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Identity, Homophily and In-Group Bias

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Summary

Many Social Interactions display either or both of the following well documented phenomena. People tend to interact with similar others (homophily). And they tend to treat others more favorably if they are perceived to share the same identity (in-group bias). While both phenomena involve some degree of discrimination towards others, a systematic study of their relations and interplay is yet missing. In this paper we report thendings of an experiment designed to address this issue. Participants are exogenously and randomly assigned to one of two groups. Subsequently they play a sequence of eight games with either an in-group or an out-group member. Wend strong evidence of in-group bias when agents are matched exogenously. When agents can a ect who they are matched with, we nd strong evidence of homophily. However, in-group biases either decrease or disappear altogether under en-dogenous matching. Self selection of homophilous agents into in-group matches alone cannot explain this fact. We also show that homophily is strongly correlated with risk aversion, and we use this fact to provide an explanation for both the existence of homophily and the disappearance of in-group biases under endogenous matching.

Keywords: In-Group Bias, Homophily, Endogenous Matching, Experiments, Game Theory

JEL Classification: D03, D01, C91, C92, C7

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Identity, Homophily and In-Group Bias*

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April 24, 2012

Abstract

Many Social Interactions display either or both of the following well documented phenomena. People tend to interact with similar others (*homophily*). And they tend to treat others more favorably if they are perceived to share the same identity (*in-group bias*). While both phenomena involve some degree of discrimination towards others, a systematic study of their relations and interplay is yet missing. In this paper we report the findings of an experiment designed to address this issue. Participants are exogenously and randomly assigned to one of two groups. Subsequently they play a sequence of eight games with either an in-group or an out-group member. We find strong evidence of in-group bias when agents are matched exogenously. When agents can affect who they are matched with, we find strong evidence of homophily. However, in-group biases either decrease or disappear altogether under endogenous matching. Self selection of homophilous agents into in-group matches alone cannot explain this fact. We also show that homophily is strongly correlated with risk aversion, and we use this fact to provide an explanation for both the existence of homophily and the disappearance of in-group biases under endogenous matching.

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1 Introduction

1.1 Motivation and Overview of Results

Two pervasive and well documented phenomena have received considerable attention in recent research in economics and the social sciences. First, in many social interactions, people tend to interact with similar others. This is true for many dimensions of similarity (such as ethnicity, gender, religious views,...) and typologies of social ties (from the intimate relations of friendship and marriage to business collaborations and everyday interactions). This phenomenon, usually referred to as *homophily*, has been long debated in sociology and, more recently, also in economics (see below for references). Second, extensive experimental evidence has shown that people tend to behave more favorably towards others who are perceived to belong to the same group. Usually referred to as *in-group bias* by psychologists and sociologists (see below for references), this phenomenon is intimately related to the notion of *identity*, recently imported by Akerlof and Kranton (2000) into rational choice economics.

By affecting the patterns of interaction and agents' behavior in fragmented societies, homophily and in-group bias have important welfare consequences. The range of policy issues related to these phenomena include the discussion about "parallel societies", (sex-) segregated education, the optimal degree of cultural homogeneity, the management of ethnic conflicts and the design of fair and efficient matching institutions among many others.

Despite the fact that both homophily and in-group bias involve some degree of discrimination towards others, a systematic joint analysis of these phenomena and of their interplay is yet missing. In this paper we attempt to fill this gap. We study the effect of endogenous matching, i.e. of an environment that gives homophily a playing field, on in-group biases. We also ask whether people with strong preference for an in-group match (homophily) do also display a larger in-group bias and if so, why this is the case. In the presence of in-group bias, for instance, homophily may well be a rational reaction to the expectation of preferential treatment from the opponent, i.e. to the anticipation of in-group biases. But there could also be deeper reasons for such a connection and we attempt to uncover those in this paper. Answering such questions helps to understand and narrow down the real trade offs between integration and separation and to evaluate the costs and benefits of cultural or other differences in identity. Addressing these questions in empirical field studies is, however, extremely difficult because it is very hard to isolate incentives and opportunities for matching and hence to demonstrate the existence of a *preference* for homophily or to measure its strength. Conducting a laboratory experiment allows us to avoid many of these difficulties.

In our experiment participants are randomly assigned to one of two groups called the RED group and the BLUE group, with no further identity enhancing activity. We adopt, hence, what is called the "near-minimal" group design paradigm (see Tajfel and Turner (1979) and the literature cited below).

In treatment EXO, participants are then matched according to a color-blind random process to play a series of 8 games designed to elicit their degree of altruism, positive reciprocity and negative reciprocity. We find that participants are about 35 percent *more* likely to reward an in-group match for good behavior, but 40 percent *less* likely to punish an in-group match for misbehavior compared to out-group matches. These findings are in line with Chen and Li (2009), which we discuss below. We also find that whether a match is in-group or not is more important than age, gender, the colour of one's group, a measure of risk aversion and a measure of cognitive reflection in determining behaviour.

In treatment ENDO agents are allowed to affect their probability of matching with RED and BLUE types. Here we (i) first elicit participants' willingness to pay (*wtp*) for an in-group (or out-group) match; (ii) we then match them according to their *wtp* using an incentive-compatible mechanism, which is such that agents with a higher *wtp* for an in-group (out-group) match are more likely to be matched with in-group (out-group) opponents. And (iii) we let participants play the 8 games.

Our first finding is that the in-group biases observed in EXO disappear when matching is endogenous (ENDO). In principle, the absence of bias in the ENDO treatment could be explained by the mere effect of self-selection of homophilous agents into in-group matches. However, as we explain carefully in the paper, how self-selection affects aggregate in-group biases is not immediate and could ex ante lead to either an increase or a decrease in in-group biases, depending on how the behavior of homophilous agents differ from that of other agents. To get a clear idea of the role of self selection, we therefore need to understand more about the characteristics of homophilous agents and about the potential correlation between homophily and in-group bias.

This takes us to our second set of results. We find that homophily (a strictly positive *wtp* for an in-group match) is indeed pervasive, and that *only* homophilous agents do display in-group biases. However, despite the correlation between homophily and in-group biases, a careful examination of participants' levels of reciprocity in in- and out-group matches leads to the conclusion that the decrease of the overall bias under endogenous matching *cannot* be explained solely in terms of self selection. Hence some shift in behavior must have occurred in response to the change in the matching institution. In particular, we find that homophilous agents are less positive reciprocal and more negative reciprocal to in-group matches in ENDO compared to average behavior in EXO.

Our last set of results relates to the sources of homophily. By comparing the level of homophily in ENDO with two control treatments where either there is no scope or substantial scope for in-group biases, we recorded no significant difference with the former and a strong and significant difference with the latter. This suggests that homophily in ENDO is more fundamental than a simple strategic reaction to the anticipation of in-group biases.

Our next result is suggestive in this respect. We find that homophily is strongly correlated with a measure of risk aversion elicited in a post-play questionnaire. This is consistent with the sociological theory that interprets homophily as a way to reduce subjective uncertainty (Hogg (2000)). Risk averse agents have therefore a rationale for being homophilous as long as in-group interaction is (perceived as) governed by more stable norms that reduce the variation in behavior. This explanation is also consistent with our previous result which has shown that homophilous agents are less positive reciprocal and more negative reciprocal to in-group matches compared to the population average. Such a shift in behavior could be due to the perception of strong norms of behavior among homophilous agents, which are harshly punished if violated ("acting white" phenomenon).

Overall our findings show that homophily and in-group bias are indeed closely intertwined. Manipulating the extent of homophily (by allowing or not for endogenous matching), will trigger changes in contingent behavior and hence in in-group biases. However their relation is not of a straightforward strategic nature, where anticipating in-group biases induces homophily, but rather of a more fundamental (preference driven) nature. In particular it seems that risk aversion may be the crucial link between the two phenomena. The correlation between risk aversion and homophily we identified, points towards a theory of homophily and in-group biases that merits, in our view, further exploration.

Our findings also contribute to resolving a pending question in the literature on homophily. Especially the recent literature on homophily has emphasized the importance of distinguishing between whether people have a *preference* for interacting with similar others, simply have more *opportunities* to interact with similar people (e.g. because they live in the same neighborhood or share the same tastes for leisure activities), or choose *strategically* to interact with similar people, e.g. because they anticipate to be treated in a more favorable way. However, previous studies have largely been unable to do so, because preferences and opportunities are hard to distinguish in the field. The advantage of the controlled laboratory experiment is that we can disentangle these different forces. In our experiment homophily is clearly not a matter of opportunities and, as argued above, it is largely non-strategic, although it may result from the rational attempt to reduce uncertainty. Instead, people seem to have a culturally learned preference to interact with similar others, which is triggered even in such a controlled environment as a laboratory experiment with minimal groups, and even when there are no other benefits from interacting with similar others.

The policy implications of our results are somewhat provoking: by letting agents be in control of their own matches, the degree of segregation (measured by the share of in-group interactions) would increase due to homophily but, at the same time, social discrimination (measured by in-group bias) may decrease due both to self selection and to a change in individual behavior. Hence self-selected segregation need not necessarily be detrimental to the level of pro-social behaviour in a society and need not increase discrimination. In this sense, the experimental evidence presented in this paper provides new elements for the assessment of policies that affect social and economic segregation.

1.2 Related Literature

Homophily The notion of homophily is among the oldest and most recurrent in social science. Although the observation that "similarity begets friendship" is as old as Aristotle and Plato, it was not until the development of computing techniques for large aggregates that a systematic study of homophily was possible. Mc Pherson, Smith-Lovin, and Cook (2001) provide a comprehensive survey of the sociological literature.

In recent research homophily has been shown to limit the diffusion of information (Jackson and Lopez-Pintado (2011), Golub and Jackson (2011)), translating distance in individual characteristics into social distance. This affects the functioning of labour markets (Calvo-Armengol and Jackson (2004)) and marriage markets (Skopek, Schulz, and Blossfeld (2011)), biasing the selection of who gets which job, who befriends who (Currarini, Jackson, and Pin (2009) Currarini, Jackson, and Pin (2010)), or who adopts health innovation and care (Centola (2011)). Homophily has also consequences on the spread of social norms and the level of cooperation in a society (Hamilton (1964), Myerson, Pollock, and Swinkels (1991) or Mengel (2008)) and, by fragmenting society, on the provision of public goods (Alesina, Baqir, and Easterley (1999)), on the level of infrastructure quality and literacy (Alesina, Devleeschauwer, Easterley, Kurlat, and Wacziarg (2003)) and on economic growth (Easterley and Levine (1997)).

Recent research has made a distinction between two primary sources of homophily: preferences and opportunities (Moody (2001), Currarini, Jackson, and Pin (2009), Currarini, Jackson, and Pin (2010), Currarini and Vega-Redondo (2011)). While preferences refer to mental attitudes about others, opportunities refer to exogenous biases that agents face in the process of forming social ties, such as, for instance, academic tracking in schools or other organizational constraints. While it is difficult to disentangle the two in empirical field studies, conducting a laboratory experiment allows us to maintain opportunities constant and isolate preferences for an in-group match. Treatment variations allow us to furthermore understand to what extent homophily is driven by culturally learned psychological attitudes (such as "stick to your own kind") or by more strategic considerations about the expected outcome of in-group and out-group matches.

In-Group Bias Just like homophily, *in-group bias* is among the most documented and robust phenomena in social science. It refers to the "systematic tendency to evaluate one's own membership group (the in-group) or its members more favorably than a nonmembership group (the out-group) or its members" (Hewstone, Rubin, and Willis (2002)). Hence, unlike homophily, in-group bias is *not* a bias in matching patterns or preferences, but instead refers to differential *behavior* of agents across in- and out-group matches.

While one would be tempted to associate in-group bias uniquely to strong social discriminatory phenomena driven by stereotyping, prejudice and racism, experimental studies have shown that agents tend to identify with groups in response to much weaker motives as well. In fact, a number of papers in psychological research have found evidence in support of in-group favoritism under a "minimal paradigm" design, where the assignment of agents to groups is made with no reference to previous interaction, correlation of preferences or pre-formed identities (see the pioneering work by Tajfel and Turner (1979)). This has been confirmed in a recent study in experimental economics by Chen and Li (2009), who have found in-group biases when agents are sorted in ad-hoc manner into two groups labeled with colours (maize and blue). Our treatment EXO is closely related to the study by Chen and Li (2009), who use a within-subject design and ask each participant (using the strategy method) to choose an action conditional on being matched within the group or outside their group. In contrast to them we use a between-subject design and do *not* use the strategy method. The advantage of Chen and Li (2009)'s design is that they can observe identity biases within subjects. However a disadvantage of their design is that it could potentially be leading, since participants may feel that their answers *should* differ simply because they are asked to make a conditional decision. Our results from treatment EXO show, though, that their findings are robust to these changes in design. Other works in experimental economics have not found biases in a truly minimal design (see Charness, Rigotti, and Rustichini (2007) in the context of prisoner's dilemma and battle of sexes, Eckel and Grossman (2005) in the context of team production and Chen and Chen (2012) in effort games.). Strong in-group biases have been found by (Ioannou and Rustichini (2012), Chen and Chen (2012), Charness, Rigotti, and Rustichini (2007) or Chakravarty and Fonseca (2012)) in designs that were not truly minimal.

One insight that is common to most recent studies on this subject (and that is also supported by our results) is that the observed in-group bias mainly results from different expectations about the behavior of in-group compared to out-group opponents (Yamagishi and Kiyonari (2000), Foddy, Platow, and Yamagishi (2009), Ruffle and Sosis (2006)). The effect of expectations is shown to out-weight the role of pure identification with the group (Ioannou and Rustichini (2012)). There is also strong evidence of the role of priming in reinforcing identity-based behavior and preferences (Charness, Cobo-Reyes, and Jimenez (2011), Benjamin, Choi, and Strickland (2010) and Van Bavel, Packer, and Cunningham (2008)). As we shall see, expectations are also among the driving forces behind homophily and in-group bias in our experiment.

While in all these papers the interaction pattern is exogenous and is not correlated with agents' characteristics, there have recently been attempts to study in-group bias when the pattern of interaction is to some extent endogenous. Evidence of a preference for in-group matching is obtained, in a pure allocation problem, by Foddy, Platow, and Yamagishi (2009) who find that agents prefer to receive donations from in-group members rather than from out-group members. They also show that this can be imputed to the expectation of better treatment inside the group. Our experimental evidence only partially confirms and points to a perceived reduction in uncertainty as a main motive for homophily (see below). A number of papers have considered public goods experiments with an endogenous group structure (Coricelli, Fehr, and Fellner (2004), Keser and van Winden (2000), Grimm and Mengel (2009) and Ahn and Salmon (2009) among others). Since selection and exclusion - that are indeed found to affect behaviour - are based on behavior rather than group membership or identity in these studies, they are somewhat less related to our work.

While all these works point to a robust evidence of in-group bias and, to a lesser extent, of homophily, a systematic study of these two forces in a unified experimental setting is yet missing, and little is known about their interplay, complementarities and the driving forces behind them. To fill this gap is one of the objectives of the present paper.

The paper is organized as follows. Section 2 describes our experimental design in full detail. Section 3 and 4 present the evidence for in-group bias and for homophily. Section 5 discusses the possible determinants for these phenomena, and for the decrease in in-group bias under endogenous matching. Section 6 concludes.

2 Design

Our experiment was conducted at the BEE-Lab at Maastricht University between March-May 2011. 258 participants participated in one of our 5 main treatments. Table 2 summarizes the treatment structure together with the number of (independent) observations per treatment.[1] Our basic treatments are treatments ENDO, EXO and CONTROL.

Treatment ENDO In treatment ENDO participants were first randomly and exogenously allocated to the BLUE and RED group. Subsequently the experiment developed as follows: First participants were asked whether they preferred to be matched with a member of the RED or BLUE group. Subsequently (on a new screen) their willingness to pay (*wtp*) for their choice was elicited. (Details on the elicitation mechanism can be found below). They were then matched with a member of the RED or BLUE group (with probabilities depending on their *wtp*) and informed about the group of their match (RED or BLUE). Subsequently the two players in a given match were randomly allocated the role of Player A and B (with equal probabilities) and played 8 games with their match in fixed sequence.

	First Mover (A) chooses	Second Mover (B) chooses	
G1	no choice	(400,400) or (750,375)	Altruism
G2	no choice	(100,300) or (400,200)	Altruism
G3	(250,250) or let B choose	(100,100) or (500,100)	Negative Reciprocity
G4	(50,650) or let B choose	(0,100) or (100,100)	Negative Reciprocity
G5	(500,0) or let B choose	(300,300) or (600,275)	Positive Reciprocity (Inequ. increasing)
G6	(250,0) or let B choose	(100,100) or (250,50)	Positive Reciprocity (Inequ. increasing)
G7	(350,100) or let B choose	(300,300) or (100,350)	Positive Reciprocity (Inequ. decreasing)
G8	(400,0) or let B choose	(200,200) or (0,400)	Positive Reciprocity (Inequ. decreasing)

Table 1: The 8 games. Payoffs are in format (π_A, π_B) where π_i is the payoff of player i.

Table 1 describes the 8 games. They are variants of some of the games described in Charness and Rabin (2002). In Games 1 and 2 there is no choice for Player A and Player B chooses between two allocations. These games indicate how altruistically Player B behaves. In all other games Player A moves first and either ends the game by picking an allocation or lets Player B choose, who then chooses between two allocations. Games 3 and 4 indicate how negatively reciprocal Player B behaves and Games 5-8 indicate how positively reciprocal Player B behaves. We will also sometimes distinguish between the cases where positive reciprocity is inequality decreasing (Games 7 and 8) or increasing (Games 5 and 6). In principle we could also distinguish whether altruism is inequality decreasing (Game 1) or not (Game 2) and whether negative reciprocity is inequality decreasing (Game 3) or increasing (Game 4). Since we do not find significant differences in the latter cases, we will not do so in the following.

Participants in the role of Player B were asked to make a conditional choice indicating what they would do if player A decided to let them choose (strategy method). This means we observed the choice of *each* participant in the role of Player B irrespective of what Player A did actually choose. Participants did not receive feedback about each other's choices until all eight games had been played. This implies that each participant can be treated as an independent observation in all the games.

Treatment EXO Our second treatment (EXO) coincides with ENDO except for the fact that participants were randomly and exogenously matched with either someone from the RED or BLUE group to play the 8 games. Comparing behaviour in EXO and ENDO enables us to understand the connection between homophily and in-group biases.

[1]54 additional participants participated in two more treatments LABEL and FIXED, the results of which we report only briefly in the Appendix. Other than the treatments reported we did not run any additional sessions or treatments, nor did we conduct pilot studies.

Treatment CONTROL In our third treatment (CONTROL) participants were randomly matched to play the 8 games, but there were no RED or BLUE groups in this treatment.[2] The control treatment allows us to see how behaviour is affected by the introduction of groups. Understanding how the creation of these artificial differences among our participants affects behaviour has relevant implications regarding the role of heterogeneity within a society.

Label	Matching	RED/BLUE groups	Games	Observations
T1 ENDO	endogenous	yes	SocialPreferences	67
T2 EXO	exogenous	yes	SocialPreferences	73
T3 CONTROL	exogenous	no	SocialPreferences	44
T4 LOWB	endogenous	yes	No Scope for Bias	38
T5 COORD	endogenous	yes	Coordination	36

Table 2: Main Treatments with Number of Independent Observations (Participants).

Those are our main treatments that we will use to understand homophily and in-group bias. Let us briefly define these two key notions, that we will discuss in more detail later.

Homophily As we mentioned before, by homophily we will refer to a *preference* for interacting with agents front he same group. We will measure homophily by the willingness to pay for an in-group match (and heterophily as the *wtp* for an out-group match). Given our design, more homophily (in the sense defined above) will of course also lead to a higher expected number of in-group matches in the ENDO treatment.

In-group Bias By in-group bias we will refer to differences in behavior across in- and out-group matches, which we will measure by the *behavior of player B* in our eight games.

Additional Treatments We conducted two additional treatments to understand the reasons behind homophily. Both LOWB and COORD coincide with ENDO, but the 8 games were different in each case. In LOWB games were such that there is no scope whatsoever for in-group biases. In other words in LOWB there are no strategic reasons to be homophilous and hence we consider the amount of homophily observed in this treatment a lower bound. In COORD, however, games were such that being from the same group could potentially help to resolve coordination problems. Hence we expected there to be more homophily in COORD compared to ENDO compared to LOWB. Understanding where ENDO lies in the range between LOWB and COORD can help us understand to which extent homophily is strategic. Sample Games from these treatments can be found in Appendix F.

Mechanism to elicit *wtp* We use the following mechanism to elicit the *wtp* of participants in treatments ENDO, LOWB and COORD. Participants are endowed with 500 ECU at the beginning of the experiment. To elicit their *wtp* they are asked to state a number between 0 and 100 that indicates how much they would be willing to pay to be matched with their preferred group. We then draw a random number between 0 and 100 from a uniform distribution. If the randomly drawn number exceeded the number stated by the participant they were matched randomly. Otherwise they were matched with their preferred group and an amount corresponding to their number was deducted from their endowment. Since we had a finite number of participants in the experiment, there was a small chance that this mechanism is infeasible. In this case (which didn't happen) we would have matched participants randomly and not deducted anything from their endowment. Participants were fully informed about all these details.

[2]Sample Instructions for treatments T1-T3 can be found in the Appendix.

Minimal Group Design The design we used to induce in- and out- groups is called the minimal group paradigm in social psychology (See e.g. Tajfel and Turner (1979)). According to the minimal group design groups are created using trivial and sometimes meaningless tasks. Summarizing 15 years of sociological research Tajfel and Turner (1986) conclude that "the trivial, ad-hoc intergroup categorization leads to in-group favoritism and discrimination against the out-group". Chen and Li (2009) have compared of ad-hoc categorization according to two colours (maize and blue) with categorization according to expressed preferences for paintings by different artists in an economic experiment. They found that both procedures lead to significant in-group biases, while there are no significant effects of the procedure on either size or direction of in-group biases. In our study we used colours RED and BLUE as group labels to avoid hierarchical labels (such as group 1 and 2 or group A and B) and to avoid that labels are correlated with things we can't control for (such as stereotypes regarding gender, race etc..).

Many studies have shown that expectations about positive and negative reciprocity vary greatly between different cultures and across genders and there are interaction effects between the two as well. See e.g. Gaechter and Herrmann (2009) or Bohnet, Herrmann, and Zeckhauser (2010). Hence to be sure that the *wtp* for in-group matches captures homophily and not e.g. differing expectations across dimensions such as gender, culture etc.., it is important to use neutral groups. If we used non-neutral groups (such as e.g. gender), then we couldn't be sure that what we call homophily does not simply reflect a gender stereotype. Of course in reality gender- and other stereotypes might well create homophily. In this study, however, we want to focus on deeply rooted culturally learned preferences for in-group matches, which are activated even for meaningless labels such as RED and BLUE. In a sense we will measure the component of homophily that is common to all dimensions (race, gender, social status etc.) in which homophily will manifest itself in real life. In the instructions we also alternated between "RED and BLUE" and "BLUE and RED" to avoid creating a hierarchy between the groups. We also test whether the color affects behavior *per se* and find that - with one exception - it doesn't (see Appendix).

Other Details We used the experimental software z-tree by Fischbacher (2007) and the recruitment system Orzee by Greiner (2004). Each session lasted between 30min (CONTROL) - 70min (ENDO) and participants earned on average 13,40 with a minimum of 5,70 and a maximum of 24,60 Euros.

3 In-group Bias

In this section we study in-group biases. We start by defining our measure of in-group bias, and then present our evidence for the EXO and ENDO treatments.

Remember that our design does not rely on the strategic method. In other words all our participants plays the games *either* in an in-group situation *or* in an out-group situation. One advantage of our design is that it is not leading, since it avoids conditional choices of the type "if I was matched within the "RED" group I would do this, otherwise I would do that". Such contingent choices might be seen as suggestive, i.e. participants might expect that they should choose differently just because a difference is made by the experimenter. The downside of our design is that we can't directly observe in-group bias at the individual agent level. So, in defining in-group bias we need to compare the behavior of participants in in-group matches and in out-group matches.

In particular we will focus on the average behavior of Player B in in-group matches and in out-group matches. The measure of in-group bias then is the difference between these measures. Note that in treatment ENDO, of course, different types of people may be found in in-group vs out-group matches and this self-selection may affect the in-group biases measured. We will come back to this question in detail in Section 5.

3.1 In-Group Bias with Exogenous Matching

Let us start by measuring in-group bias in treatment EXO, agents have no way of affecting the matching probabilities. Table 3 shows the results of logit regressions where we regress a binary variable indicating whether a participant in the role of player B displayed altruistic, negatively or positively reciprocal behavior in each of the games on another binary variable that indicates whether the match was an in-group match (variable "in-group"). We clustered standard errors by individual, since we observed each participant in two games for each category. Remember the categories are altruism (games 1,2), negative reciprocity (3,4), positive reciprocity (inequality increasing case 5,6) and positive reciprocity (inequality decreasing 7,8).

We find that there is significantly *less negative reciprocity* in in-group compared to out-group matches ($p < 0.002$, see G3-G4 in Table 3) and *more positive reciprocity* in Games 5-6 (where positive reciprocity is inequality increasing) ($p < 0.011$, see Table 3). In particular there is a 34 percent increase in positive reciprocity and a 40 percent decrease in negative reciprocity in in-group matches according to the marginal effects of the logit regression below. (See also figure 1). Those results are consistent with Chen and Li (2009) who, with a within subject design, find a 19 percent increase in positive reciprocity and a 13 percent decrease in negative reciprocity in in-group compared to out-group matches.

EXO	G1-G2	G3-G4	G5-G6	G7-G8
constant	-1.8245^{***}	0.3364^{***}	-2.3978^{***}	-0.6931^{*}
in-group	0.9555	-1.8405^{***}	2.1234^{**}	-0.6649
groups	40	40	40	40

Table 3: In-group Bias in EXO. Logit Regression with standard errors clustered by id. 40 individuals in the role of Player B, 80 observations. ***1%,**5%,*10% significance.

Table 4 shows the same regression but we included additional variables from the questionnaire as well as a dummy "RED" that takes the value 1 for participants from the RED group to see whether colour matters per se. The questionnaire variables are age, a gender dummy (1=female), a measure of risk aversion and a measure of cognitive reflection. All the variables are described in detail in the Appendix.

The main message is that in-group biases identified in Games 3-4 and 5-6 remain significant

EXO	G1-G2	G3-G4	G5-G6	G7-G8
constant	-8.1378^{**}	1.9952^{**}	-9.7469^{**}	8.9449^{*}
in-group	1.8166^{**}	-1.5726^{***}	2.1414^{***}	1.0084
age	0.0697	−0.1177	0.2888^{*}	−0.3150
gender	−1.1008	0.5008	−0.0190	-1.7060^{*}
RED	2.0637^{**}	−0.5904	0.2084	−0.4652
risk aversion	0.5911^{**}	0.2217	−0.0388	0.2656
cognitive reflection	0.9022^{**}	0.0548	0.5933^{*}	−0.5270
groups	39	39	39	39

Table 4: In-group Bias in EXO. Logit Regression with additional variables (Standard errors clustered by id). 39 individuals (groups) in the role of Player B, 78 observations. One individual dropped who preferred not to answer gender/age question in questionnaire. ***1%,**5%,*10% significance.

when these variables are introduced and the coefficients are of about the same size. In fact statistical significance is even higher for positive reciprocity when controlling for these variables (G5-G6). Interestingly a new in-group bias appears for the category Altruism (Games 1-2) when controlling for these variables. Participants are more altruistic towards in-group members. In addition, it seems that more risk averse, more cognitively reflected people and people from the RED group are more altruistic. However none of these variables can robustly explain behavior in any of the other game categories. The single most important variable is the in-group dummy.

3.2 In-Group Bias under Endogenous Matching

We next measure in-group bias in treatment ENDO with endogenous matching, where agents can affect the probability of an in-group (or out-group) match at a monetary cost. Our main result here is that when agents choose who to match with, the aggregate in-group bias *either diminishes or totally vanishes* in statistical terms. This is illustrated in Figure 1, depicting the measures of in-group bias in both the treatments with exogenous matching (EXO) and with endogenous matching (ENDO), for the different pairs of games.

One important issue in comparing the EXO and ENDO treatments is that in the latter, whether or not a person ends up in an in-group match is not exogenous to behavior. In particular, the same characteristic that leads an agent to have a differential behavior across in-group and out-group matches may affect that agent's preference over who to be matched with.[3] We will come back to this question in detail below. To control for the willingness to pay, and therefore isolate the effect of a match's type on behavior, we have included the variabl *wtp x in-group* in some of the logit regressions reported in Table 5, which measures an agent's willingness to pay in order to be assigned to an in-group match (his/her "homophily"); From Table 5 we see that once the type of match is controlled for, the agents' attitudes towards the type of match (in- or out-group) do not significantly affect their behavior, except in games 7 and 8 (positive reciprocity), where the effect is marginally significant and in the direction of a larger in-group bias for agents with more marked preferences for in-group matches. More importantly, the non significant coefficients for the in-group dummy shows that, after controlling for the effect of agents' willingness to pay on realized matches, the type of match (in-group vs. out-group) has no significant effect on behavior. The right column for each of the game shows coefficients where the *wtp* variable are omitted; here, the joint effect of attitudes on the realized match and on behavior generates a marginally significant positive bias for games 5 and 6 (positive reciprocity). Still, because of these potential endogeneity issues, the results in Table 5 should be read with care. Hence, as additional evidence, we also present the correlation coefficients from a Spearman

[3] As we will show below, this is indeed the case since "homophilous" agents do behave differently from others.

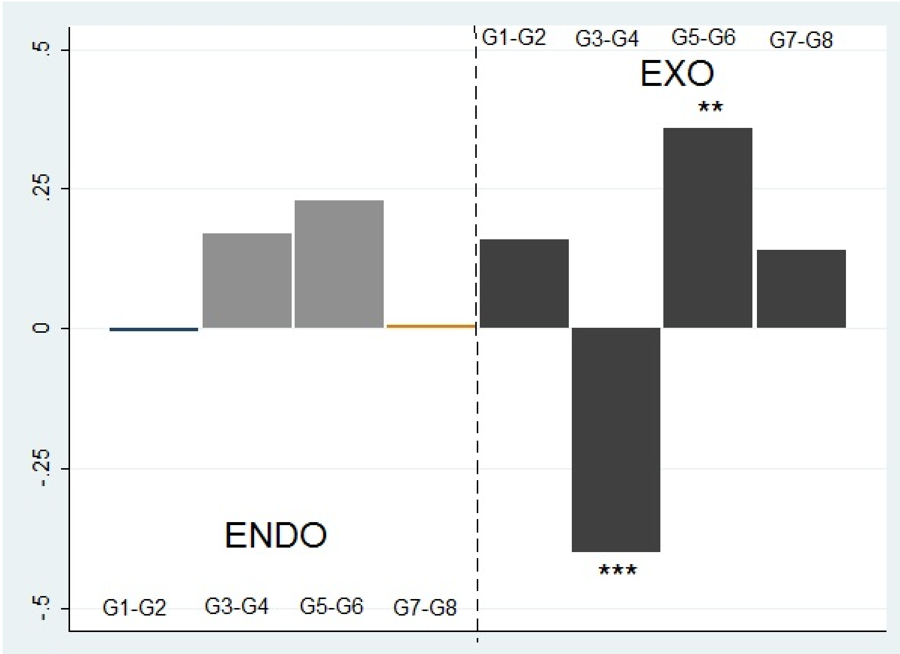


Figure 1: In-Group Biases. The graph shows the difference in the percentages of B-players displaying "altruism" (Games 1-2), "negative reciprocity" (Games 3-4), "positive reciprocity" (inequality increasing (Games 5-6)) or "positive reciprocity" (inequality decreasing (Games 7-8)) between in-group matches and out-group matches. On the left hand side is ENDO and on the right hand side is EXO. *** 1%,** 5%,* 10% significantly different from zero (minimum significance level in Tables 3, 5 or 7).

correlation test (Table 7), where we correlate behaviour with the binary variable "in-group". This table illustrates that biases (correlation coefficients) are uniformly larger in EXO compared to ENDO (in terms of their absolute value) and are only statistically significant in EXO, with the exception of a marginally significant coefficient for Games 5 and 6 (positive reciprocity) in ENDO.

	G1-G2	G1-G2	G3-G4	G3-G4
constant	−0.9555***	−1.3332***	−1.3633***	−1.3633**
in-group	−0.2615	−0.0430	0.9167	0.8933
wtp x in-group	0.0094		−0.0011	
groups	40	40	40	40
	G5-G6	G5-G6	G7-G8	G7-G8
constant	−1.3633***	−1.3633***	0.7777**	0.7777**
in-group	0.9375	1.2091*	0.6442	0.0332
wtp x in-group	0.0134**		−0.0239	
groups	40	40	40	40

Table 5: Logit Regression with standard errors clustered by id. In-group Bias in ENDO. 40 individuals (groups) in the role of Player B, 80 observations. *** 1%,** 5%,* 10%

Table 6 shows the results of the same regression as the base regressions in Table 5, but again we have included some variables from the questionnaire. In this regression as well we do not find any significant in-group biases for treatment ENDO. The marginally significant coefficient on in-group in Games 5-6 disappears here and instead in-group appears as marginally significant in Games 3-4. Taken together there is no evidence for robustly significant in-group biases in

ENDO	G1-G2	G3-G4	G5-G6	G7-G8
constant	-2.3640^{**}	-1.1748^{**}	-0.5385^{**}	-0.1517
in-group	-0.1902	1.4295^{*}	0.6632	0.3072
age	0.1409	0.0446	-0.0152	0.0347
gender	-0.9131	0.4831	-0.1231	0.1231
RED	0.2853	-0.7944	0.9275	-0.5058
risk aversion	-0.3137	-0.2068	-0.1492	0.1716
cognitive reflection	-0.3051	-0.1064	-0.2423	-0.0878
groups	40	40	40	40

Table 6: In-group Bias in ENDO. Logit Regression with additional variables (Standard errors clustered by id). 40 individuals (groups) in the role of Player B, 80 observations. ***1%,**5%,*10% significance.

	ENDO	EXO
Altruism (Games 1-2)	-0.0314	0.2728^{*}
Neg. Reciprocity (Games 3-4)	0.2363	-0.4551^{***}
Pos. Reciprocity (I) (Games 5-6)	0.3103^{*}	0.5392^{***}
Pos. Reciprocity (d) (Games 7-8)	0.0205	0.1870

Table 7: Spearman correlation coefficients. Correlation between the frequency of altruistic, negatively reciprocal etc.. behavior and in-group match dummy. 40 individuals in the role of Player B, 80 observations. *** 1%,** 5%,* 10%

ENDO. We summarize this finding in our Result 1.

Result 1 *The aggregate in-group bias vanishes or decreases in the transition from exogenous to endogenous matching.*

In Section 5.1 we study the possible sources of the decrease in in-group bias recorded in Result 1. The analysis starts from the consideration that there are two ways in which endogenous matching could affect in-group bias. First, under endogenous matching homophilous agents will tend to self select into in-group matches, while heterophilous self select into out-group matches. This affects in-group bias only if homophily (and heterophily) are correlated with behavior in the games being played. Second, endogenous matching may affect in-group bias by directly changing the contingent behavior of agents across types of matches. A first step towards a better understanding of Result 1 is therefore to study how prevalent homophily is in our data and how it correlates with behavior. This is done in the next section.

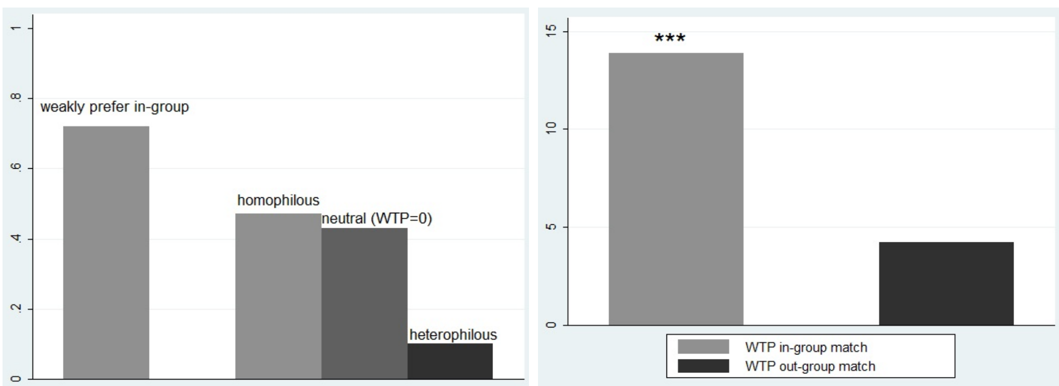
4 Homophily

We start by assessing how prevalent homophily is in our experiment, and then explore the correlation between homophily and observed in-group bias.

4.1 Extent of Homophily

We define three types of agents, based on their declared willingness to pay and on the type of preferred match. *Strictly homophilous* agents are those with a strictly positive willingness to pay for an in-group match; *Strictly heterophilous* agents have a strictly positive willingness to pay for an out-group match; and *Neutral* agents have a willingness to pay of zero.

Figure 6 shows the share of these types in the population. The left-most bar in figure 2(a) measures the share of agents that declared to prefer an in-group match, including those that afterwards declared a willingness to pay of zero. The three right bars in Figure 2(a) show the percentages of strictly homophilous, neutral and strictly heterophilous participants in ENDO.



(a) Matching Preference (b) Willingness to Pay

Figure 2: More than 50 percent of participants prefer to be matched homogeneously ($p < 0.001$ according to a binomial test). The average willingness to pay for a in-group match is higher than that for a out-group match, which does not significantly differ from zero. (Mann-Whitney, $p = 0.0001$) (***1%,**5%,*10%).

There are about 45% of strictly homophilous agents, about the same proportion of neutral agents, and a very low number of strictly heterophilous agents that make up for about 10% of the population. Figure 6(b) shows the average willingness to pay (*wtp*) for in-group and out-group matches, respectively. The average *wtp* is computed as the average of all agents who stated to prefer an in-group or out-group match, hence it includes neutral agents. This average willingness to pay is significantly larger than zero only for (weakly) homophilous agents, suggesting that homophily is not only more prevalent but also associated with more intense preferences over matchings. The average *wtp* for an in-group match is only about 15 (out of a max of 100), which is a reflection of both the substantial share of neutral agents (with wtp=0) and the fact that homophily works at a relatively subconscious level in the experiment with minimal groups. The entire distribution of the *wtp* in treatment ENDO can be found in Figure 7 in the Appendix.

Result 2 *There are about 45% of strictly homophilous agents, 45% neutral agents, and 10% strictly heterophilous agents in the ENDO treatment.*

4.2 In-group Bias among Homophilous Agents

Is homophily (and, more in general, are attitudes towards types of match) correlated with discriminatory behavior across in- and out-group matches? As we mentioned before, this issue is important to understand the driving forces behind the decrease in the aggregate in-group bias under endogenous matching. Figure 3 shows in-group biases for the three different types of matching preferences in negative and positive reciprocity games (3-4 and 5-6, respectively). In the positive reciprocity games, we record a significant and positive in-group bias only for homophilous agents, while no bias is present on average for neutral and heterophilous agents. No bias is present in negative reciprocity games. This evidence is consistent with the results of the regressions reported in Table 5, where the only significant interaction effect between degree of homophily (willingness to pay) and bias was found for the case of positive reciprocity.

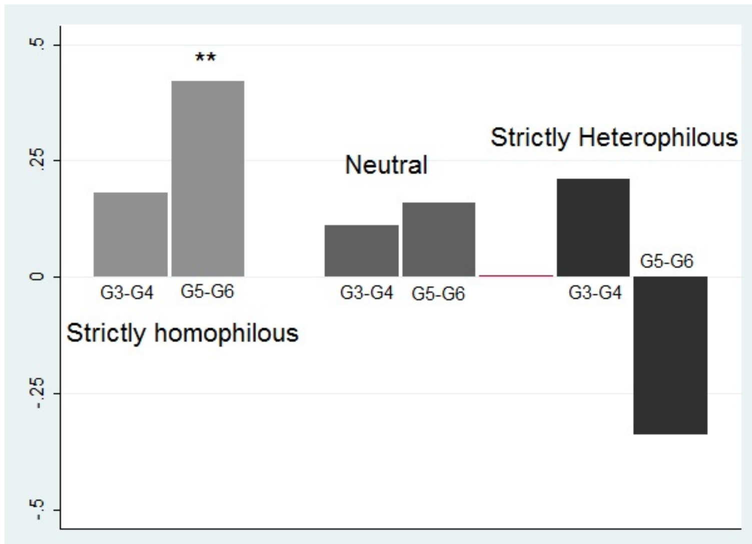


Figure 3: In treatment ENDO in-group biases are only found when restricting to homophilous agents. *** 1%,** 5%,* 10%.

The type of bias we find in the positive reciprocity games is of the type one would naturally expect: agents that prefer to match with similar agents, are also prone to reward similar others in return for kind actions; by the same logic agents that prefer to match with dissimilar others would be expected to reward similar agents less. We find evidence for both intuitions, although only in the case of homophilous agents the effect is statistically significant.

Further evidence can be found from a Spearman correlation test report in table 8. We can also compare the levels of reciprocity contingent on the type of match. While there is no significant difference in levels of negative reciprocity, we find that in the inequality increasing case (Games 5-6) strictly homophilous agents display more positive reciprocity in in-group matches than others do (0.64 compared to 0.25, two-sided Mann-Withney test $p = 0.0958$).

	Homophilous	WTP=0	Heterophilous
Neg. Reciprocity (Games 3-4)	0.3158	0.0558	0.3043
Pos. Reciprocity (Games 5-6)	0.5190**	0.1484	-0.6667
Number of Observations (Share)	18(45%)	17(43%)	5(12%)

Table 8: Spearman correlation coefficients. Correlation between the frequency of altruistic, negatively reciprocal etc.. behavior and in-group match dummy. 40 individuals in the role of Player B, 80 observations. *** 1%,** 5%,* 10%

Result 3 *Under endogenous matching, in-group biases can be found only among strictly homophilous agents, who are more positively reciprocal towards the in-group than towards the out-group.*

4.3 Risk Aversion and Homophily

In a post experimental questionnaire we also elicited risk aversion of participants. As a measure of risk aversion we use a variable that counts to how many questions in the questionnaire the participants answered sure outcome. (The questions can be found in the Appendix). Hence the variable ranges from 0 (least risk averse) to 7 (most risk averse). Table 9 shows the distributions of the variable risk aversion in treatments ENDO and EXO, which are remarkably similar.

	ENDO	EXO
0 (least risk averse)	0.10	0.10
1	0.07	0.08
2	0.29	0.21
3	0.31	0.34
4	0.18	0.17
5	0.02	0.05
6	0	0
7 (most risk averse)	0	0.01

Table 9: Distribution of the variable Risk aversion.

Participants with a higher willingness to pay for an in-group match are more risk averse (Spearman test $\rho = 0.3586^{***}$).[4] Figure 4 illustrates the predicted values of a linear regression where we explain the *wtp* for an in-group match via the risk aversion variable as well as data points in risk aversion - *wtp* space. This evidence points to some intriguing explanation of the possible psychological sources of homophily. Agents may subconsciously expect to have more precise priors on the behavior of similar agents, and hence feel they face ex-ante less variance when interacting with similar others. Therefore, more risk averse agents would end up investing more in a safer relationship. We come back to this issue in section 5.1.2

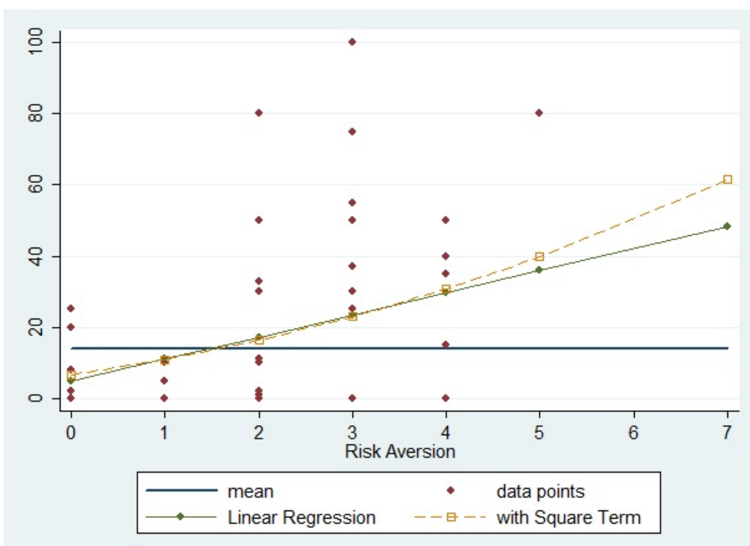


Figure 4: Fitted values from a linear OLS regression of the *wtp* for an in-group match on Risk-Aversion.

We also conducted a cognitive reflection test in the questionnaire and found no significant correlation between cognitive reflection and homophily (nor between cognitive reflection and willingness to pay).

[4]This effect is also significant across all treatments with endogenous matching, i.e. aggregating data from ENDO, LOWB and COORD (Spearman-test: $\rho = 0.1986^{**}$).

Result 4 *Homophily is positively correlated with risk aversion.*

5 Explaining homophily and the decrease of in-group bias

Having assessed how homophilous agents are, and to what extent homophily correlates with identity bias, we can now address the issue of what drives the transition in in-group bias recorded in Result 1.

5.1 Determinants of the decrease of in-group bias

We will address in turn two different explanations of the decrease in in-group bias. The first explanation, self-selection, asserts that there is no change in conditional behaviour for any of the types of participants, but that in-group biases vanish in ENDO as a result of self-selection of more homophilous agents into in-group matches and more heterophilous agents into out-group matches. We will address this explanation first and afterwards study possible shifts in conditional behaviour.

5.1.1 Self-selection

The self-selection hypothesis assumes that the different assortment of agents that results from endogenous matching is the sole determinant of the decrease in in-group bias recorded in Result 1. In particular, this assumption postulates that there is no shift in type-dependent contingent behavior between the two treatments EXO and ENDO. Our task in this section is to assess whether the concentration of homophilous agents in in-group matches and of heterophilous agents in out-group matches taking place in ENDO can explain Result 1.

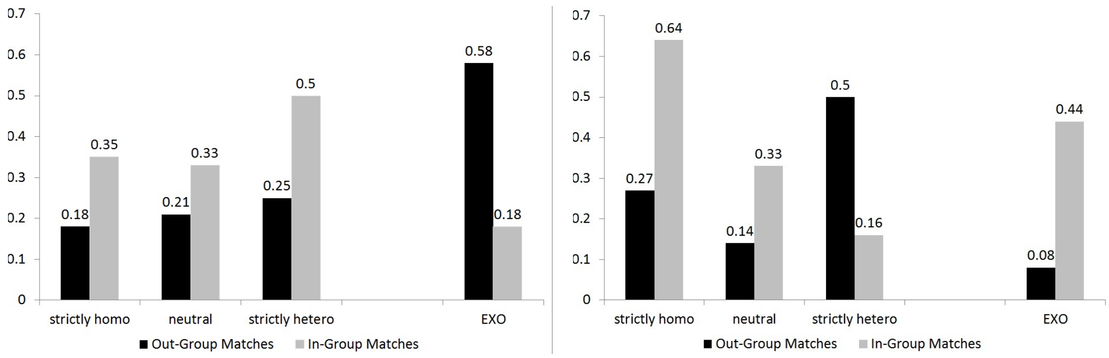
The first point we wish to make is that the way in which self-selection operates is not obvious and depends not only on the biases that various types of agents have, but also on how average levels of reciprocity rank. To fix ideas, let us define by IN_{hom} and OUT_{hom} the average behavior of homophilous agents in in-group matches and out-group matches, respectively, and by In_{het} and Out_{het} the corresponding values for heterophilous agents. It can be easily checked that whenever $IN_{hom} \geq IN_{het}$ and $OUT_{hom} \geq OUT_{het}$ we necessarily have an increase in the bias passing from the EXO to the EXO. In fact, the reassortment of types across in- and out-group matches would unambiguously increase the average behavior in in-group matches, and decrease it in out-group matches. However, other rankings would imply opposite conclusions, or no conclusion at all. When, for instance, the two inequality above are reverse, we have a decrease in the bias from EXO to ENDO, and when only one holds we have ambiguous effects.

It is then clear that in order to test the self-selection hypothesis we need to refer to the observed levels of reciprocity in the ENDO and EXO treatment of our experiment. These are summarized in figure 5 below.

To rule out self-selection we now have to answer two questions: (i) are there possible realizations of the matching process that can produce the bias in EXO? (holding contingent behavior in ENDO for all three types constant and placing a 95 percent confidence interval on the distribution of types) and (ii) is contingent behavior in in-group and out-group matches significantly different between ENDO and EXO?

We answer these questions separately for the case of negative and positive reciprocity. Note that by doing so we are testing a weaker hypothesis, since it is the same realization of the matching process that has to produce *both* the bias in negative and positive reciprocity. We start with the case of negative reciprocity illustrated in Figure 5(a).

Negative Reciprocity For all types, negative reciprocity is weakly higher in in-group matches compared to out-group matches in ENDO. At the same time, we observed significantly *less*



(a) Negative Reciprocity (b) Positive Reciprocity

Figure 5: Levels of reciprocity in ENDO (by type of matching preference) and in EXO (rounded). Remember that 45 percent of agents are classified as homophilous and neutral, respectively and 10 percent as heterophilous.

negative reciprocity at the aggregate level in in-group compared to out-group matches in the EXO treatment. Furthermore all types are *more* negatively reciprocal in in-group matches in ENDO compared to average behavior in in-group matches in EXO (t-test for equality of means $p = 0.1015$, one-sided: $p = 0.0508$). And all types are *less* negatively reciprocal in out-group matches in ENDO compared to average behavior in out-group matches in EXO (t-test for equality of means $p < 0.0001$). Hence, even allowing for any distribution of types, there is no realization of the matching process that could have produced this outcome without a shift in behavior.

Positive Reciprocity Here we see that all types are more positively reciprocal in out-group matches in ENDO compared to EXO (t-test for equality of means, $p = 0.0537$).[5] This directly implies that no realization of the matching process in EXO may have generated the observed average level of reciprocity, clearly demonstrating that self-selection *alone* cannot explain the changes in aggregate behaviour we observe by moving from exogenous to endogenous matching.

Result 5 *Self selection alone cannot explain the decrease of in-group bias in the transition from exogenous to endogenous matching.*

5.1.2 Discussion

Motivated by Result 4, we will now attempt to identify plausible directions and explanations for the shift in behavior triggered by the endogeneity of the matching process. Our explanation for the shift in behavior stresses the role of the change in expectations about the type of opponents found in in-group matches in ENDO vs EXO. By affecting the distribution of types across in-group and out-group matches, self selection affects agents' expectations about whether their opponent is either homophilous, heterophilous or neutral conditional on the type of realized match. This can have interesting consequences on behavior.

Assume for example that homophilous agents expect from other homophilous agents to be particularly kind in in-group matches, and less kind in out-group matches. When perceived as a violation of this norm, unkind behavior is likely to be punished harshly. This will indeed apply to in-group matches in the endogenous treatment, where opponents are likely to be homophilous, but not in the exogenous matching, where there is no correlation between type of match and

[5] We can also conduct this test separately for all types and find significance levels of $p = 0.0929$ (strictly homophilous) and $p = 0.0656$ (neutral) for the one-sided test, but no significance for heterophilous agents due to their small number.

type of opponent (homophilous, neutral, heterophilous). By the same logic, compliance with the norm by being kind to in-group members will be less strongly rewarded by homophilous agents. This explains both why we observe a bias in positive reciprocity only for homophilous agents, and why the aggregate bias should decrease when passing from exogenous to endogenous matching.

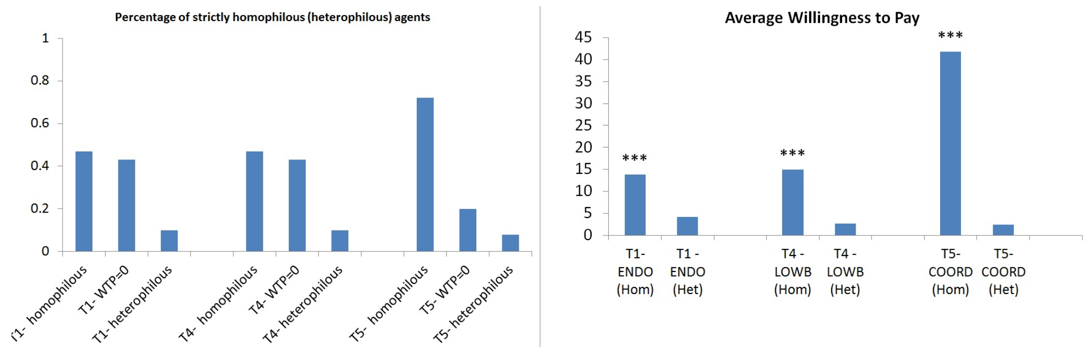
Note that the above explanation is based on a shift in behavior triggered by a change in the expectations that agents have about their opponents in in-group matches, rather than on a change in the way they feel about in-group vs. out-group matches. In other words, the institution of endogenous matching affects beliefs rather than preferences. Through self selection, homophilous agents tend to cluster in in-group matches, forming disjoint close-knit communities within groups. Such communities tend to be characterized by strong social norms, which are enforced by means of selective punishments and rewards. Unexpectedly, this can lead to a reduction in overall in-group bias, by counterbalancing discriminatory behaviour towards out-group members with harsher sanctioning of norm violation by in-group members. Such effects seem to underly social phenomena such as, for instance, the punishing of *acting white* behavior which refers to a person's perceived betrayal of identity.

Of course, other explanations that refer e.g. to the monetary investment into in-group relationships are conceivable. For instance, agents who invested a significant amount into an in-group match may feel entitled to receive kind behavior in these matches. Hence, these agents would punish unkind behavior more harshly, and reward kind behavior less. However, our evidence is not very supportive of this hypothesis for two reasons: first, although homophilous agents are different from others, their behavior in in-group matches is not strongly correlated with their willingness to pay; second, this hypothesis would suggest that homophily is itself strategic, by this meaning that it is meant to lead to higher monetary payoffs. As we argue in the following subsection, this last conjecture is not supported by evidence.

5.2 Determinants of homophily

Agents seems to display different behavior depending on whether or not they are homophilous. But why are agents homophilous in the first place? This is an important issue to evaluate the consequences of policies that are meant to provide incentives to affect the degree of fragmentation of society. Compared to much of the existing literature relying on field data, the controlled experimental setting allows us to disentangle opportunities from strategic incentives and intrinsic preferences. Since all participant face the same meeting opportunities by design, we can here focus on distinguishing between direct incentives coming from the expected payoffs in the games and indirect incentives coming from preference parameters an/or biased belief.

To understand whether homophily is strategic in the sense that it is driven by the desire to increase expected payoffs, we can compare our main treatment ENDO to our treatments LOWB and COORD. Remember that in LOWB the games played are such that there is no way for a player to favor others from a particular group. In other words there is no scope for in-group bias. In COORD, instead, there are clear incentives for in-group matching. (Sample Games from treatments LOWB and COORD can be found in Appendix F). Where ENDO ranges in between these treatments helps us to understand to what extent homophily in ENDO is driven by expected payoffs. Comparing ENDO and LOWB we see that there is almost no difference in average willingnesses to pay, which is even slightly higher in LOWB. Moreover, the percentage of strictly homophilous agents exactly coincides in the two treatments (see Figure 6). Treatment COORD on the other hand is significantly different from both ENDO and LOWB, both in terms of the average willingness to pay and of the percentage of strictly homophile agents (Mann-Whitney, $p < 0.0019$ and $p < 0.0581$, respectively). This shows that if there are explicit incentives for homophily (as in COORD), participants do respond to those. All this suggests that homophily is not strategic in treatment ENDO.



(a) Strict Preferences (b) Matching Preference

Figure 6: The average willingness to pay for a in-group match is higher than that for a out-group match, which does not significantly differ from zero. (Mann-Whitney test (***1%,**5%,*10%)).

Result 6 *Comparison of WTP across treatments ENDO, LOWB and COORD suggests that homophily in ENDO is not driven by concerns for expected payoff.*

Having argued that expected payoff maximization is not the driving force behind homophily, we can formulate conjectures about what in preferences and/or in beliefs provides agents with motives to be homophilous. One piece of evidence we can use to narrow down the range of possible explanations is the fact that risk aversion is strongly correlated with homophily (measured by the willingness to pay for in-group match). If homophilous agents feel they can better predict the behavior of in-group others, they will tend to associate less variance to in-group matches, and therefore will tend to stay away from out-group interactions. This effect will be stronger the more risk averse they are. This explains the correlation between risk aversion and homophily; but why should agents beliefs in the first place that they are better able to predict behavior in in-group matches? One possible explanation lies in what we have argued in the section 5.1: interaction among homophilous agents is regulated by strict social norms which enforce stable and henceforth predictable behavior. Since in-group interaction tends to be composed of homophilous agents in ENDO, agents tend to associate stability with in-group matches.

This evidence suggests that risk aversion can be one determinant of homophily. Interestingly, this is consistent with the recent sociological theory that explains group identification as a reflection of agents' desire to decrease their perceived uncertainty over the outcome of social interaction (Hogg and Abrams (1993), Hogg (2000)).

5.3 The Effect of the Introduction of Groups

Before we conclude we have a brief look at our CONTROL treatment where agents played the same 8 games as in EXO and ENDO, but where no mention was made of different groups. Understanding how behaviour in EXO differs from CONTROL can help understand how the introduction artificial group differences or identities affects behavior.

	EXO in-group	EXO out-group	CONTROL
G1-G2	0.30	0.13	0.22
G3-G4	0.18	0.58	0.26
G5-G6	0.43	0.08	0.30
G7-G8	0.79	0.66	0.74

Table 10: Comparison of Behavior EXO and CONTROL.

Table 10 shows the result of this comparison. In all four categories of games behavior in CONTROL lies in between average behaviour in in- and out-groups in EXO. This shows that

- at least in our setting - the introduction of different identities does not lead to substantially different behaviour on average. An exception is the case of negative reciprocity (games 3-4), where behaviour in the CONTROL treatment is much closer to in-group behavior in EXO and significantly different from out-group behavior in EXO. Hence the introduction of artificial identities leads to a loss in welfare due to an increase in negative reciprocity as well as to discrimination our case. This is true only, as our previous results have shown, under exogenous matching conditions.

6 Conclusions

We have studied the connection between two pervasive characteristics of social interactions: homophily and in-group bias. We found that they are tightly linked: Giving homophily a playing field (by allowing for endogenous matching) significantly reduces in-group biases. Furthermore in-group biases are only found among agents that are also homophilous. We also found that risk aversion is strongly correlated with homophily.

These results should be of interest to any social scientist studying discrimination, segregation and the like. They also have implications for a number of important policy dimensions, especially for situations where matching is an issue. Those include matching workers into teams, children to schools or social workers or field agents to different neighborhoods. Our results show that allowing some degree of choice in who to work with, can reduce in-group biases and hence discrimination at the work place. In applications, of course, other factor that were blended out in this experiment, need to be considered as well, such as information asymmetries between different groups or complementarities in skills etc.

Future research, both in the lab and in the field, is needed to understand the sources of homophily and the reasons why in-group biases decrease when homophily is given a playing field, i.e. when we allow for endogenous matching. One direction for this research could lie in the theory brought forward in this article which is based on two assumptions: In-group interactions among homophilous agents are regulated by strict norms of behavior and deviations from these norms are harshly punished (hence the reduction in in-group bias). Secondly, these norms (seem to) make behavior in in-group matches more predictable, hence providing a motive for risk averse agents to be homophilous.

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A Appendix: Behavior Player A

Player A's decision to let Player B decide or not can be motivated by (i) concerns on the distribution of payoffs (such as efficiency, equality etc.) and (ii) by anticipation of Player B's behaviour. If a participant in the role of Player A lets Player B choose in Game 3, then we can reasonably interpret this to mean that s/he does not expect B to be negatively reciprocal. If s/he lets Player B choose in Games 7-8, then we can interpret this to mean that s/he does expect Player B to be positively reciprocal. In Games 4,5 or 6 a case could be made that Player A may let B choose because this will be inequality reducing. This makes player A's behaviour more difficult to interpret in terms of in-group bias, which is why we have focused on Player B's decision for the main part of the paper.

Games 3 and 4 - Negative Reciprocity There are no significant differences between in- and out-group matches in terms of the behavior of Player A in ENDO. 56 percent and 46 percent of them, respectively, decide *not* to let player B make a choice. There is also no significant difference between in- and out-group matches in EXO, where 38 percent and 53 percent respectively decide *not* to let player B make a choice. The difference between ENDO and EXO is marginally significant for in-group matches and insignificant for out-group matches.

Games 5 and 6 - Positive Reciprocity In ENDO there are strong and significant differences between in-group and out-group matches. In out-group matches only about 10 percent of agents let Player B choose, while in in-group matches 62 percent let Player B choose ($p = 0.0010$). In treatment EXO there are no significant differences between in- and out-group matches with 33 percent and 25 percent respectively letting Player B choose.

Games 7 and 8 - Positive Reciprocity In ENDO only 7 percent of agents let Player B choose in out-group matches, while 38 percent let Player B choose in in-group matches. The difference is significant ($p = 0.0273$). In treatment EXO 3 percent let Player B choose in out-group matches, while 14 percent let Player B choose in in-group matches. This difference is not significant.

B Appendix: Effect of Group Labels

We first ask whether people have a higher willingness to pay to play with a RED rather than the BLUE group. The average willingness to pay to play with the RED group is 20.41 in ENDO and the average w.t.p to play with BLUE is 19.77. The two are not significantly different according to a Mann-Whitney test.

We then ask whether behavior is affected by being in a RED or BLUE group per se.

	red	blue
Altruism	0.23	0.15
Neg. Rec. (Games 3-4)	0.32	0.32
Pos. Rec. (Games 5-6)	0.35	0.16
Pos. Rec. (Games 7-8)	0.67	0.76

Table 11: Colours don't matter per se. ENDO

There are no significant differences between blue and red players in either of the treatments and for any of the games. The colour of the group does not seem to matter per se.

	red	blue
Altruism	0.23	0.12
Neg. Rec. (Games 3-4)	0.31	0.43
Pos. Rec. (Games 5-6)	0.29	0.28
Pos. Rec. (Games 7-8)	0.71	0.73

Table 12: Colours don't matter per se. EXO

C Appendix: Distribution of *wtp*

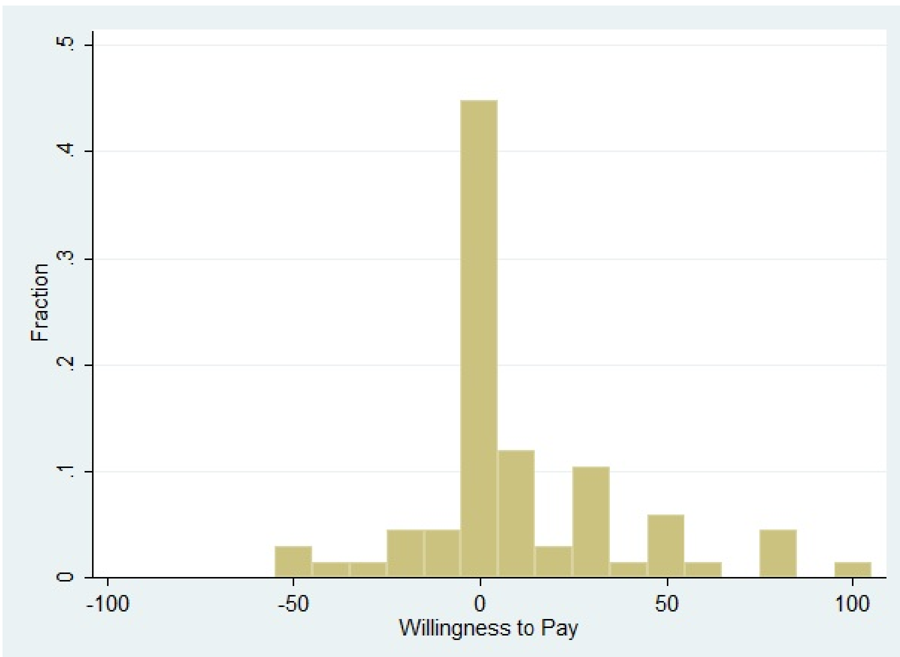

Figure 7: The distribution of willingness to pay in treatment ENDO. Negative Numbers indicate *wtp* for an out-group match and positive numbers *wtp* for an in-group match. Bin width is 10.

D Appendix: Questionnaire

D.1 Questions

- General Questions with multiple options to tick.
  - What is your nationality?
  - What is your gender?
  - What is your age?
  - What is your field of study?
- Cognitive Reflection Test
  - A bat and a ball cost 1.10 Euros in total. The bat costs 1 Euro more than the ball. How much does the ball cost?
  - If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?

– In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?

- Risk Aversion
  – If you had the choice between throwing a coin and receiving 100 Euros if heads comes up and 0 Euros if tails come up or a deal where you get 10 Euros for sure which would you prefer?
  – If you had the choice between throwing a coin and receiving 100 Euros if heads comes up and 0 Euros if tails come up or a deal where you get 20 Euros for sure which would you prefer?
  – If you had the choice between throwing a coin and receiving 100 Euros if heads comes up and 0 Euros if tails come up or a deal where you get 30 Euros for sure which would you prefer?
  – If you had the choice between throwing a coin and receiving 100 Euros if heads comes up and 0 Euros if tails come up or a deal where you get 40 Euros for sure which would you prefer?
  – If you had the choice between throwing a coin and receiving 100 Euros if heads comes up and 0 Euros if tails come up or a deal where you get 50 Euros for sure which would you prefer?
  – If you had the choice between throwing a coin and receiving 100 Euros if heads comes up and 0 Euros if tails come up or a deal where you get 60 Euros for sure which would you prefer?
  – If you had the choice between throwing a coin and receiving 100 Euros if heads comes up and 0 Euros if tails come up or a deal where you get 70 Euros for sure which would you prefer?

D.2 Overview Variables

	interpretation	range EXO	mean EXO	range ENDO	mean ENDO
risk aversion	7 most risk averse, 0 least	[0,7]	2.63	[0,5]	2.48
gender	1= female , 0=male	[0,1]	0.55	[0,1	0.65
age		[18,25]	21.71	[18,29]	21.66
cognitive reflection	number of correct answers	[0,3]	1.71	[0,3]	1.40

Table 13: Questionnaire Variables used in Regressions Section 3.

E Appendix: Additional Treatment LABEL

	red	blue
prefer in-group	0.65	0.65
wtp in-group	14.4	12.41
wtp out-group	0.75	6.58

Table 14: Percentage of red and blue participants preferring an in-group match, as well as average willingness to pay for a in-group or out-group match in Period 1.

None of the differences between red and blue participants are significant (Mann-Whitney, $p > 0.7267$). However there is a higher willingness to pay for a in-group than for a out-group match across all participants (Mann-Whitney, all periods, $p = 0.0092$).

	red	blue
Altruism	0.20	0.30
Neg. Recip.	0.25	0.30
Pos. Recip.	0.30	0.37
Ant. PosR	0.15	0.18
Ant. PosR	0.15	0.18

Table 15: Are labels followed? Altruistic and Reciprocal Behavior by Red and Blue participants as well as Anticipation of Positive and negative Reciprocity if the match is blue/red.

The table shows that labels are not followed. Red participants are not more altruistic or reciprocal than blue participants. (None of the differences are significant).

F Additional Treatment EXO(FIXED)

In all our treatments the 8 games were played thrice and participants were rematched randomly with another participant for the second and third repetition of the games. For this rematching we used matching groups of size 8.[6] For the main part of the paper we have only focused on behaviour in period 1, i.e. the first time that participants play the games. Note that since there is no feedback each participant is an independent observation in period 1. The number of independent observations reported in Table 2 refers to period 1. As explained above in periods 2 and 3 there are less independent observations. We will report report on these periods here and also discuss our additional treatment EXO(FIXED). Treatment EXO(FIXED) coincides with EXO, but players are matched in fixed pairs for all three repetitions of the 8 games. This treatment allows us to study differences in the evolution of in-group biases over time.

G Sample Instructions

G.1 ENDO

Welcome and thanks for participating in this experiment. Please read these instructions carefully. They are identical for all the participants with whom you will interact during this experiment. If you have any questions please raise your hand. One of the experimenters will come to you and answer your questions. From now on communication with other participants is not allowed. If you do not conform to these rules we are sorry to have to exclude you from the experiment. Please do also switch off your mobile phone at this moment.

For your participation you will receive 2 Euros. During the experiment you can earn more. How much depends on your behavior and the behavior of the other participants. During the experiment we will use ECU (Experimental Currency Units) and at the end we will pay you in Euros according to the exchange rate 1 Euro =500 ECU. All your decisions will be treated confidentially.

These instructions are exactly the same for all participants in the room.

THE EXPERIMENT

Phase 1: The RED and BLUE groups

[6]Due to poor show up in some of the sessions we used matching groups of size 7.

At the beginning of the experiment each participant receives an endowment of 500 ECU.

All participants in this room are randomly assigned to one of two groups, the BLUE group and the RED group. Once the software starts you will be informed about which group you belong to.

Phase 2: Your choice of who to interact with

In Phase 3 of the Experiment that we describe below you will interact in a number of games. Before that - in Phase 2 - you can state a preference for whom to interact with. In particular you can first state a preference for whether you would like to interact with someone from the RED or BLUE group.

Afterwards you will see a new screen. If you have previously stated that you would like to interact with someone from a particular group (either BLUE or RED), then you will have the possibility to increase the chances that you will actually be matched with someone from that group on the third screen.

You can increase your chances to be matched with someone from your desired group as follows:

First you will indicate a number between 0 and 100 that indicates how much you would be willing to pay to be matched with your preferred group that you indicated on Screen 2. We will draw a random number between 0 and 100 (where all numbers have the same probability). If our number is smaller than your number, you will be matched for sure with your preferred group. In this case an amount corresponding to your number will be deducted from your endowment. If our number is larger than your number you will be matched randomly with a member of either group. Example: Here is an example of how the procedure works: Assume you indicate the number 21 and we draw randomly the number 46. Then since $46 > 21$ you will be matched randomly with someone from either the RED or the BLUE group. However if e.g. you indicate 83 and we draw randomly the number 16, then since $83 > 16$ you will be matched with the group you prefer. However, in this case your endowment will be reduced by 83 (the number that you stated).

Hence the higher the number you state, the more likely it is that you will be matched with your desired group. On the other hand your endowment is also reduced by more if you state a higher number. There is a small probability that it is not feasible to match everyone with their desired group (e.g. if everyone states 100). If this is the case you will be randomly matched and your endowment will not be reduced.

Phase 3: The Games

In Phase 3 you will play the following 8 games together with an interaction partner. Whether your interaction partner will be from the BLUE or RED group will depend on your choices in Phase 2. Before Phase 3 begins you will be informed about which group your interaction partner belongs to. Similarly your interaction partner will be informed about which group you belong to.

Here is a list of all 8 games you will play. You will play each game exactly once. Before the games begin either you or your interaction partner will be randomly determined to be Player A. If you are not Player A then you will be Player B in all 8 games. Whether you or your interaction partner will be Player A is fully independent of your or your interaction partner's group.

1. Game 1: Player B chooses between two outcomes. (400,400) meaning that each player gets 400 or (750,375) meaning that Player B gets 375 and Player A 750.

2. Game 2: Player B chooses between two outcomes. (100,300) meaning that player A gets 100 and Player B 300 or (400,200) meaning that Player A gets 400 and Player B 200.

3. Game 3: Player A chooses between two options. (250,250) meaning that each player gets 250 or s/he lets player B choose. If s/he lets B choose then B can choose between (100,100)

meaning that each player gets 100 and (500,100) meaning that player A gets 500 and player B gets 100.

4. Game 4: Player A chooses between two options. (50,650) meaning that player A gets 50 and player B 650 or s/he lets player B choose. If s/he lets B choose then B can choose between (0,100) meaning that A gets nothing and B gets 100 and (100,100) meaning that each player gets 100.

5. Game 5: Player A chooses between two options. (500,0) meaning that player A gets 500 and player B gets 0 or s/he lets player B choose. If s/he lets B choose then B can choose between (300,300) meaning that each player gets 300 and (600,275) meaning that player A gets 600 and player B gets 275.

6. Game 6: Player A chooses between two options. (250,0) meaning that player A gets 250 and player B gets 0 or s/he lets player B choose. If s/he lets B choose then B can choose between (100,100) meaning that each player gets 100 and (250,50) meaning that player A gets 250 and player B gets 50.

7. Game 7: Player A chooses between two options. (350,100) meaning that player A gets 350 and player B gets 100 or s/he lets player B choose. If s/he lets B choose then B can choose between (300,300) meaning that each player gets 300 and (100,350) meaning that player A gets 100 and player B gets 350.

8. Game 8: Player A chooses between two options. (400,0) meaning that player A gets 400 and player B gets 0 or s/he lets player B choose. If s/he lets B choose then B can choose between (200,200) meaning that each player gets 200 and (0,400) meaning that player A gets 0 and player B gets 400.

It is important to note that you won't get any feedback about what your interaction partner chose until the last game has been played.

Phase 4: A post-experimental Questionnaire

At the end of the experiment there will be a short questionnaire to be filled in which will take about 5 minutes.

Summary

1. First you will be informed about which group (RED or BLUE) you belong to.

2. You can state a preference for being matched with someone of the BLUE or RED group and you can increase your chances of being matched with someone of that group via the procedure explained above.

3. You will play the 8 games described above with your interaction partner. Whether your interaction partner is from the RED or BLUE group will depend on your choices in Step 2.

4. There will be a short questionnaire at the end.

Enjoy the Experiment!

G.2 EXO

Welcome and thanks for participating in this experiment. Please read these instructions carefully. They are identical for all the participants with whom you will interact during this experiment. If you have any questions please raise your hand. One of the experimenters will come to you and answer your questions. From now on communication with other participants is not allowed. If you do not conform to these rules we are sorry to have to exclude you from the experiment. Please do also switch off your mobile phone at this moment.

For your participation you will receive 2 Euros. During the experiment you can earn more. How much depends on your behavior and the behavior of the other participants. During the experiment we will use ECU (Experimental Currency Units) and at the end we will pay you in Euros according to the exchange rate 1 Euro =500 ECU. All your decisions will be treated confidentially.

These instructions are exactly the same for all participants in the room.

THE EXPERIMENT

Phase 1: The RED and BLUE groups

All participants in this room are randomly assigned to one of two groups, the BLUE group and the RED group. Once the software starts you will be informed about which group you belong to.

Phase 2: Your match

In Phase 2 of the Experiment you will be randomly matched with an interaction partner from either the RED or BLUE group to play the games we will describe below.

Phase 3: The Games

Before the start of Phase 3 you will be informed about whether your interaction partner is from the BLUE or RED group. Similarly your interaction partner will be informed about which group you belong to.

Here is a list of all 8 games you will play. You will play each game exactly once. Before the games begin either you or your interaction partner will be randomly determined to be Player A. If you are not Player A then you will be Player B in all 8 games. Whether you or your interaction partner will be Player A is fully independent of your or your interaction partner's group.

1. Game 1: Player B chooses between two outcomes. (400,400) meaning that each player gets 400 or (750,375) meaning that Player B gets 375 and Player A 750.

2. Game 2: Player B chooses between two outcomes. (100,300) meaning that player A gets 100 and Player B 300 or (400,200) meaning that Player A gets 400 and Player B 200.

3. Game 3: Player A chooses between two options. (250,250) meaning that each player gets 250 or s/he lets player B choose. If s/he lets B choose then B can choose between (100,100) meaning that each player gets 100 and (500,100) meaning that player A gets 500 and player B gets 100.

4. Game 4: Player A chooses between two options. (50,650) meaning that player A gets 50 and player B 650 or s/he lets player B choose. If s/he lets B choose then B can choose between (0,100) meaning that A gets nothing and B gets 100 and (100,100) meaning that each player gets 100.

5. Game 5: Player A chooses between two options. (500,0) meaning that player A gets 500 and player B gets 0 or s/he lets player B choose. If s/he lets B choose then B can choose between (300,300) meaning that each player gets 300 and (600,275) meaning that player A gets 600 and player B gets 275.

6. Game 6: Player A chooses between two options. (250,0) meaning that player A gets 250 and player B gets 0 or s/he lets player B choose. If s/he lets B choose then B can choose between (100,100) meaning that each player gets 100 and (250,50) meaning that player A gets 250 and player B gets 50.
7. Game 7: Player A chooses between two options. (350,100) meaning that player A gets 350 and player B gets 100 or s/he lets player B choose. If s/he lets B choose then B can choose between (300,300) meaning that each player gets 300 and (100,350) meaning that player A gets 100 and player B gets 350.
8. Game 8: Player A chooses between two options. (400,0) meaning that player A gets 400 and player B gets 0 or s/he lets player B choose. If s/he lets B choose then B can choose between (200,200) meaning that each player gets 200 and (0,400) meaning that player A gets 0 and player B gets 400.

It is important to note that you won't get any feedback about what your interaction partner chose until the last game has been played.

Phase 4: A post-experimental Questionnaire

At the end of the experiment there will be a short questionnaire to be filled in which will take about 5 minutes.

Summary

1. First you will be informed about which group (RED or BLUE) you belong to.
2. You will be matched with someone of the BLUE or RED group.
3. You will play the 8 games described above with your interaction partner. Whether your interaction partner is from the RED or BLUE group will be determined in Step 2.
4. There will be a short questionnaire at the end.

Enjoy the Experiment!

G.3 CONTROL

Welcome and thanks for participating in this experiment. Please read these instructions carefully. They are identical for all the participants with whom you will interact during this experiment. If you have any questions please raise your hand. One of the experimenters will come to you and answer your questions. From now on communication with other participants is not allowed. If you do not conform to these rules we are sorry to have to exclude you from the experiment. Please do also switch off your mobile phone at this moment.

For your participation you will receive 2 Euros. During the experiment you can earn more. How much depends on your behavior and the behavior of the other participants. During the experiment we will use ECU (Experimental Currency Units) and at the end we will pay you in Euros according to the exchange rate 1 Euro =500 ECU. All your decisions will be treated confidentially.

These instructions are exactly the same for all participants in the room.

THE EXPERIMENT

In the experiment you will play 8 games with another randomly selected participant. Here is a list of all 8 games you will play. You will play each game exactly once. Before the games begin either you or your interaction partner will be randomly determined to be Player A. If you are not Player A then you will be Player B in all 8 games. Whether you or your interaction partner will be Player A is fully independent of your or your interaction partner's group.

1. Game 1: Player B chooses between two outcomes. (400,400) meaning that each player gets 400 or (750,375) meaning that Player B gets 375 and Player A 750.

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3. Game 3: Player A chooses between two options. (250,250) meaning that each player gets 250 or s/he lets player B choose. If s/he lets B choose then B can choose between (100,100) meaning that each player gets 100 and (500,100) meaning that player A gets 500 and player B gets 100.

4. Game 4: Player A chooses between two options. (50,650) meaning that player A gets 50 and player B 650 or s/he lets player B choose. If s/he lets B choose then B can choose between (0,100) meaning that A gets nothing and B gets 100 and (100,100) meaning that each player gets 100.

5. Game 5: Player A chooses between two options. (500,0) meaning that player A gets 500 and player B gets 0 or s/he lets player B choose. If s/he lets B choose then B can choose between (300,300) meaning that each player gets 300 and (600,275) meaning that player A gets 600 and player B gets 275.

6. Game 6: Player A chooses between two options. (250,0) meaning that player A gets 250 and player B gets 0 or s/he lets player B choose. If s/he lets B choose then B can choose between (100,100) meaning that each player gets 100 and (250,50) meaning that player A gets 250 and player B gets 50.

7. Game 7: Player A chooses between two options. (350,100) meaning that player A gets 350 and player B gets 100 or s/he lets player B choose. If s/he lets B choose then B can choose between (300,300) meaning that each player gets 300 and (100,350) meaning that player A gets 100 and player B gets 350.

8. Game 8: Player A chooses between two options. (400,0) meaning that player A gets 400 and player B gets 0 or s/he lets player B choose. If s/he lets B choose then B can choose between (200,200) meaning that each player gets 200 and (0,400) meaning that player A gets 0 and player B gets 400.

It is important to note that you won't get any feedback about what your interaction partner chose until the last game has been played.

A post-experimental Questionnaire

At the end of the experiment there will be a short questionnaire to be filled in which will take about 5 minutes.

Enjoy the Experiment!

H Sample Games LOWB and COORD

	X	Y
X	0,0	200,200
Y	200,200	0,0

Table 16: Game 1 in treatment LOWB

	BLUE	RED
RED	0,0	200,200
BLUE	200,200	0,0

Table 17: Game 1 in treatment COORD

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