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On the Effects of Group Identity in Strategic Environments*

Chloé Le Coq† James Tremewan‡ Alexander K. Wagner§

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Abstract

We examine differences in behavior between subjects interacting with a member of either the same or different identity group in both a centipede game and a series of stag hunt games. We find evidence that subjects interacting with outgroup members are more likely to behave as though best-responding to uniform randomization of the partner. We conclude that group identity not only affects a player's social preferences, as identified in earlier research, but also affects the decision making process, independent of changes in the utility function.

Keywords: Group identity; centipede game; stag hunt game; experiment
JEL-Classification: C72, C91, C92, D83

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1 Introduction

It is well established that group identity manipulations can increase altruism, positive reciprocity and the desire for maximizing social welfare among ingroup partners, even when group assignment is based on arbitrary criteria (for an overview, see Chen and Li, 2009; Chen and Chen, 2011; Goette et al., 2012a,b). In this paper, we consider the possibility that group identity affects not only preferences, but also affects a player's decision making through the underlying belief-formation process or belief-action correspondence. This idea shares some relationship with the concept of social projection in psychology (Robbins and Krueger, 2005; Acevedo and Krueger, 2005; Ames et al., 2011), but has not received attention in the economics literature.

We report the results of two separate experiments which reveal that people interacting with outgroup partners in strategic interactions are, ceteris paribus, more likely to behave as though their opponent is behaving randomly. We show that this effect can augment, diminish, or even reverse the impact of group identity on social preferences, and in the latter case can result in counter-intuitive outcomes, for example, outcomes contrary to predictions of standard preference-driven models of group identity.

Our first experiment was originally designed to examine the impact of social preferences on behavior in the centipede game. Participants were assigned to almost "minimal groups" according to their preferences over paintings (following Chen and Li, 2009) and interacted with ingroup or outgroup members. Following the social-preference hypothesis, our prior was that increased altruism, positive reciprocity and the desire for maximizing social welfare would lead to pairs from the same identity group to continuing longer and reaching more efficient outcomes. However, we found that the opposite was the case, with pairs from different groups (outgroups) continuing longer. The explanation we found for this counter-intuitive result was that subjects were more likely to act as though the behavior of outgroup members was random, compared to behavior when facing ingroup members. This could occur either because subjects form different beliefs about the strategic sophistication of outgroup members or feel less able to predict their behavior. With the exponentially-increasing payoffs in the centipede game, the best response to uniform randomization of the opponent is to choose continue.

We implemented a follow-up experiment (Experiment 2), applying the same group identity manipulation in a series of extended stag hunt games, to further test the explanations of behavior suggested by the results in the centipede game (Experiment 1). Experiment 2 allowed us to test our explanation independently using new data, and importantly, without relying on stated beliefs of participants. Confirming our initial results, we again found that subjects interacting with outgroup members were more likely than those interacting with ingroup members to choose strategies which were best responses to uniform randomization (BRUR) by their partner.

Results across two experiments point at two intuitive interpretations for why subjects behave as if outgroup members are treated as acting randomly. In the first, outgroups are seen as being genuinely strategically unsophisticated in comparison with ingroup members, thus raising an individuals self-esteem. Alternatively, subjects may feel less able to predict outgroup behavior and, having no idea about what they will do, apply the principle of insufficient reason and assign equal probability to all possible actions.

As an additional test of our findings, we elicited participants' beliefs about the behavior of their opponents in both experiments and found differences in the treatment effects across experiments. In Experiment 1, we found no treatment effect between elicited beliefs but support for changes in the belief-action correspondence between group affiliation treatments. In Experiment 2, there was a significant treatment effect, suggesting that the group identity manipulation also affected the belief-formation process itself. These conflicting findings suggest our belief data is not sufficiently reliable to distinguish between the interpretations described in the previous paragraph, but add to the emerging discussions on biases in belief elicitation (e.g. Schlag et al., forthcoming; Schotter and Trevino, 2014) and on the underlying relationship between (ex-post) stated beliefs and behavior in strategic interactions (e.g. Costa-Gomes and Weizsäcker, 2008; Rubinstein and Salant, 2014).

Overall, our insights contribute to the understanding of the effects of group identity in strategic interactions, and more specifically, fully explain a number of puzzling empirical and experimental observations in bargaining and market environments. Graddy (1995), for example, showed that white fishmongers charge less to Asian customers (in take it or leave it offers); Ayres (1991) found that test buyers get worse deals from car salespeople of same gender or race. A recent experimental study closely related to our work is Li et al. (2011) who also use group identity manipulations to study seller-buyer relationships in oligopolistic markets. Their results show that sellers charge lower prices to buyers of the other group than of the same group and is consistent with our results of an uncertainty-driven discrimination if salespeople are less certain about the relevant outgroups' bargaining strategy than that of ingroups. Increased uncertainty regarding outgroup behavior also provides an explanation of why employers are often less willing to hire people of different gender or ethnic groups, even in the absence of any preference for discrimination.

2 Experiment 1: centipede game

The study was designed to investigate the role of social preferences on behavior in the centipede game.[1] To this end, we used a seven-legged centipede game with exponentially-

[1]The centipede game, has attracted much attention both in the theoretical and experimental game theory literature. It has been repeatedly demonstrated in experimental studies, however, that the game

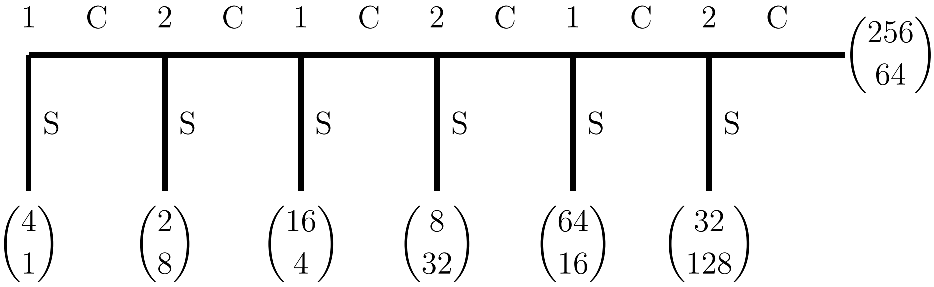


Figure 1: Centipede game with exponentially-increasing payoffs (Experiment 1).

increasing payoffs, as depicted in Figure 1. In this game, two players (labelled neutrally as player type 1 and 2 respectively) alternately faced the decision to continue or stop, $a \in \{C, S\}$, until one of them chooses stop, which ends the game, or player 2 chooses C at the final node. The unique subgame-perfect Nash equilibrium is such that players choose to stop at each of their decision nodes, the game thus ending at the first node.

If group identity increases reciprocity, a natural hypothesis is that subjects playing with an ingroup member are more likely to continue at any given decision node compared to subjects interacting with an outgroup member. Theoretically, increased altruism and concerns for social-welfare maximization would make players continue longer by making later nodes relatively more attractive; positive reciprocity would also lead to continue longer as players repay the favor of continuing by doing likewise.[2] This can be summarized in the following hypothesis.

Hypothesis 1. *Participants in the ingroup treatment are more likely to choose continue at any given node than those in the outgroup treatment.*

is rarely terminated at the first node, the unique subgame-perfect Nash equilibrium in the game. Most of the literature has argued that the systematic deviations from the subgame-perfect equilibrium outcome result from some form of bounded rationality (Rosenthal, 1981; Aumann, 1995, 1998). Boundedly rational explanations of behavior in the experimental literature on the centipede game include quantal response equilibria (Fey et al., 1996; McKelvey and Palfrey, 1998), learning (Nagel and Tang, 1998; Rapoport et al., 2003), varying abilities to perform backward induction or limited depths of reasoning (Palacios-Huerta and Volij, 2009; Levitt et al., 2011; Gerber and Wichardt, 2010; Kawagoe and Takizawa, 2012; Ho and Su, 2013). With the exception of McKelvey and Palfrey (1992) and Fey et al. (1996), who allow for altruistic behavior, none of these papers has explicitly tested for the possible import of social preferences in the centipede game.

[2] McKelvey and Palfrey (1992) and Fey et al. (1996) provide formal theoretical models for the case of altruism. In both the imperfect information model in the former paper, and the AQRE model in the latter, a higher proportion of altruists increases the probability of the game ending at later nodes.

2.1 Design

The experiment was divided into four parts: a group identity task, participation in a centipede game, elicitation of beliefs regarding the partner's behavior, and a post-experiment questionnaire.

Part 1. Following the procedure in Chen and Li (2009), we used a modified version of the "minimal group paradigm" of Tajfel and Turner (1979) to induce group identity among participants. In this paradigm, group membership is constructed from artificial contexts to prevent any reasonable association of particular group membership with ability, social preferences, or the like. Participants stated their preferences over five pairs of paintings in this task, with each pair consisting of one painting by Paul Klee and one by Wassily Kandinsky. The identities of the painters were not revealed to participants at this stage. Based on their relative preferences, half of the participants (12 out of 24 per session) were assigned to the "Klee group" and the other half to the "Kandinsky group". The group assignment remained fixed for the course of the experiment. After the group assignment, participants had to guess who of the two painters created two additional paintings. To enhance the effect of group identity, participants were given the possibility of communicating within their own group via a chat program. Participants were incentivized with 10 points for each correct guess. Participants received no feedback on performance until all decision-making parts of the experiment were completed.

Part 2. Before the start of the centipede game, depicted in Figure 1, participants were informed about their player type (I or II) which was drawn randomly. Treatment allocation for each session was random, with half of the participants matched with a member of the same group (*ingroup* treatment) and the other half with a member of the other group (*outgroup* treatment). We used the strategy method (see, e.g. Brandts and Charness, 2011) to elicit participants' strategies as we were interested in the full strategy vector and not only the outcome.[3] A participant chose continue/stop at each of her three nodes sequentially, from left to right. The current decision node was highlighted on screen, see screenshot in C.2. Participants were informed that they would not learn the decisions of their respective matching partner until all decisions were made in all parts.[4]

[3] Kawagoe and Takizawa (2012) find no difference in behavior between the direct-response and strategy method implementation of the game. Consult Brandts and Charness (2011) for a comparison of these two methods over many studies.

[4] Note that participants played a second identical centipede game, but with a subject drawn from the opposite group as in the first game. We decided against using the observations of the second game in the analysis because of order effects. A two-sided Wilcoxon rank-sum test for the outgroup data rejects the hypothesis that strategies chosen by subjects playing an outgroup member in the first game are drawn from the same distribution as strategies chosen by subjects playing an outgroup member in the second game (p-value $= 0.058$). The same test for ingroup data was insignificant (p-value $= 0.160$). We speculate that the order effect is due to subjects "anchoring" on their initial choice (54 out of 96 subjects chose an identical strategy in both game).

Part 3. We elicited participants' beliefs about the population behavior of their matched partner types. More specifically, participants guessed how many out of 12 players (all of whom are playing in the role of their respective matching partner in the game) chose "stop" at each of their three decision nodes. Similar to the presentation of decision nodes in part 2, the elicitation method was implemented sequentially for each node (see C.2). A prize of 100 points was paid for a correct guess.[5] Participants learned about the task only after making their own decisions so as not to influence behavior in the actual games. After all decisions in part 3 were made, a matching partner for the game was randomly drawn to determine the game's outcome and participants were informed about their performance in the all parts of the experiment.

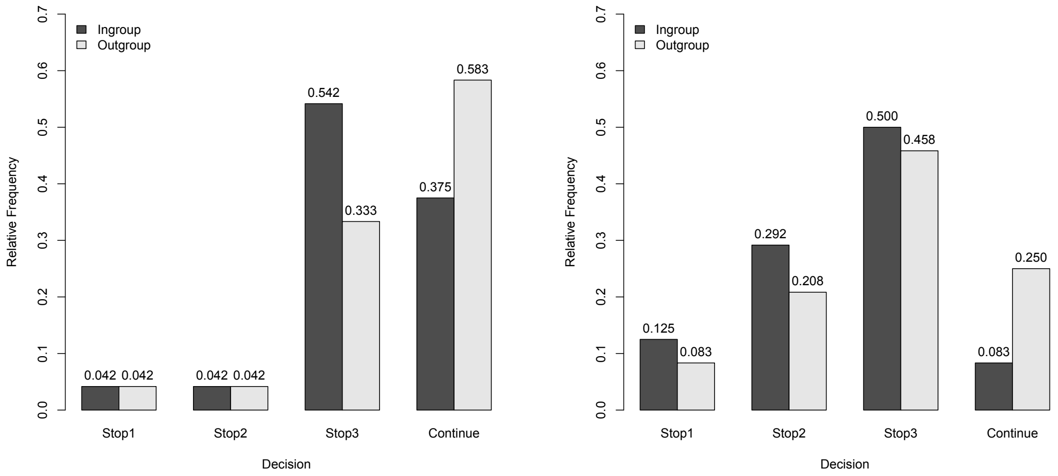
Part 4. Participants completed a short post-experiment questionnaire.

Procedures. The experiment was programmed and conducted using z-Tree (Fischbacher, 2007). Sessions took place in Lakelab, the experimental economics laboratory at the University of Konstanz. Participants were student volunteers recruited from the subject pool of the University; economics and psychology students were excluded from participation. Each subject participated in only one session. We conducted 4 sessions, each comprised of 24 participants (96 participants in total). After the experimenter read out the rules for participation, subjects received a set of written instructions about the general procedure of the experiment (see C.1 for the instructions). At the end of a session, points earned across all experimental parts were added up and converted into Euros at an exchange rate of 20 Points = 1 Euro. In addition, each participant was given a 3 Euro show-up fee. Sessions lasted 45 minutes (including time for payment) and participants earned between 4.25 and 20 Euros (8.60 on average), paid out privately at the end of the experiment.

2.2 Results

We start by summarizing the players' strategies, separated by player roles, in Figure 2. The distribution of strategies does appear to be different between treatments, with subjects stopping earlier in ingroup than in outgroup interactions. Indeed, the modal decision for players, pooling data across player roles, is to stop at the third decision node in the ingroup treatment and to always continue in the outgroup treatment. This evidence is also reflected by the fact that the distribution of stopping nodes differs weakly between treatments when pooling over player roles (two-sample Wilcoxon rank-sum, p-value = 0.087). The distribution of outcomes shows that the treatment differences, that do exist in behav-

[5]It is well known that this method elicits beliefs about the modal action. Hurley and Shogren (2005) and Schlag and Tremewan (2014) show that it also elicits an interval for the mean probability, in our case of width 1/13. As a test of the robustness of our results we use a variety of probabilities from the elicited intervals. We chose this method because it is easily understood by subjects. It also has the advantage over scoring rules of being robust to risk aversion.



(a) Strategy distribution player 1

(b) Strategy distribution player 2

Figure 2: Strategy distributions by player roles and treatment (centipede game).

ior, lead to substantial differences in realized payoffs. In fact, subjects playing outgroup members earn 58 points on average compared to 35 points for those playing ingroup members. The hypothesis that strengthening of positive social preferences would push the distribution of stopping nodes in the ingroup treatment to the right of the outgroup treatment is clearly rejected by the data. On the contrary, it appears that any treatment effect is in the opposite direction of Hypothesis 1.

Even though the experimental data fail to find evidence for the social preference hypothesis by considering only strategies, it is still possible that social preferences play a role. If subjects believe for some reason that ingroup players are more likely to stop earlier than outgroup players, this could counteract any effect of strengthened social preferences. This possibility is however also not supported by the elicited beliefs summarized in Table 1. Stated beliefs about behavior of the partner's population are very similar across treatments, with the distributions being significantly different only in the case of the player 1s' stated beliefs at the last decision node (two-sided Wilcoxon rank-sum test, p-value $= 0.084$; after adjusting for multiple comparisons using Bonferroni correction even this difference is not significant at any conventional level). Furthermore, we also observe similar variance in elicited beliefs between treatments, implying that subjects do not estimate or report their belief with more noise in the outgroup treatment. Overall, the induced group identity does not seem to modify stated beliefs towards behavior of the matched partner.

To further test whether changes in beliefs are obscuring a social preference effect, we report the results (marginal effects) of a probit model on the probability of a player contin-

Player type	Node	Elicited belief	
		Ingroup	Outgroup
1	2	1.33 (2.76)	1.54 (3.59)
	4	3.54 (3.68)	3.42 (3.74)
	6	7.29 (3.94)	9.13 (3.50)
2	1	1.96 (4.18)	1.33 (3.07)
	3	3.42 (4.09)	3.13 (3.30)
	5	9.00 (3.15)	8.33 (3.25)

Notes: Average number of subjects, out of 12, guessed to stop at each node (by player type and treatment). Standard deviation in parentheses.

Table 1: Elicited beliefs (centipede game).

uing in Table 2. All three decisions of a subject are included, with standard errors clustered at the individual level. Model 1 includes only a dummy for playing an ingroup member and confirms the previous non-parametric test that subjects playing outgroups continue longer, also significant at the 10% level. Model 2 also controls for the beliefs about the number of players that will continue at the *subsequent* decision node. Note that, including this variable as a regressor, we lose the observations of player 2s' final decision node, as there are no subsequent decisions. The results show that the subjects' beliefs are consistent with their decisions whether or not to continue, and this relationship is significant at the 1% level.

Model 3 adds an interaction term between the elicited belief and the ingroup treatment dummy to allow for the possibility that the relationship between reported beliefs and actions differs between treatments. The estimated coefficients are all significant and imply that the relationship between beliefs and actions is twice as strong in the ingroup treatment.[6] Finally, Model 4 controls for whether the decision is a subject's first, second,

[6] Because of the non-linearity of the model, the size and significance of the interaction effect depends on the values of the other covariates (see Ai and Norton, 2003), and the coefficient, standard errors, and significance level reported in the table are averages. Figures 5 and 6 (in A) show the size and significance of

	Model 1	Model 2	Model 3	Model 4
Ingroup (=1)	–0.097*	–0.088*	–0.192***	–0.203***
	(0.055)	(0.045)	(0.073)	(0.071)
Belief		0.039***	0.029***	0.016***
		(0.006)	(0.007)	(0.007)
Ingroup×belief			0.021*	0.024*
			(0.011)	(0.010)
Decision				–0.113***
				(0.033)
# observations	288	240	240	240
Log likelihood	–177.284	–93.74	–92.052	–85.759
Wald stats	3.09	52.97	60.23	71.83
(χ^2, p-value)	0.079	<0.001	<0.001	<0.001
Pseudo R^2	0.009	0.237	0.251	0.302

Notes: This table presents the marginal effects in probit regressions. The dependent variable in all regressions is the probability of continuing. Standard errors in parentheses are clustered by subject. *** indicate significance at the 1% level, ** significance at the 5% level, * significance at the 10% level.

Table 2: Probability of continuing estimated by probit model (Experiment 1).

or third. Subjects are less likely to continue at later nodes, but this does not affect the conclusions of Model 3.

2.3 Discussion

Group identity manipulations have previously been shown to strengthen social preferences (i.e. increase altruism, propensity to positively reciprocate, and desire for social-welfare maximization), but we find evidence to the contrary in our exponentially-increasing centipede game: subjects continue longer with outgroups and are more likely to choose to continue with outgroups, even if their stated beliefs indicate a high probability that their partner will stop at the next node.

Our explanation for this counter-intuitive result is that subjects facing outgroup members are more inclined to behave as though their partner acts randomly (alternative explanations will be discussed in Section 4). Given the payoffs in our game, a risk-neutral

the estimated interaction effect for each of the observations. As these figures show, the effect is substantial and significant at the 5% level for subjects who have a continuation probability of less than about 0.9, and not significantly different for those who are almost sure to continue.

and self-interested player should only stop it she believes the probability of her partner stopping at the subsequent node is greater than 6/7, a rather high degree of certainty. There are two possible explanations for the observed behavior. Subjects may either regard outgroups as less strategically sophisticated, or find it hard to make predictions about their behavior and thus place less weight on beliefs derived from their own reasoning process. The former explanation is not consistent with our belief data (which does not differ between treatments) whereas the latter concords with the significant interaction effect in the probit regressions (see Table 2).

3 Experiment 2: extended stag hunt games

We designed a follow-up experiment, in which we implement a series of extended stag hunt games (Figure 3), to further test our explanation of the results of Experiment 1. In each of the five 3×3 extended stag hunt games we employ in Experiment 2, the action set of a row player consists of $a_i = \{U, M, D\}$, with the corresponding action set of a column player of $a_j = \{L, C, R\}$. Because of the symmetric payoff structure we do not describe the column player's actions separately. Selecting action 'U' guarantees a certain but low payoff; choosing 'M' earns a medium payoff in the case of coordination and some insurance in the case of miscoordination, but less than the payoff from 'U'; choosing 'D' earns a high payoff in the case of coordination, and nothing otherwise. There are three pure-strategy Nash equilibria, characterized by each player choosing the same strategy (U, M, or D).

To control for the possibility that an alternative unconsidered explanation makes one of the actions more attractive in one of the treatments, the payoffs in the games have been chosen such that the best response to uniform randomization is 'U' in games 1 and 4, 'D' in games 2 and 3, and 'M' in game 5. This also gives us a strong test our behavioral hypothesis without relying on elicited beliefs. We state now our first behavioral hypothesis for Experiment 2.

Hypothesis 2. *Subjects in the outgroup treatment are more likely than those in the ingroup treatment to select the best response to uniform randomization (BRUR). This corresponds to 'U' in games 1 and 4, 'D' in games 2 and 3, and 'M' in game 5.*

In each Nash equilibrium, players receive the same payoff as each other, which eliminates fairness concerns, and as a one-shot simultaneous game, there is also no room for reciprocity. In B.2, we show that introducing altruism does not affect the equilibria of the game. However, more altruistic players face a higher (lower) cost of miscoordination after playing 'U' ('D'). So if social preferences do play a role, we would expect subjects partnered with ingroup members to be more likely to choose the latter strategy.

The fact that the best response to uniform randomization (BRUR) of the other player differs between games allows us to control for this possible effect of altruism and other,

	L	C	R
U	$4,4$	$4,2$	$4,0$
M	$2,4$	$5,5$	$2,0$
D	$0,4$	$0,2$	$6,6$

Game 1

	L	C	R
U	$2,2$	$2,1$	$2,0$
M	$1,2$	$6,6$	$1,0$
D	$0,2$	$0,1$	$10,10$

Game 2

	L	C	R
U	$3,3$	$3,2$	$3,0$
M	$2,3$	$6,6$	$2,0$
D	$0,3$	$0,2$	$11,11$

Game 3

	L	C	R
U	$3,3$	$3,2$	$3,0$
M	$2,3$	$4,4$	$2,0$
D	$0,3$	$0,2$	$7,7$

Game 4

	L	C	R
U	$3,3$	$3,2$	$3,0$
M	$2,3$	$6,6$	$2,0$
D	$0,3$	$0,2$	$8,8$

Game 5

Figure 3: Extended stag hunt games (Experiment 2).

unconsidered, effects by comparing outcomes in the different games *within* treatments, as follows.

Hypothesis 3. *The proportion of subjects who best respond to uniform randomization will be greater than the proportion of subjects who choose the same action (U, M, D) in a game where it is not the best response to uniform randomization. This effect should be greater in the outgroup treatment than the ingroup treatment.*

The intuition behind this hypothesis is straightforward and predicts, for instance in Game 1, that the proportion of participants who choose 'U' (the BRUR action in this game) will be greater than the proportion who chose 'U' in Games 2,3, and 5 (where it is not the BRUR action). Note that we expect some subjects in the ingroup treatment will also BRUR, just fewer than in the outgroup treatment, which is why we specify that the magnitude of changes in proportions between games will differ between treatments. Finally, Hypothesis 4 looks for additional support of our explanation by considering elicited beliefs.

Hypothesis 4. *Subjects in the outgroup treatment report beliefs that are closer to uniform randomization than those in the ingroup treatment.*

3.1 Design

For the design of Experiment 2, which consisted of 4 parts, we followed the same general procedure as in Experiment 1: a group identity task, decisions in a series of games, elicitation of beliefs regarding partner's behavior, and a post-experiment questionnaire.

Part 1. The group identity procedure was identical to the one used in part 1 of Experiment 1.

Part 2. Participants were asked to make decisions in a series of five extended stag hunt games, shown in Figure 3. As in Experiment 1, they were reminded of which group they were part of (”You are in the Klee/Kandinsky group”), then informed that their decisions would be matched with the decisions of a member of a particular group (”Your decision will be matched with the decision of a randomly selected participant from the Klee/Kandinsky group”) depending on the treatment. Participants were allocated to treatments randomly, with roughly half of the participants matched with a member of the same group (*ingroup* treatment) and the rest with a member of the other group (*outgroup* treatment).[7] As all five games are symmetric, every subject assumed the role of a row player. Moreover, the sequence of presentation of the five games was randomized.[8] Finally, participants were informed of the decisions of their partner, only after all decisions in the experiment had been made, and paid for one randomly chosen game.

Part 3. We elicited participants' beliefs about the behavior of their partner using a quadratic scoring rule (QSR). Subjects could manipulate two sliders to indicate the probability with which they believed their partner would choose 'L' or 'C' and a third slider indicating the probability assigned to 'R' moved automatically so that the three numbers added to one. To avoid the difficulty of explaining the QSR, the payoffs a subject would earn, given their guesses and the three possible decisions of their parter, were displayed and

[7] The precise number depended on how many subjects were in each identity group. This design was necessary for matching purposes.

[8] We are concerned that subjects may have seriously considered only the first game they played, and seeing the similarity with the following games simply chosen the same option, resulting in order effects. In fact, 36% of subjects chose the same action for all five games. For comparability with the centipede game in Experiment 1, we only present in the result section the first game played (the order of games was randomized so the sample sizes are uneven).

updated as the sliders were moved. The actual belief elicitation was preceded by a tutorial which explained the mechanism and allowed subjects to familiarize themselves with the payoffs associated with different positions of the sliders. Beliefs were elicited about each of the five games, with one randomly chosen for payment. Again, the games were presented in a randomized order for each subject. As in Experiment 1, participants learned about the task only after making their own decisions so as not to influence behavior in the actual games. They were also informed that the game for which they were paid in part 2 would be different from that paid in part 3 to reduce the possibility of hedging.

Part 4. In the questionnaire, subject's were presented a series of 15 binary choices between a certain payoff (ranging from 0.5 Points to 7.5 Points in 0.5 steps) and the aforementioned lottery. One of these choices was randomly chosen and paid accordingly. Then, participants completed a short post experiment questionnaire regarding a number personality attitudes which also included questions about the group assignment. Moreover, we elicited each subject's certainty equivalent of a lottery that paid 10 Points with probability 0.5 and nothing otherwise.

Procedures. The experiment was conducted with z-Tree (Fischbacher, 2007) in the Vienna Center for Experimental Economics. Participants were student volunteers recruited from the universities in Vienna using ORSEE. Each subject participated in only one session. We conducted 5 sessions with between 22 and 28 participants per session (120 participants in total, 64 in the outgroup treatment and 56 in the ingroup treatment). Instructions for each part were presented on screen. At the end of a session, points earned across all experimental parts were added up and converted into Euros at an exchange rate of 1 Point = 0.5 Euro. In addition, each participant received a 3 Euro show-up fee. Sessions lasted about 45 minutes (including time for payment) and participants earned between 4 and 19.30 Euros (12.34 on average). Participants received their payments privately at the end of the experiment.

3.2 Results

We begin by reporting the distributions of actions, separated by treatment, for the first game played by each subject. In each of these games, shown in Figure 4, the label of an action (Up, Middle, Down) is capitalized whenever it is a best response to uniform randomization (BRUR) of the opponent. The distributions of actions are also summarized in Table 4. The most commonly chosen action in the ingroup treatment in all games is Down. In contrast, the most commonly chosen action in the outgroup treatment is the BRUR action in four out of five games (the exception being Game 4). These two results are in line with both our main hypothesis, that subjects facing an outgroup partner are more likely to choose a BRUR action, and also previous results in coordination games (e.g. Chen and Chen, 2011) in the sense that increased altruism helps subjects in the ingroup coordinate on the most efficient equilibria.

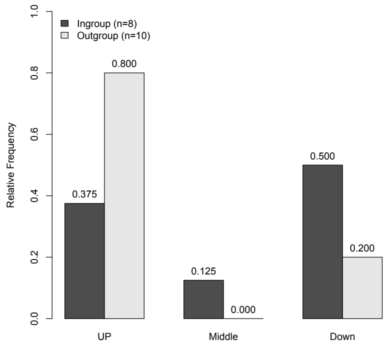
Comparing the proportion of subjects choosing the BRUR actions across treatments and all five games, we find that participants in the outgroup treatment choose BRUR actions with 56%, which is significantly larger than the 41% of BRUR actions chosen by participants in the ingroup treatment (one-sided z-test, $z = 1.659$, p-value $= 0.048$). The results are clearly in support of Hypothesis 2.

Concerning Hypothesis 3, Tables 6 and 7 report the difference between the proportion of players choosing BRUR in a *given* game and the proportion of subjects who choose the same action in a *different* game where it is not the best response to uniform randomization of the opponent. Out of the 16 possible comparisons, 14 in the outgroup and 13 in the ingroup are in the hypothesized direction as can be seen by the (positive) signs of the differences in these tables. We find that in 14 out of these 16 possible comparisons, the magnitude of this change is greater in the outgroup than the ingroup treatment. Taking the average effect over all five games, a BRUR action is 36 percentage points more likely to be chosen than an equivalently labelled non-BRUR action in the outgroup treatment, compared to only a 6 percentage points change in the ingroup treatment.

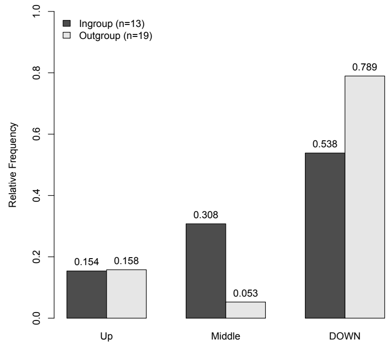
To test this formally, we use a Fisher's exact test looking for a non-random relationship between actions and the games. This gives a p-value of 0.933 in the ingroup treatment, but a p-value of 0.001 in the outgroup treatment. Thus, we find strong evidence that the distribution of actions between games differs significantly in the outgroup treatment, but no such evidence for the ingroup treatment.

Turning to elicited beliefs, Figure 5 (in B) shows the average probability placed on each of the three possible actions in each game for the ingroup and outgroup treatments respectively. To test whether subjects in the outgroup treatment have beliefs closer to uniform randomization we consider the Euclidian distance between the elicited beliefs and placing a probability of a third on each action. Two-sided Wilcoxon rank-sum tests, using pooled data across games, reveal no difference in the distributions of these distances between the ingroup and outgroup treatment ($z = 0.156$, p-value $= 0.88$).[9] Consistent with the results on actions, subjects in the ingroup treatment place on average the highest probability on the event that their partner chooses Down. Also, it appears that subjects in the outgroup treatment tend to place higher weight on BRUR actions. Indeed, the probability placed on the partner playing the BRUR action does differ significantly between treatments (two-sided Wilcoxon rank-sum, p-value $= 0.01$). No treatment differences are found in the distributions of probabilities placed on 'D' (p-value $= 0.84$) or 'U' (p-value $=$ 0.40).

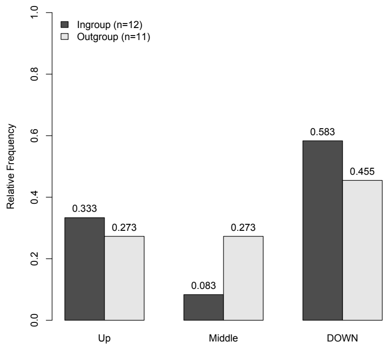
[9] As we used the quadratic scoring rule, risk aversion would bias responses towards placing one third on each action which could cause problems if subjects in one treatment happened to be more risk-averse than the other. However the number of safe choices in the certainty equivalent elicitation is almost identical between treatments (ingroup $= 8.25$; outgroup $= 8.02$; Wilcoxon rank-sum test: p-value $= 0.67$).



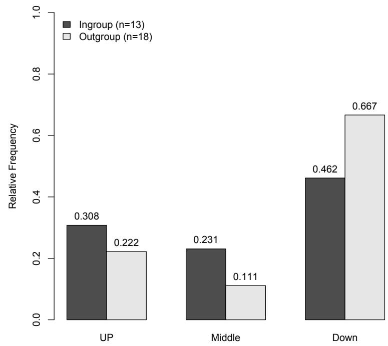
(a) Game 1



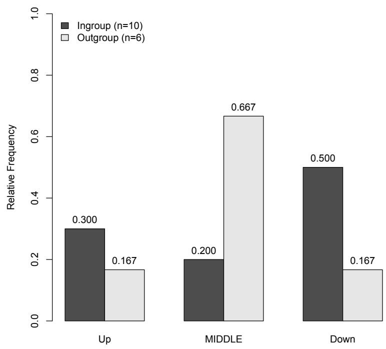
(b) Game 2



(c) Game 3



(d) Game 4



(e) Game 5

Figure 4: Decisions in the extended stag hunt games (capitalized action in a game denotes BRUR).

	Model 1	Model 2	Model 3
Ingroup (=1)	–0.152*	0.023	–0.216
	(0.090)	(0.116)	(0.220)
Belief		0.014***	0.012***
		(0.002)	(0.002)
Ingroup×belief			0.006
			(0.005)
# observations	120	120	120
Log likelihood	–81.779	–50.667	–49.867
Likelihood-ratio	2.76	64.99	66.59
(χ^2, p-value)	0.096	<0.001	<0.001
Pseudo R^2	0.0167	0.391	0.400

Notes: This table presents the marginal effects in probit regressions. The dependent variable in all regressions is the probability of playing BRUR. *** indicate significance at the 1% level, ** significance at the 5% level, * significance at the 10% level.

Table 3: Probability of playing BRUR estimated by probit model (Experiment 2).

To study the belief action relationship in a similar manner to our analysis of Experiment 1, we report probit regressions on the probability of choosing the BRUR action in Table 3. Model 1 supports the findings of the non-parametric tests, showing that outgroups are 15% more likely to chose the BRUR action. However, in stark contrast to Experiment 1, Model 2 shows that this difference is entirely accounted for by elicited beliefs: the coefficient on the belief a subject states about the probability their partner will play BRUR is highly predictive of the probability that they themselves will choose that action, while the ingroup dummy becomes close to zero. Introducing an interaction effect does not improve the fit (Model 3).

3.3 Discussion

The experimental data provide strong evidence that BRUR is more common in the outgroup treatment than in the ingroup treatment, confirming our main hypothesis regarding behavior. We do not find evidence that subjects in the outgroup treatment are more likely to report beliefs that their partner is playing a uniformly random strategy in the game (Hypothesis 3). Beliefs do differ by treatment, but such that subjects believe that outgroups are more likely to be playing the BRUR actions. In the next section we discuss the implications of these results in relation to our results from the first experiment.

4 General discussion

Taken together, the behavioral data (from Experiment 1 and 2) provides strong evidence that people interacting with outgroup members are more likely to behave as though their partner is uniformly randomizing. Our findings are consistent with evidence in psychology that social projection, in the sense of perceived similarity and hence predictability of others, is stronger in ingroup than in outgroup interactions (Robbins and Krueger, 2005; Ames et al., 2011). Moreover, our results are also consistent with a recent neuroscientific study of Baumgartner et al. (2012), which identifies differences in the activation of the mentalizing system (a region associated with social reasoning or projection in the brain) of subjects when facing ingroup and outgroup behavior.

The fact that subjects interacting with outgroup members are more likely to BRUR can have counter-intuitive effects if one is only considering social preferences. In our centipede game, increased BRUR in the outgroup treatment has the opposing effect on behavior to the one predicted by increased social preferences amongst ingroup members. In Experiment 1, the former effect outweighed the latter. This particular outcome, however, rests crucially on the specific payoff structure of the game. For example, Chen and Li (2009) report results on a two-person sequential game with the same structure as a two-legged centipede game (Resp 8) and find that ingroups continue longer than outgroups. However, given the payoff structure in their game, the BRUR action is to stop (because the potential payoff gains from continuing are small compared to our exponentially increasing payoffs), so both effects are working in the same direction.

Our stag hunt games are similar to the minimum effort game in Chen and Chen (2011). They find that ingroup pairs are able to coordinate on equilibria that are pareto superior to those chosen by outgroup pairs, a result they attribute to social preferences. We find evidence supporting this argument in that ingroup pairs in our experiment have, as their modal choice, the strategy that leads to the pareto-optimal equilibria in all five games. However, in one of our games (Game 2) where this strategy is also the BRUR action, the BRUR effect outweighs the social-preference effect and is selected by a higher proportion of players in the outgroup treatment than in the ingroup treatment. Thus, the effect we have identified is not disputing the well-established impact of group identity on social preferences. These two effects are rather complementary or countervailing, depending on the strategic environment and precise payoffs.

In the remainder, we consider alternative explanations for our treatment effects, both in actions and beliefs, in the two experiments considered in this paper. In particular, we consider the effects of social preferences, risk preferences, level-k reasoning, and biases of the belief elicitation mechanisms.

The literature on social preference suggests that subjects in the centipede game should continue longer with ingroup members, which is the opposite of what we find. It is highly unlikely that our group identity manipulation decreased altruism, positive reciprocity or social welfare concerns, as this would contradict a large body of literature. As shown in B.2, a simple model of social preference does not change the equilibria in the extended stag hunt games. Increased altruism does decrease the risk associated with choosing 'D', which may explain why it is the modal choice in all five games in the ingroup treatment, i.e. social preferences may play a role in our data. However, social preference arguments cannot explain why the behavior of outgroups is so strongly related to the best response to uniform randomization, which changes between games.

Higher sensitivity to risk when interacting with ingroups in the centipede game could also explain stopping earlier. However, in the coordination games the modal choice of those in the ingroup treatment was the riskiest action ('D'). Similarly, a level-k explanation would involve subjects in the ingroup treatment behaving at a higher level in the centipede game but a lower level in three out of five of the coordination games.[10] Thus, neither risk nor level-k reasoning can simultaneously explain both sets of results.

We now turn to beliefs were we find inconsistent results in the two experiments. While in Experiment 1 there is no treatment effect, in Experiment 2 there is. Neither result shows subjects in the outgroup treatment being more likely to believe that their partner will uniformly randomize. However, there are a number of reasons to questioning the accuracy and relevance of our elicited beliefs. The review of Schotter and Trevino (2014) cites a number of papers which find that beliefs, elicited ex-post, are good predictors of actions in games. We also find that beliefs are informative in Experiment 1, as shown by the significant coefficients in Table 2, and in Experiment 2 where they explain the whole treatment effect on actions in Table 3.[11] However, taking average values across papers reviewed by Schotter and Trevino (2014), only around 2/3 of subjects best-respond to their stated beliefs. It is largely unknown whether the remaining 1/3 of subjects' deviation from best-responding is due to noise, systematic biases in the elicited beliefs, or whether those participants are following a different decision theory altogether.

Rubinstein and Salant (2014) identify two biases, associated with ex-post belief elicitation: self-similarity (subjects are being more likely to believe that partners choose the same action as oneself) and strategic justification (subjects try to ex-post rationalize their actions in their belief statement). They find that asking for population frequencies promotes self-similarity bias, whereas asking for the probability that a particular subject will

[10] See Kawagoe and Takizawa (2012) for a proof that higher levels stop earlier in the centipede game. In the stag hunt games, with the typical assumption of level-0 players randomizing uniformly, all levels greater than zero choose the best response to uniform randomization. In Games 1, 2, and 5, more players in the outgroup treatment choose this higher level action.

[11] Actions chosen first may influence beliefs elicited ex-post. The evidence on this is ambiguous (see Schlag et al., forthcoming), so here we remain agnostic as to whether the actions were influenced by beliefs or vice-versa and simply note the strong relationship.

take a given action increases strategic-justification bias. We used population frequencies in Experiment 1 but asked for the probabilistic choice of an individual in Experiment 2. In the light of Rubinstein and Salant (2014), it is possible that the biases they identify, particularly self-similarity bias, which would be strengthened for ingroup members (because of social projection), may have contributed to the contradictory results on stated beliefs across experiments. This supposition is supported by Bernold et al. (2014) who find a weaker correlation between actions and beliefs in a Prisoners' dilemma game when framed as a Wall Street game as opposed to a Community game, where participants presumably identify more with each other in the latter.

Besides the different belief elicitation mechanisms between the two experiments, our experimental games differed in that the first experiment involved asymmetric games, whereas in the second they were symmetric. Self-similarity bias, which is likely to be affected by group identity, will probably play a stronger role in symmetric games, where one can simply assume that the other person is reasoning in an identical manner to oneself.

A more straightforward explanation for the lack of coherence between our findings on actions and elicited beliefs is that beliefs elicited ex-post are not fundamental to the original decision making process. This is the conclusion of Costa-Gomes and Weizsäcker (2008) who find that the beliefs that determine actions were drawn from a different distribution than elicited beliefs.[12]

Initially, we found interesting differences in the strength of relationship between beliefs and actions across treatments in the centipede game. We speculated that rather than operating through beliefs, the differences in actions we observed were due to a difference in the way beliefs derived from introspection were translated into actions when interacting with outgroups or ingroups. However, given the contrasting results in the follow-up experiment, it is conceivable that the differences we observed are more likely to be caused by systematic bias in the elicited beliefs.

All in all, there are two possible explanation for the behavior we observed in our experiments. One possibility is that outgroup players are believed to uniformly randomize because they are perceived as less sophisticated than ingroup members. This argument is in line with the idea that group affiliation is ultimately aimed at increasing one's self-esteem. In line with this interpretation, Agranov et al. (2012) for instance show that the perception of the other person's strategic sophistication (through framing) affects own behavior in the beauty contest game. The other possibility is that participants find it more difficult to make predictions about behavior of outgroups, leading them to apply the principle of insufficient reason, and attribute equal probability to each choice of their outgroup part-

[12]It is noteworthy that the strongest relationship between actions and beliefs tend to involve experiments where the game and belief elicitation are repeated many times, with the belief elicitation occurring immediately after each stage game. Our designs are closer to Costa-Gomes and Weizsäcker (2008) in that subjects first play a number of different games, then all beliefs are elicited subsequently.

ner. Both of these mechanisms result in the same observed choices of players. Therefore, without more reliable data on elicited beliefs, we cannot identify the mechanism behind our behavioral results.

5 Conclusion

In this paper we have identified a channel through which group identity can affect behavior in strategic environments in addition to the well-established influence through social preferences. Subjects interacting with outgroup members are more likely than those interacting with ingroup members to choose a best response to the belief that their partner is uniformly randomizing amongst their available strategies. This result could have one of two equally reasonable and intuitive explanations: people may regard those from other groups as less strategically sophisticated, a phenomena not uncommon in the real world; alternatively, if one perceives another to be fundamentally different from oneself, it should be harder to make predictions about their behavior because of the uncertainty underlying their strategic reasoning.

We also find some interesting results regarding elicited beliefs, which we hope will spur further research into improving belief elicitation methods, and understanding the complex relationship between beliefs and actions in strategic interactions.

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A Experiment 1 (centipede game): additional results

A.1 Interaction effects in probit regression (see Table 2)

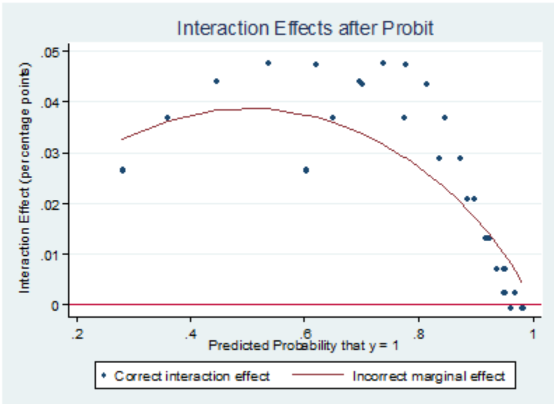


Figure 5: Marginal effects of interaction between ingroup and belief in Model 3 of Table 2 (dots indicate independent observations).

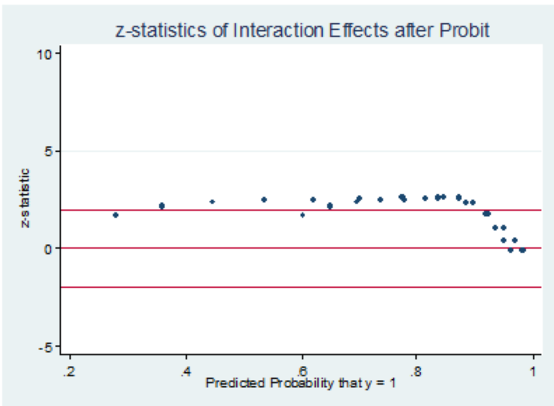


Figure 6: Z-scores of interaction between ingroup and belief in Model 3 of Table 2 (dots indicate independent observations).

B Experiment 2 (stag hunt games): additional results

B.1 Distribution of actions and beliefs in stag hunt games

	Ingroup			Outgroup		
Game	U	M	D	U	M	D
1	**3**	1	4	**8**	0	2
2	2	4	**7**	3	1	**15**
3	4	1	**7**	3	3	**5**
4	**4**	3	6	**4**	2	12
5	3	**2**	5	1	**4**	1

Table 4: Distribution of actions (BRUR actions in bold face).

	Ingroup			Outgroup		
Game	U	M	D	U	M	D
1	**30**	24	47	**60**	18	22
2	34	24	**42**	14	16	**70**
3	26	21	**53**	20	32	**48**
4	**22**	18	61	**38**	15	47
5	17	**33**	49	30	**29**	41

Table 5: Distribution of beliefs given in probabilities (BRUR actions in bold face).

Game	1	2	3	4	5
1	–	0.22	0.04	n.a.	0.08
2	0.04	–	n.a.	0.08	0.04
3	0.08	n.a.	–	0.12	0.08
4	n.a.	0.15	-0.03	–	0.01
5	0.08	-0.11	0.12	-0.03	–

Table 6: Changes in BRUR to Non-BRUR behavior across games in ingroup treatment.

Game	1	2	3	4	5
1	–	0.64	0.53	n.a.	0.63
2	0.59	–	n.a.	0.12	0.62
3	0.26	n.a.	–	-0.21	0.29
4	n.a.	0.06	-0.05	–	0.06
5	0.67	0.61	0.39	0.56	–

Table 7: Changes in BRUR to Non-BRUR behavior across games in outgroup treatment.

B.2 Effect of altruism in the extended stag hunt game

Figure 7 shows the payoff structure of the extended stag hunt games, with restrictions on the parameters $b < a < c < d$. Figure 8 shows the same game assuming the utility function $U_i(x_i, x_j) = (1-\alpha)x_i + \alpha x_j$ where $\alpha \in [0, 0.5]$ represents the degree of altruism player i feels towards player j. Given the parametric restrictions, it is easy to see that the Nash equilibria are unchanged for any degree of altruism. It can also be seen, however, that the cost of miscoordination after choosing U is increasing in α, whereas the cost of miscoordination after choosing D is decreasing in α (the cost after M depends on parameters). So although there is no change in equilibria, it is possible that participants, who feel more altruistic towards their partner, are less likely to choose U and more likely to choose D.

	L	C	R
U	a, a	a, b	$a, 0$
M	b, a	c, c	$b, 0$
D	$0, a$	$0, b$	d, d

Figure 7: General game.

	L	C	R
U	a, a	$a-(a-b)\alpha, b+(a-b)\alpha$	$a-a\alpha, a\alpha$
M	$b+(a-b)\alpha, a-(a-b)\alpha$	c, c	$b-b\alpha, b\alpha$
D	$a\alpha, a-a\alpha$	$b\alpha, b-b\alpha$	d, d

Figure 8: Game with Altruism.

C Supplementary material: instructions and screenshots (not for publication)

C.1 Instructions Experiment 1

In the following we provide the English translation of the experimental instructions. Participants received instructions regarding the general procedure, the group identity manipulation and the centipede game. Note that the instructions for the group identity manipulation were adapted from Chen and Li (2009). Instructions of each part were shown to participants just prior to the respective part. Instructions in the original language (German) are available upon request.

General instructions *[written]*

Welcome to this economic experiment! The experiment in which you are about to participate is part of a research project on decision-making.

If you have a question, now or during the experiment, please raise your hand and remain silent and seated. An experimenter will come to you to answer your question in private.

If you read the following instructions carefully, you can earn a considerable amount of money in addition to the **3 Euro**, which you receive just for participating in the experiment. How much money you can earn additionally depends both on your decisions and the decisions of the other participants.

It is therefore very important that you read these instructions, and all later onscreen instructions, very carefully.

During the experiment you are not allowed to communicate with the other participants. Violation of this rule will lead to the exclusion from the experiment and all payments.

We will not speak of Euros during the experiment, but rather of points. Your whole income will be calculated in points. At the end of the experiment, the total amount of points you earned will be converted to Euros at the following rate:

20 Points = 1 Euro.

At the end of the experiment you will be privately and anonymously paid in cash the amount of points you earned during the experiment in addition to the 3 Euro you receive for participation.

In the following we describe to you the general procedure of the experiment: You will be asked to make various decisions in two consecutive parts of the experiment. In each of the 2 parts you can earn points for your decisions. How much points you can earn in each part will be announced before you have to make your decisions. After all decision-making parts of the experiment, a questionnaire concludes the experiment.

All the information you require for making decisions in part 1 of the experiment will be displayed directly on screen. You will receive all the information you require for part 2 of the experiment after completion of part 1 of the experiment.

Instructions for part 1 of the experiment *[on-screen]*

Welcome to part 1 of the experiment.

In the following you will be shown 5 pairs of paintings by two artists. The paintings were created by two distinct artists. Each pair of paintings consists of one painting being made by each artist. For each pair, you are asked to choose the painting you prefer. Based on the paintings you choose, you (and the other participants) will be classified into one of two groups.

You will then be asked to answer questions on two more paintings. For each correct answer, you will earn additional points. You may get help from other members or help others in your own group while answering the questions.

The composition of the groups remains fixed for the rest of the experiment. That is, you will be a member of the same group for the whole experiment.

After part 1 has finished, you will be given further instructions about the course of the experiment.

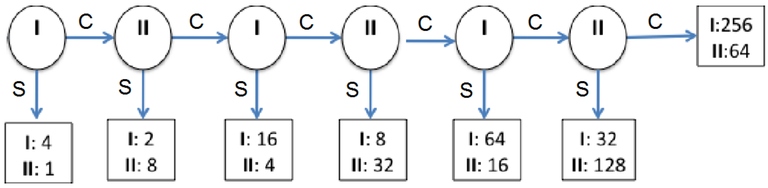
Instructions for part 2 of the experiment *[written]*

In part 2, you are asked to make decisions. The game depicted below describes a game between two players who make decisions in turn. This picture will be shown to both players, called **player I** and **player II**. It summarizes all possible decisions players can make as well as all the points player I and player II can earn in the game depending on its outcome.

Both players (I and II) have on each of their 3 decision nodes, which are depicted by a circle marked I and II respectively, the possibility to choose either **Continue (C)** or **Stop (S)**. This means player I decides between Continue (C) or Stop (S) on the first circle (read from left) and at all other circles marked with **I**. Similarly, player II decides between Continue (C) or Stop (S) on all circles marked with **II**.

How much points each player earns in the game depends on the decisions of both players. The points player I and player II receive in each of the possible outcomes of the game, are depicted in the respective square box below.

General structure of the decisions: The two players (I and II) decide sequentially and alternately. The game begins at the first circle marked with I (see upper left corner in the picture) There, player I chooses to play either Continue (C) or Stop (S). If player I chooses Stop (S), the game ends and player I receives 4 points and player II receives 1 point. If player I chooses on her



first circle marked with I to Continue (C) then play proceeds and it is player II's turn to decide (see first circle II, read from left in the picture). Player II then chooses either Continue (C) or Stop (S). If player II chooses Stop (S), the game ends and player I receives 2 points and player II receives 8 points. If player II chooses Continue (C), then play proceeds to the next circle marked with I where player I chooses again between Continue (C) and Stop (S). And so on.

Your decisions: Before you make decisions in this game at the computer screen, you will be informed about whether you are a player I type or a player II type. Your player type will be drawn randomly and your type will remain fixed for all decisions. You will then be asked, separately for each of your three decision nodes, to choose either Continue (C) or Stop (S). Please bear in mind that, at the time of your decisions you do not yet know the decisions of the other player.

The outcome and your point earning from the game is calculated as follows: As soon as all players made their decisions, each player I is randomly and anonymously matched with a player II. All decisions of these two players are then combined to calculate the outcome of the game and with it the respective point earning of each player. You will be informed about the outcome and your points in the game after all decisions have been made. It is therefore important that you made your decision in the game carefully, since they influence the outcome and the points you earn.

If you have questions regarding the explanation of the game, please raise your hand now. You will receive all further explanations directly on screen.

Instructions for part 2 of the experiment *[onscreen]*

Thank you very much for your decisions. You will be informed about the outcome (as well as the points you received) in the two previous scenarios at the end of the experiment.

Now, please answer the following questions regarding the **first scenario** [**second scenario**] in which you have participated. In this scenario, you interacted with a participant from the **Klee group** [**Kandinsky group**].

If you correctly answer the next three questions, which will be presented to you on the next 3 screens, then you will receive 100 points. How much points you receive for your answers will be reported to you at the end of the experiment.

Click OK to proceed.

C.2 Screenshots Experiment 1

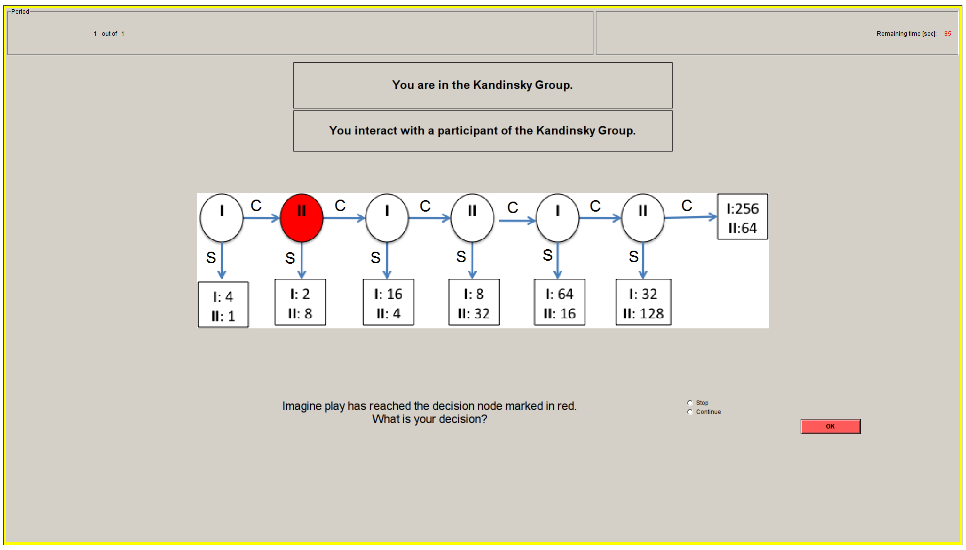


Figure 9: Decision screen (at decision node 2).

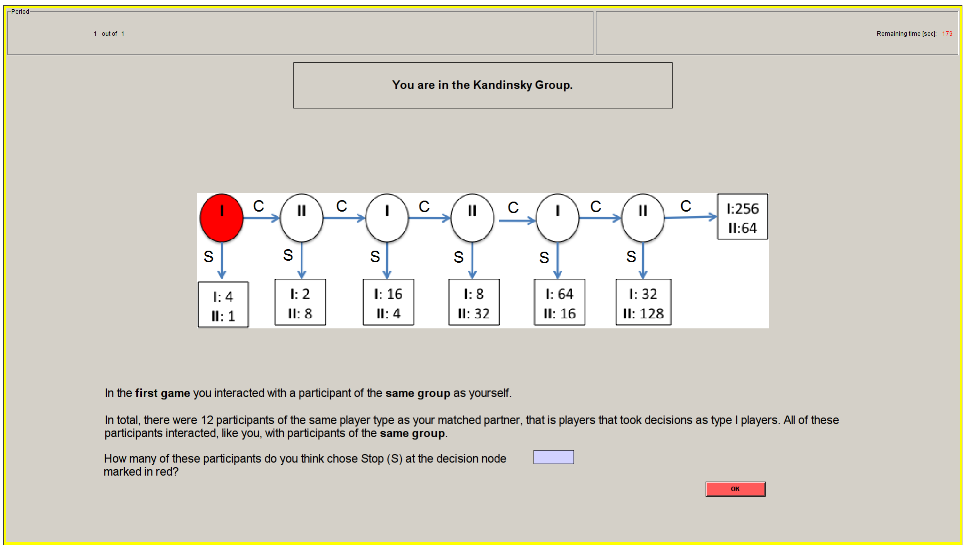


Figure 10: Belief elicitation screen (belief about population behavior at decision node 1).

C.3 Instructions Experiment 2

In the following we provide the experimental instructions. Experiment 2 follows the same general procedure and the same general instructions as Experiment 1. The only differences in the general instructions regard the exchange rate, which was 2 points = 1 Euro, and the payoff for the correct answer in the painter identification task, which was 1 point for each correct answer. Note that, in contrast to Experiment 1 which was conducted in German, the language of this experiment was English. Instructions of each part were shown to participants just prior to the respective part on the screen.

[SCREEN 1, explanation of stag hunt games]

Instructions

The table on the right shows an example of the choices you will be making in the experiment. It is only an example. The tables you will see during the experiment will have different numbers from this one.

In the actual experiment, you will be shown tables like this one (but with different numbers), and asked to choose one of your available actions (U(p), M(iddle) or D(own)). The participant with whom you are matched will take one of her/his actions (L(eft), C(entre) or R(ight)). Neither you nor the other person will know what the other has chosen until both actions have already been decided.

There are nine possible outcomes, each corresponding to a cell of the table. The combination of your action and the other person's action determines the cell of the table chosen, which tells you how much you and the other person will earn: The number of Points you receive appears in the lower left corner of each cell of the table (the blue number). The number of Points the other person receives appears in the upper right corner of each cell of the table (the red number).

For example:

- If you choose U and the other person chooses L, you earn 5 Points and the other person earns 5 Points.
- If you choose M and the other person chooses R, you earn 3 Points and the other person earns 1 Points.
- If you choose D and the other person chooses C, you earn 1 Points and the other person earns 3 Points.

Please be sure you understand how to read this table. Raise your hand if you would like further explanation. Otherwise, click OK to continue to the next screen which will test your understanding.

[SCREEN 2]

You will now be asked five questions about a different table to check your understanding. You will not progress to the next question until you have answered the previous one correctly.

Your answers will not affect your payment. Please click OK to continue.

[SCREEN 3, actions in stag hunt games]

Instructions of part 2

You will now be asked to make decisions for 5 different tables.

You are in the Klee group [Kandinsky group]. **For each table**, your decision will be matched with the decision of a **randomly selected participant from the Klee group [Kandinsky group]** to decide the outcome:
You will not see the outcomes until the end of the experiment.

At the end of the experiment **one of the five** games will be randomly chosen and you and the randomly selected participant from the Klee group [Kandinsky group] will be awarded points according to your and their decision. Please click OK to continue.

[SCREEN 4, belief elicitation]

Instructions of part 3

In this part of the experiment you will be shown again the 5 tables you saw in part 2.

For each table: you will be asked to guess how likely it is that the randomly selected participant from the **Klee group** [**Kandinsky group**] you are matched with made each of the possible choices.

At the end of the experiment **one of the five tables** will be randomly chosen and you will be paid according to the accuracy of your guess for that table. Exactly how this is to be done will be explained on the next screen. Please click OK to continue.

[SCREEN 5]

Tutorial

These instructions refer to the left hand side of this screen. When you are making your real guesses, these instructions will be replaced by the tables you saw in the previous part. You can use the first two sliders to indicate the probability with which you think the other person will choose L, C, and R. You will not be able to adjust the slider asking about "R". It will move automatically to ensure that your three guesses add to 100%.

- Click on the first line and a slider will appear where you click (you will be able to adjust it later). - DO THIS NOW

- Now click on the second slider, and a second slider will appear. - DO THIS NOW

As long as the probabilities you have chosen on the first two sliders add to 100% or less, a slider will appear on the third line as well. The probabilities you have selected appear in blue beside the lines if they add to less than 100%, and red otherwise.

- Move the sliders up and down until you understand how they work. - DO THIS NOW

When you have guessed three probabilities that add to 100% and shown on the final line how confident you are of your guess, you will be able to click "OK" to move on to the next game.

- Click somewhere on the last line and an OK button will appear (as long as the probabilities you have selected add to 100%). This button will not work during this tutorial. - DO THIS NOW

You will be paid according to how accurately you predict what the other person does: The amount you will earn for each choice of the other person will be shown on the screen whenever the probabilities you have selected add to 100%.

If you say they will pick an action with 100% probability and you are right, you will earn 10 Points. If you have less than 100% probability on the action they choose, you will earn less than 10 Points. **These payments are made in such a way that you can expect to earn the most by answering honestly.**

Use the sliders to answer the following questions (they are just to check your understanding and will not affect your earnings). When you have answered the questions, please click the OK button on this side of the screen to continue.

- How much will you earn if you guess that the other person will choose L with 100% probability and they choose C?
- How much will you earn if you guess that the other person will choose L with 25% probability, C with 25%, and R with 50% probability and they choose R?
- How much will you earn if you guess that the other person will choose L with 60% probability, C with 30%, and R with 10% probability and they choose C?

C.4 Screenshots Experiment 2

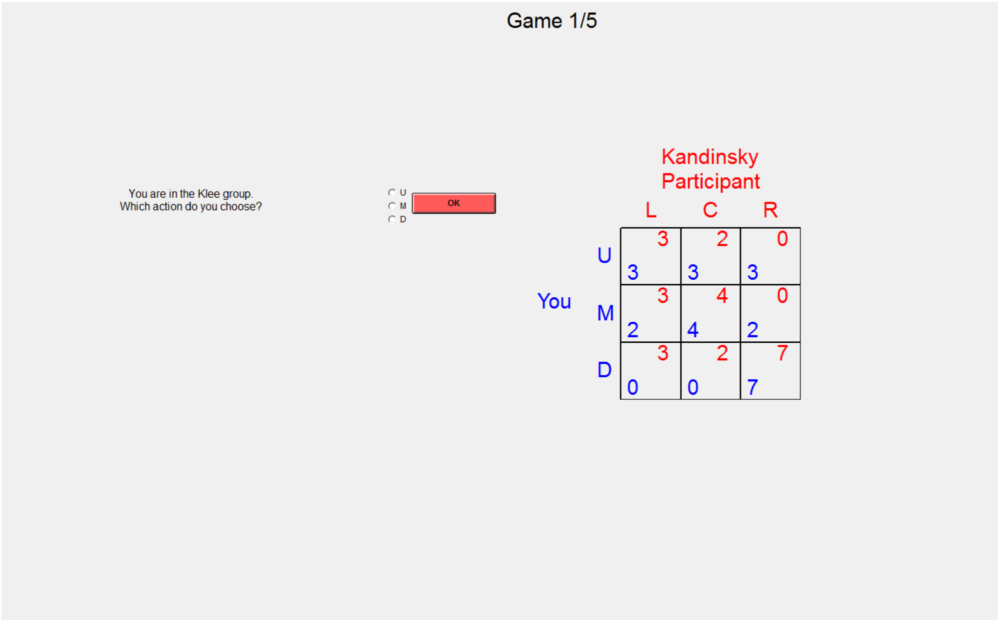


Figure 11: Decision screen.

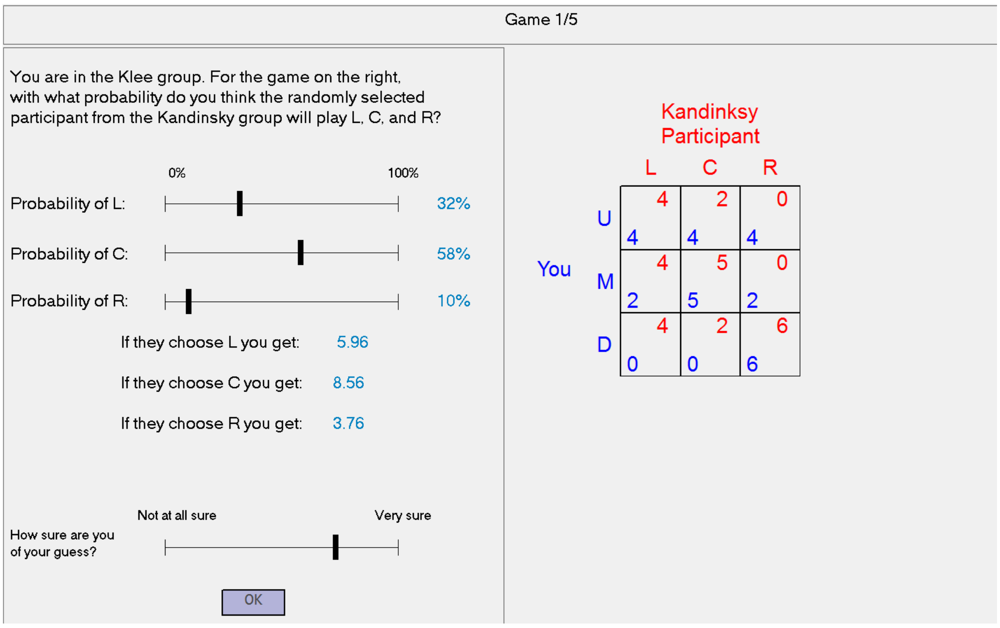


Figure 12: Belief elicitation screen.