiment.

Further procedures

Before the 99 rounds of the experiment start, we will ask you to participate in ***three training-rounds***. You will have to answer questions in order to proceed further in these training-rounds. In the training-rounds you are not matched with other participants but with the computer program. **You cannot draw conclusions about choices of other participants based on the results in the training-rounds.** The training-rounds will not count for your payment.

We will now start with the three trainings-rounds. If you have any questions, please raise then your hand. One of us will come to you to answer them.