Group Identity and Coalition Formation:

Experiments in a three-player divide the dollar Game[1]

James TREMEWAN

June 17, 2010

Abstract:

This paper is an experimental study on the effect of group identity on the formation of coalitions and the resulting distribution of resources. After inducing group identity based on preferences over paintings, subjects play symmetric three-player _divide the dollar_ games with a majority rule decision process. The main finding is that where two players are from one group and one from the other, those in the minority earn significantly less than majority players. This is largely a result of a two-way split between majority players occurring more frequently, either because of the increased salience of this outcome, or a shift in social preferences.

Résumé:

Cet article propose une étude expérimentale de l'effet de l'identité de groupe sur la formation des coalitions et la distribution des richesses qui en résulte. Dans une première étape, on induit chez les sujets une identité de groupe basée sur des goûts communs pour des peintures. Dans une deuxième étape, les sujets jouent par trois un jeu symétrique de type «divide the dollar» avec vote à la majorité. Le résultat principal est que lorsque parmi les trois sujets qui doivent prendre une décision, deux sujets appartiennent au même groupe, ils gagnent significativement plus que le joueur de l'autre groupe. Ceci s'explique soit par un changement de préférences sociales, soir par le fait que le partage avantageant les deux joueurs du même groupe est rendu plus saillant par le fait que les deux joueurs appartiennent au même groupe, ce qui rend plus facile la coordination.

[1] Many thanks for comments and assistance from Yan Chen, Vincent Crawford, Roberta Dessi, Guido Friebel, Astrid Hopfensitz, Michael Kosfeld, Chloé Le Coq, Xin Li, Paul Seabright, Caspar Siegert, Joel van der Weele. I am very grateful for the assistance of Bernard Richter at the FLEX Laboratory, Goethe Universität, and funding from the Embassy of France, New Zealand and CEPREMAP.

1 Introduction

The formation of coalitions is an essential element in determining a variety of social and economic outcomes at all levels of human interaction: examples include the activities of trade unions and industrial cartels, political decisions at both a domestic and international level, and decisions within organizations and families. Coalitions influence the distribution of resources, who gets jobs, and who fights which wars. Often factors such as nationality, race, religion, and gender play a key role in who is included and who is excluded from a given coalition, because of both greater trust of, and concern for, those with whom one identifies.

This paper is an experimental study on the effect of group identity on the formation of coalitions and the resulting distribution of resources. Following Chen and Li (2009), group identity is induced based on preferences over paintings. Subsequently, subjects play three-player "divide the dollar" games with a majority rule decision process. To provide a baseline and look at the outcomes and strategies employed in an entirely symmetric game, some sessions consist of games with all three players from the same group (homogenous triads). In the other sessions, two players are from one group and one from the other (heterogenous triads). The results show that individuals in the minority in heterogenous triads earn significantly less on average than the two majority players.

Three explanations are considered. Firstly, inducing group identity may change the preferences of players, making them care more about the payoff of ingroup members. Secondly, it is possible that coalitions between players in the same group are more common because group identity acts as a co-ordinating device, making certain outcomes more salient. Thirdly, it may be perceived that the minority player is in a weaker position, and thus has less bargaining power, leading to unequal divisions between majority and minority members.

To further explore these possibilities, two more games were played: a dictator game where each subject unilaterally decided upon a division between themselves and two other players, and a two-person bargaining game where two players bargained over a division between themselves and a third inactive player. The results of the dictator game clearly indicate that the inducement of group identity creates a preference for unequal distributions (i.e. majority players give the minority player a smaller share of the pie than the other majority player) and the two-player bargaining game, in conjuction with the distribution of offers in the coalition formation game, provides some evidence that minority players have less bargaining power.

Finally, after playing the games, minority players and those who earned less identified less strongly with their group. This reflects findings from the literature on status and identity, where people are more likely to identify with groups they perceive as more successful.

Numerous experiments in social psychology and economics (and casual observation) show that people behave differently depending on whether they are interacting with people from the same or different groups, where group identification may be in terms of gender, ethnicity, or other social groupings.[1] Greater altruism, leniency and cooperation have been observed in interactions with in-group members. In a series of experiments beginning with Tajfel et al [1971], these effects have been shown to occur even when the division of subjects into groups is based on trivial performance tasks, or even random. This is important because it eliminates the possibility that discrimination is "statistical" (Phelps [1972], Arrow [1973]) or based on stereotypes of members of different groups. It also suggests that a "taste for discrimination" (Becker [1957]) can be more than a preference for interacting with people with particular characteristics, and exists at a deeper, more abstract level.

This paper follows Chen and Li [2009] in inducing group identity based on painting preferences. One advantage of using induced rather than natural identities is that, as mentioned before, we can be confident that any discrimination is a pure group identity effect, and not related to stereotypes which could affect beliefs about the strategies other players may use. A second advantage is that preferences are less likely to be concealed because of fears about being seen as being discriminatory or "politically incorrect," which could occur if natural identities were used.[2]

Another strand of literature that could relate to this experimental setup is about the effect of status on bargaining outcomes. In the heterogenous treatment it is possible that, although the strategic situation is entirely symmetric,

[1] See Chen and Li [2009] for a summary.

[2] For example, natural identities are used in Fershtman and Gneezy [2001] who study trust, dictator, and ultimatum games as played between Ashkenazic and Eastern Jews. They conclude that the discrimination that occured in their experiments was due to (erroneous) stereotypes about behaviour, and find no "taste for discrimination" that would have been evident in the dictator games. This contrasts with the results of the dictator game in this paper which shows clear evidence of discrimination. It is odd that induced identities result in a type of discrimination where real identities, identities which are at the root of another type of discrimination, do not. A possible explanation is that when real identities are used, subjects may be concerned about being seen as racist, which is unlikely to happen with induced identities.

the minority player is regarded as having lower status, or less bargaining power. Ball et al [2001] find that players randomly assigned to a high-status group acquire a larger share of the available surplus as both buyers and sellers.

Experiments in coalition formation (in some contexts also referred to as multi-lateral bargaining) have been carried out in the fields of sociology, economics, social psychology, and political science. Early experimenters were largely interested in testing and comparing the predictions of solution concepts for n-person games from cooperative game theory[3] (e.g. the core, bargaining set, Shapely value) and more recently non-cooperative models.[4] Experiments testing the setter[5] and Baron-Ferejohn model,[6] essentially multi-player versions of the ultimatum game and Rubenstein's bargaining model respectively, find the same discrepencies between theory and experimental evidence as with the two-player versions: failure to agree immediately, and less than full rent extraction. There is clear evidence of fairness concerns or other-regarding preferences in coalition formation games.

Several papers have investigated fairness, reciprocity and other-regarding preferences in three player coalition games. Güth and van Damme [1998] study ultimatum bargaining with one proposer, one responder and one inactive player, under different information conditions. They conclude that neither the proposer nor responder care about the inactive player, and that any "generosity" of the proposer to the responder is due the fear of the offer being rejected. Riedl and Výrašteková [2003] also study ultimatum bargaining, but this time with two active responders, and varying the consequences of rejection for the second responder. They find a large amount of heterogeneity in the subject pool: some subjects are indifferent to anything but their own payoff, whereas others exhibit altruism or spite, sometimes depending on the role of the other player in question.

In neither of the previous two papers do subjects select their coalition partners. In Okada and Riedl [2002] proposers chose whether to offer a division of a sum between themselves and two other players, or a smaller sum between themselves and just one other player. The two-player coalition is often chosen, leading to large inefficiencies. In the study most relevant to this paper, Holm [2000] uses a similar set-up, but with responders identified by either a

[3]See, for example, McKelvey and Ordshook [1980]
[4]See, for example, Fréchette et al [2005]
[5]Romer and Rosenthal [1978]
[6]Diermeier and Morton [2005]

Swedish, or non-Swedish name. Holm finds that in the cases where Swedish subjects chose a two-player coalition, they were significantly more likely to select a Swedish partner over a non-Swedish partner, although there was no evidence of discrimination in the distribution of resources within coalitions.

In this paper we are interested in what kind of coalitions form in a less structured setting, allowing all participants to propose and accept offers with as few restrictions as practicable. As expressed in Luce and Raiffa [1957]: "... the formalization of preplay communication simply buries some of the most interesting aspects of the problem... and we do not want to prejudge these problems by entering them into the extensive form in some special manner." The relatively unstructured multi-person bargaining process employed in the experiment is one of the major innovations of this paper.

As a result of the massive complexity resulting from allowing coalitional deviations, a theoretical approach to coalition formation, especially in games with no core as in this experiment, is inevitably faced with a choice between arbitrary and restrictive assumptions, and an unhelpful multiplicity of solutions. In a non-cooperative model one must impose a well-defined sequential bargaining process, and in cooperative model strong assumptions must be made about the consequences of deviation (i.e. what is the resulting coalition structure of the players that are not part of the deviating coalition?). This makes coalition formation an ideal canditate for purely experimental investigation, which will hopefully lead to knowledge about which abstractions may be legitimate in theoretical frameworks.

The paper continues as follows: section 2 describes the experimental design and implementation, section 3 gives the results of the coalition formation game, section 4 gives the results of the dictator and two-way bargaining game, section 5 discusses the results in the context of existing literature, and section 6 concludes.

2 Experimental Design

The first part of the experiment was designed to divide the subjects into two groups and induce a sense of group identity. In each of the second, third and fourth parts, the games consisted of dividing 12 tokens, each worth 50 cents, between three people. The second part was a coalition formation game which was played 16 times under a stranger matching protocol. The third part was a dictator game where each subject had to divide the tokens between themselves and two other players. The fourth part was a bargaining game where two players decided on a division of the tokens between themselves and a third person.

Part One: Group Identity

The method used in part one followed Chen and Li [2009] but with some minor differences. Each subject was shown sequentially five pairs of paintings, and asked which of the two they preferred. Each pair was made up of one painting by Paul Klee and one by Wassily Kandinsky. Unlike Chen and Li, players were not necessarily placed in the group for which they had selected the highest number of paintings, as the nature of the games that were to be played meant that it was important to have subjects divided in specific proportions. Thus, the subjects were told that they would be placed in a group based on which artist they prefered, and this was true in the sense that selecting a high number of paintings by a given artist increased the probability of being in that group. If there were too many in one group, a number of those with the weakest preference for that artist were randomly selected to be moved into the other group.

Once group membership had been determined, the subjects were told which group they were in, then shown another screen. On the left hand side were the answers to one of the pairs of paintings previously shown, with different subjects seeing different paintings.[7] In the centre of the screen were two new paintings. On the right hand side of the screen was a chat box. The subjects were asked to guess which of the two artists painted each of the new paintings, and allowed to use the chat box to communicate with other subjects from the *same* group to give and receive advice. This last exercise was designed to strengthen feelings of group identity.

Part Two: Coalition Formation Game

The second part was the main focus of the experiment. The game was played in groups of three (henceforth called 'triad's to save confusion with Klee/Kandinsky groups). In the homogenous treatment, each triad was made up of players from the same group; in the heterogenous treatment, each player consisted of two players from one group (majority players) and one player from the other group

[7]This also differed from Chen and Li, where the answers to *all* pairs of paintings were shown. Here only one was shown in order to minimize the chance that subjects inferred they had been put in the "wrong" group, which could reduce or eliminate any sense of group identity that might otherwise be generated.

(the minority player). In the homogenous sessions half the players were placed in each group, whereas in the heterogenous sessions two-thirds were placed in one group and one-third in the other. This was done to ensure that there was as much variation as possible in the re-matching.

The playing screen was divided into three parts. In the top half, each player could suggest divisions of the 12 tokens by typing numbers into three boxes. The top box was for the number of tokens the player wanted for themselves. The labels on the lower two boxes depended on the treatment and the role played by the player. In the homogenous sessions, the middle box was labeled "Player A", and the bottom box "Player B." For half the majority players the middle box was for the number of tokens they wanted to apportion to the player from their own group, and the bottom box was for the number of tokens for the player of the minority group, the boxes being labeled "Klee Player" or "Kandinsky Player" as appropriate. For the other half of majority players this was reversed. This was done to account for any potential bias subjects might have for making offers to the top player. For minority players, the middle box was labeled "Klee/Kandinsky A" and the bottom "Klee/Kandinsky B."

After typing in three numbers the player could click one of two buttons to send the suggested division[8] to another player: the top button sent the message to the player associated with the middle box, and the bottom button to the player associated with the bottom box. If the numbers were not all positive, did not add to 12, or a box was left blank, an error message occured. After sending a suggestion, the numbers were erased, so a suggested division had to be retyped if it was to be sent to both of the other players. Suggestions could be sent to either player at any time.

In the bottom left of the screen was a box that tracked all the suggestions that had been made to the player: how much each player would receive, and who the suggestion was sent to. Suggestions made to the player appeared in a list in the bottom right of the screen. At any time, a player could click on any suggestion they had received then, on an accept button, in which case this division would be implemented, and the round would end. Offers could not be withdrawn. There was a time limit of 90 seconds after which, if no offer had been accepted, all players would receive nothing.

To try to ensure that subjects understood the process, they were given writ-

[8]In the experiment instructions, reference was made only to "suggestions" or "suggested divisions" rather than "offers" because it was thought that the term offer might imply to the subjects a two-way division. Here the terms will be used interchangably.

ten instructions, then asked several control questions. There was then a tutorial round, where each subject typed in and sent a suggestion to each of the other players, then practiced accepting a suggestion. The screen they saw in the tutorial round was identical to the one they would see throughout this game, except that the numbers in the suggestions they received were replaced with "9999" so that this round would not influence their strategy in the paid rounds.

The game was played 16 times with a stranger matching protocol. The subjects retained the same role in every game, so that the screen was the same for each subject in each round. Overall, the implementation of the game was intended to impose as little structure as possible on the bargaining process, while keeping play simple.

Part Three: Dictator Game

In the dictator game, each subject was free to divide 12 tokens between themselves and two other subjects in any way they liked. In order to emphisise that this was a new game, and reduce the possibility of strategies played in the previous round from influencing the outcome, players who had played in heterogenous groups in the coalition formation game now divided the tokens between themselves and two subjects from their own group. One third of players who had been in homogenous groups were able to share tokens with two subjects from their own group, one third with two subjects from the other group, and one third with one subject from each group.

This matching of subjects allows identification of two types of effects: the difference in group cohesion between subjects who had been minority, majority or homogenous groups, and were now only dividing tokens between members of their own group; and group identity effects, by comparing the decisions of subjects who were sharing tokens with members of the same or other group, but had shared the same experiences up to this point in the experiment.

Instructions were given orally, after which a summary could be read on the computer screen where the groups of the two other subjects were identified.

Part Four: Bargaining Game

In the fourth part of the experiment, two players had to come to an agreement over how to divide 12 tokens between themselves and one other subject. The screen was identical to that of the coalition game, except that there was only one button for sending messages as there was only one other player active in the decision-making process. Play proceeded in the same manner as the coalition game, and the time limit was also 90 seconds.

To maximise the number of observations from the subjects, and have everyone active so as not to give information about which individuals might be the inactive players, every subject played this game. The payments to the third, inactive player were assigned to random subjects from the appropriate groups. This meant that half the subjects received two payments from this round: one from the game where they were active, and one from a game where they were the inactive player.

Again, subjects who had played in heterogenous groups in the coalition game played this game in homogenous groups. Subjects who had played in homogenous groups were divided equally into three types of pairs: part of a homogenous decision-making pair matched with a third from their own group; part of a homogenous decision-making pair matched with a third from the other group; and part of a heterogenous pair. Written instructions were given, and control questions asked to ensure that subjects understood this new game.

Implementation and Payments

Six sessions were run in total, the first three using homogenous groups in the coalition games; the second three, heterogenous groups. All sessions took place at the FLEX Laboratory at the Goethe University, Frankfurt, using students from that university. Each session lasted approximately one hour. At the end of each session, subjects were paid a showup fee of 5 Euros, for correct decisions in part one, three randomly selected payoffs from the 20 games of parts two, three, and four, and according to the outcome in the Holt and Laury test. The average payment was 13.89 Euros, with a minimum actual payment of 5.10 Euros and a maximum payment of 18.85 Euros. All programs were written in z-Tree (Fischbacher, 2007).

3 The Coalition Game

The first point of interest is whether minority players fare better or worse than others. This is not clear *a priori*. The literature on group identity suggests that players would prefer to share money with a member from their own group, thus one might expect the minority player to be excluded more often, and receive lower payoffs on average. On the other hand, if the minority player feels in a worse bargaining position and is willing to accept a lower share, the minority player may feature in more coalitions which could more than make up for lower payoffs *per* coalition.

Any discrimination that does occur must be through one of three channels: to whom offers are sent (are majority players more likely to send offers to their fellow majority player?); from whom one accepts offers (are majority players more likely to accept offers from the other majority player?); or in types of offers (do offers favour majority players?). These three possibilities are investigated.

Section 3.1 will describe what occured in the homogenous treatments, to discuss basic strategies used in play, and to have a benchmark against which to compare results in the heterogenous treatments. Section 3.2 will describe the overall impact of discrimination on individual payoffs and the types of coalitions that arose. Section 3.3 proposes and tests several hypotheses about the different avenues for discrimination which exist in the heterogenous treatments in order to determine the cause of the differing payoffs between different types of players.

Notation: In what follows, a suggested division or outcome (x, y, z) means the player who makes the suggestion would receive x, the player to whom the suggestion is sent would recieve y, and the third player would receive z.

3.1 Outcomes and Strategy: Homogenous Triads

Outcomes were heavily concentrated on even two-way splits, i.e. (6,6,0), and even three-way splits, i.e. (4,4,4), with around 80% of the former, and 10% of the latter. The remainder were a mixture of asymmetric divisions between two or three of the players. Table 1 details numbers of different types of offers, and rates of acceptance. Figure 1 shows the evolution of the proportion of the two most common outcomes and offers over time: (6,6,0) initially becomes more frequent, and (4,4,4) less frequent, but stabilizes in the last ten or so periods.

A probit regression on the event that an offer is accepted (Column 1 of Table 4) shows some evidence evidence of altruism. There is a small, but highly significant, positive effect of the size of the portion given to the excluded player on the probability of an offer being accepted. As would be expected, the size of the offer to the receiver is more important, the coefficient being roughly seven times larger. Also, faster offers are more likely to be accepted.

There is some slim evidence of strategic thinking occuring. Consider the game where each player makes an offer to either (or both) of the other players, then a random player is chosen to accept an offer. This is reasonably close to what occurred in these experiments. In such a situation, if a player believes that others will make a (12-x, x, 0) offer, the best response for $x < 8$ is to make (12-x-1, x+1, 0) offers, to gain 12-x-1 with certainty, rather than 12-x with some probability. In level-k parlance (e.g. Stahl and Wilson, 1995), a level zero player would be one who knows that no-one accepts less than four, wants to gain as much as possible, so offers (8,4,0). Thus, a level 1 player offers (7,5,0), level 2 offers (6,6,0), and level 3 offers (5,7,0). All these offers occured with some frequency, and were increasing in expected return from making an offer in the level of the strategy.[9]

After the first round or two, a division was determined in approximately 5 seconds. Subjects made an average of slightly less than one offer per round. This mirrors the experience of Kalisch et al. (1952) who ran some face to face coalition games. They found in symmetic games "the tendency was to try to speak as quickly as possible after the umpire said "go," and to conclude some sort of deal immediately." Here this was replaced by frantic typing and clicking of mice.

Due to the pace of proceedings, mistakes occurred, but reasonably infrequently. For example, out of 654 offers where the offerer kept six tokens and offered six to another, only 26 were sent to the player who would receive zero.

3.2 Group Identity Effects: Heterogenous Groups

As can be seen in the following table, minority players received on average 0.75 tokens less than majority players. This effect varied in strength from session to session, but was negative in all cases.

Player Type	Mean Payoff	Variance of Payoffs
Homogenous Group	4	7.2
Minority	3.47	7.8
Majority	4.26	6.36

Table 2 shows several panel regressions with individual random effects. The first two columns use the raw data, whereas in the second two, all rounds where

[9]It would be interesting to run the game where a random player is chosen to accept an offer from among those made to them: it is possible that without the pressure to accept an offer quickly to avoid being excluded, this kind of strategic thinking would be more prevalent. The standard equilibrium solution to this game is that everyone makes (1,11,0) or (0,12,0) offers, keeping at most one token for themselves, because in their offers they are effectively in Bertrand competition with with the third player. A level-k or cognitive hierarchy approach is likely to be more convincing.

an obviously mistaken offer was made (i.e. where the receiver would have received zero if they were to accept) have been excluded. Columns 2 and 4 use only the last ten rounds, when players should be familiar with the game and further learning effects should be small. The effect of being in the minority is to reduce payments by between 0.79 and 1.14 tokens on average. This effect is highly significant. [10]

Table 3 shows the results of probit regressions on the probability of receiving zero in a given round with the same four samples as Table 2. This probability is 13-20% greater if a player is in the minority.

A clearer understanding of what is happening can be gained by concentrating on the four "focal outcomes." These are the three possible even two-way splits, and the even three-way split, which account for around 85% of outcomes in heterogenous treatments, and 90% in homogenous treatments.

Figure 2 shows graphically what occurs: each point on the triangle represents a division of the 12 tokens, the closer a point to a corner, the more tokens received by the player on that corner. For example, the corners represent all twelve tokens being taken by the labelled player; a point on a side represents the 12 tokens being shared by the two players at either end of the side, with more going to the player to whom the point is closer, and the third player receiving zero; the point in the centre represents an even three-way split. The radius of a circle is proportional to the number of data points it represents. Where there is nothing to distinguish players and placement of outcomes is ambiguous, they are distributed evenly between the possible points. It can be seen that the difference in average earnings is due to a greater concentration of outcomes on the focal point corresponding to the even two-way split between majority players.

Figure 3 shows the asymmetric outcomes displayed in the same way, but on a larger scale. Two points stand out: firstly, asymmetric outcomes are more frequent in heterogenous triads; secondly, when asymmetric outcomes occur, they do not seem to systematically favour majority players.

[10] The larger effects in the samples without errors can be largely explained by the errors of one individual who clearly did not understand the playing screen. This (majority) player's offers to minority players were consistently (6,6,0), however offers to majority players were mis-entered to be (6,0,6). Thus, in this subject's games, the minority/majority coalitions were much more likely. To put this into perspective, in the three heterogenous sessions, 60 out of 1011 offers were clear errors. Of these, 16 were made by this one individual, and were all majority to majority offers. Looking at the other 44 errors, 17 were majority to majority offers, 14 majority to minority offers, and 13 minority to minority offers, so there is no evidence that this type of error is more common for any type of offer, outside of this one individual.

3.3 Causes of differing outcomes

There are three possible types of discrimination: to whom one makes an offer, from whom one accepts offers, and the types of offers made. Each will be discussed in turn.

Hypothesis 1 (Discrimination in target of offers): *For a suggested division (*x, y, z*) such that* y > z*, a majority player will send the suggestion to the minority player 50% of the time.*

Chen and Li (2009) found that subjects show greater charity concerns, and less envy towards in-group members. Either effect would clearly lead to this hypothesis being rejected, as the majority player should prefer the larger sum to go to his fellow majority player.

To whom one sends an offer does indeed depend on group identity. The probability that an offer by a majority player is sent to a minority player is 44%, shown to be significantly less than 50% at the 1% level of significance using a probit with robust standard errors clustered by session. Restricting attention to first offers, the figure is 42%, significantly less than 50% at the 10% level. It is possible that one type of player receives many offers, but they are systematically worse (or better). We can eliminate this effect by looking only at (6,6,0) offers. In this case the probabilities are 38% and 34% for all offers and first offers respectively, both less than 50% at the 1% level.

Hypothesis 2 (Discrimination in acceptance): *The probability a suggested division (*x, y, z*) such that* x > z *is accepted is indepenent of the identity of the sender.*

For the same reasons stated above, one would also expect this hypothesis to be rejected.

Looking at the types of offers with a large number of observations, majority players accept a (6,6,0) offer 52% of the time if it was made by the other majority player, but only 46% of the time if made by the minority player. The figures for (4,4,4) contracts are 22% and 15% respectively.

However looking at probit regressions on the probability of an offer being accepted, it seems to make no difference who makes the offer. Column 2 of Table 4 shows that the only significant determinant in whether a majority player accepts an offer is the number of tokens they will receive. The coefficient on a dummy indicating an offer from a minority player is insignificant.

As mentioned before, it is not clear that an offer which has not been accepted has been rejected. The only clear indication of preferences is when a player had two offers available simultaneously, and was successful in selecting one of them. This occured 117 times. In only 11 cases was the higher payoff rejected: in five of these, a majority offer was rejected in favour of a minority offer; in three a minority offer was rejected in favour of a majority offer. In 33 instances, both offers would result in the same payoff. Of these, 15 times a minority offer was rejected in favour of a majority offer, and 12 times a majority offer was rejected in favour of a minority offer.

When it comes to acceptance of offers, on the whole it does not seem that players discriminate according to the identity of the offerer. People care only about the size of the of their payoff.

Hypothesis 3 (Types of offers): *The types of offers (x, y, z) made are independent of the group membership of the sender, receiver, and excluded player. More specifically:*

a) *The number of tokens offered to the receiver is independent of group membership.*

b) *The number of tokens suggested for the excluded player is independent of group membership.*

c) *The probability of offering an even three-way split is independent of group membership.*

d) *The number of tokens kept by the offerer is independent of group membership.*

The types of offers made depend not only on the desired outcome of the offerer, but on the subjective probabilities each player assigns to the acceptance of different offers to different people. However, as far as types of offers reflect desired outcomes, differential charity concerns or envy suggest that at least parts *a*, *b* and *c* of this hypothesis should be rejected. Let $(\bar{x}, \bar{y}, \bar{z})$ be average offers in homogenous triads. In offers from one majority player to another, one would expect $y > \bar{y}$ and $z < \bar{z}$, violating parts *a* and *b*. In offers from a majority player to a minority player one would expect these inequalities to be reversed. As a majority player should want to give less to a minority player than a majority player, offers of even three-way splits should be less frequent from majority players. Part *d* is less certain: for a majority offerer, this depends on whether tokens taken from a minority player are kept or given to the receiver, and from whom come the additional tokens given to the other majority player.

The situation for offers made by minority players is not at all clear. In terms of desired outcomes, one would expect $y < \bar{y}$ and $z < \bar{z}$, however satisfying either of these inequalities could only decrease the probability of acceptance, assuming the minority player expected some degree of altruism between the majority players. As we will see, the differences between minority offers and offers in homogenous triads are almost certainly driven by (mistaken) beliefs about the probability of acceptance.

The frequencies of different types of offers in heterogenous triads does depend on the identity of the offerer and receiver, as shown in Tables 5 and 6. Table 7 shows the average divisions offered. Only the last 10 rounds are included, in case of learning effects, and clear errors (i.e. when the receiver is offered zero) are excluded.

Table 7 suggests that the effect of group identity on majority offers are as expected. Compared to offers made in homogenous triads, majority players show less concern for the excluded player when it is the minority player, and more when it is their fellow majority player: when a majority player makes an offer to another majority player, they give 0.21 of a token less to the minority player, taking a 0.07 for themselves and 0.14 to the other majority player; when a majority player makes an offer to a minority player, they take around 0.14 of a token less for themselves, and transfer it to the other majority player (now the excluded player).

Minority players have a tendency to try to treat the majority players more symmetrically. The average payment to the excluded player is 0.23 of a token greater than in the homogenous triads, with 0.16 of this coming from the amount the minority player keeps for themselves and 0.07 coming from what is given to the receiver of the offer.

Table 8 presents panel regressions with individual random effects, using only the first offer made in each round by a given subject. The regressors are dummy variables indicating whether the offer was made by/to a majority/minority player. The ommitted category is offers made in homogenous triads. Two of the effects apparent from the simple averages are found to be robust: when majority players make offers to their fellow majority player, they offer more to the receiver and give less to excluded minority player; and minority players keep less for themselves and offer slightly less to the receiver, and much more to the excluded player.

None of the coefficients when a majority player makes an offer to a minority player are significant, and the two that had been predicted are of the wrong sign. A possible explanation for the positive sign on this dummy in column 2 is that the types of majority players who make offers to the minority are those who feel sorry for them, and so want to offer them more.

These findings suggest three reasons minority players receive less over all. Firstly, when agreements are between majority players, the minority player receives less than they would have as an excluded player in a homogenous triad. Secondly, they tend to make less attractive offers to the receiver, probably under the mistaken belief that majority players care about the other majority player when deciding whether or not to accept an offer, but given they seem to care only about their own payment when deciding whether or not to accept, their offers are in fact less likely to be accepted. Finally, even if one of their offers is accepted, they tend to have apportioned less to themselves.

All these effects are mostly due to the number of even two and three-way splits offered. Columns 4 and 5 of Table 8 gives the results of a probit regresion of the probability of an offer being an even two or three-way split. Three-way splits are 8% less likely to be offered when an offer is from a majority player to another majority player, significant at the 1% level. Two-way splits are 15% less likely when the offer is from a majority to a minority player, also significant at the 1% level.

As with most similar experiments, people act more selfishly over time. They give less to the excluded player, splitting it between themselves, and the person to whom they are making the suggested division to increase the probability of acceptance. Offers of even three-way splits become less probable over time. All time trends are quadratic, reflecting rapid learning in early periods.

Table 9 shows the average payouts in implemented offers. As compared with players in the homogenous treatment, the minority player receives 0.08, 0.17, or 0.09 of a token less, depending on whether they are the offerer, receiver, or excluded player. These are small numbers compared with the half a token deficit that is to be explained, indicating that most of the action occurs in the make-up of coalitions.

To sum up, minority players earn less than majority players. This is largely due to being less likely to receive offers, and thus be part of the deciding coalition. There is no strong evidence of discrimination in the acceptance of offers, with only a small part of the deficit being explained by the composition of implemented offers.

4 Three-way Dictator and Two-way Bargaining Games

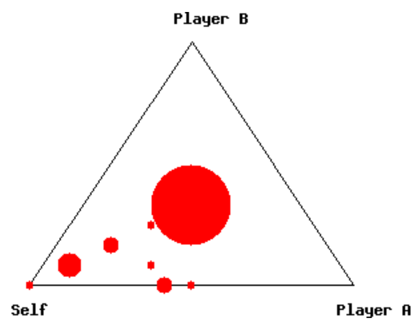
4.1 Three-way Dictator Game

Given that most of the discrimination in the coalition game occurs because of the make-up of coalitions, it could be argued that majority players make more offers to fellow majority players simply because group identity is acting as a co-ordinating device, causing one focal outcome to become more salient. However, the dictator game clearly shows there is discrimination in the preferences over the distribution of tokens to all three players.

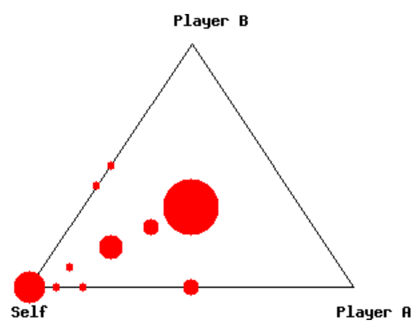
The results of the dictator game are summarized in the three diagrams on the following page. The first striking fact is the large amount of altruism: few people took everything for themselves, even if they found themselves in a triad with two others from the other group. However the altruism is clearly dependent on group identity: in comparison to the homogenous group case, when sharing with two from the other group the divisions drift towards the selfish corner; when sharing with one from each group the data points move down in favour of the in-group.

The average amount given to a minority player by a majority player is 1.29, which is less than the 2.29 and 2.5 given to majority players by the minority, and players in homogenous to each other respectively, significant at the 5% level. To ensure comparability of these averages, only data from the third box on the screen of players who had initially played in homogenous groups were used.

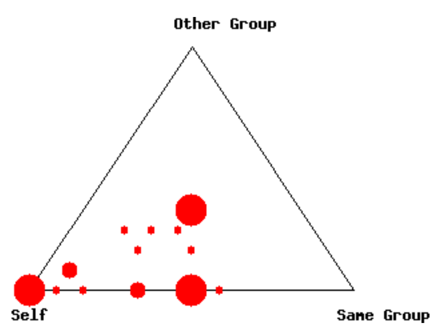
Sharing with two others from the same group



Sharing with two others from the other group



Sharing with one player from each group



4.2 Two-Player Bargaining Game

The outcomes for the two player bargaining game, again only looking at data from subjects who had played in homogenous triads in the coalition game, are shown in the following table. The second column contains data for triads where two people from the same group are bargaining over a division with a third from the same group, the next column is where the third is from the other group, and in the final column is the data for when two people from different groups are bargaining.

Contract type	AA ⇒ A	AA ⇒ B	AB ⇒ A
(7,5,0)	0	0	1
(6,6,0)	8	11	9
(5,5,2)	1	0	0
(5,2,5)	0	0	1
(4,4,4)	3	1	1

Obviously the sample size is very small, but the results are suggestive: there is more altruism when the inactive player is from the same group as both the bargainers; minority status reduces bargaining power (in the two divisions where the bargainers received unequal amounts, the minority bargainer received less).

In both these games, even three-way splits were more likely in homogenous triads than heterogenous triads, which was not evident in the coalition formation game. The coalition formation game is highly competitive, and the fear of being excluded may reduce the effects of fairness concerns or ingroup/outgroup behaviour, as the possibility of receiving zero may induce a majority player to accept an even split with a minority player when they would prefer either the division to be in their favour, or an equal split with their fellow majority player.

5 Discussion

This section discusses the results of this experiment in the context of the existing literature. The first part relates to general strategy and social preferences, while the second focusses on issues specific to group identity.

5.1 Strategy and social preferences

The first point to be discussed is the preponderance of two-way even splits. These made up roughly 60% of suggested divisions, and 80% of accepted divisions. Unlike even splits in dictator and ultimatum games, these results in principle require no recourse to concepts of fairness: the set of two-way even splits make up both the Von Neumann-Morgenstern solution (von Neumann and Morgenstern, 1944), and the bargaining set (Aumman and Maschler, 1961), both of which assume rational, self-interested players. The key difference between the two and three player cases is that in the latter case an uneven two-way split is not only unfair, but also unstable, in the sense that the third player can offer to the worse off player a better deal from *within the solution (or bargaining) set.*

However, I was surprised at the lack of variation, anticipating more strategic thinking along the lines of the level-k interpretation outlined at the end of section 3.1. Additionally, if the empirical "expected return" calculated in table x is not too unrealistic, then (5,7,0) was indeed the most successful offer and should have been played more. One explanation would be inequality-aversion[11] (as in Fehr and Schmidt [1999]), which would result in the small expected gain from moving from a (6,6,0) to a (5,7,0) proposal being out-weighted by the disutility of having an unequal split implemented among two otherwise symmetric agents.

Inequality aversion would also explain the lack of opportunistic (7,5,0) or even (8,4,0) proposals and outcomes. Given the risk of receiving zero, the fact that the the ex ante expected gain from the game is four tokens, and assuming some degree of risk aversion, I had anticipated these divisions to be both proposed and accepted more often. Inequality aversion in the responder, and anticipation of this by the proposer, could account for the small number of such divisions.

An alternative possibility is that two-way even splits are so common simply because they are cognitively the least costly to imagine. At restaurants, people often "go Dutch" because no-one can be bothered adding up each person's share of the bill. Once a selfish player has realised that the third player doesn't need to be given anything, a two-way even split becomes the simplist in two ways. Firstly, it is arithmetically the most obvious division (apart from keeping all 12, which is never going to be accepted). Secondly, it requires no further thought or moral justification: the division satisfies the most basic idea of fairness, and needs no careful balancing of material gain and acceptability to the responder. The haste with which the game is played may increase the relevance of this point as compared with two-player bargaining experiments.

Of course this experiment was not designed to distinguish between these the-

[11] For now the reference group is assumed to consist of only the proposer and accepter.

ories, and so whether the results are best explained by standard game theory, fairness concerns, cognitive limitations or laziness is at this stage pure speculation.

Where standard selfish preferences do require augmentation is in explaining divisions where the third player receives more than zero. Such divisions are not "coalitionally rational" (see Aumann and Maschler) as the decision-making coalition (the proposer and responder) can secure more for themselves by reducing the third players payment to zero. Around 28% of proposed, and 14% of accepted divisions gave a positive payoff to the third player, which is most likely[12] explained by at least some players having social preferences (e.g. Charness and Rabin [2002]) which give weight to the third player.

The literature is divided as to whether the decision-makers in three player divide the dollar and similar games care about a third player if they are not active in the implemented deal. Neither Güth and van Damme nor Kagel and Wolfe [2000] find any evidence of concern for the third player. On the other hand, Charness and Rabin found that a little over half of their subjects in a three-way dictator game were willing to reduce their own payoffs in order to equalize the payoffs of the others, increasing the payoff of the worst off. Riedl and Vyrastekova find that while half of the responders in a three-way ultimatum game are insensitive to changing the payoffs to the other responder, the other half exhibit altruism or spite, and a little under 10% have a preference for a three-way equal split.

Here the results from the coalition formation game reveal a much higher proportion of players with a preference for a three-way equal split. The proportion of players who make at least one (4,4,4) proposal is 0.36 for players in homogenous triads, 0.73 for minority players, and 0.39 for majority players. Looking only at the last 10 rounds, these figures drop to 0.22, 0.32, and 0.25, respectively. On the one hand these figures may overstate preferences for fairness, as many players only made such an offer once in 10 rounds, but on the other hand this could simply show a preference for an unequal offer over being excluded and receiving zero, which often occured to players who had made (4,4,4) offers. Simply making the offer once, especially after six rounds of learning, indicates a strong preference for this outcome. The higher rate of preference for three-way even splits relative to the Riedl and Výrašteková paper could be explained by the absolute strategic symmetry of the coalition formation game, which makes these

[12] See footnote 12.

outcomes more salient compared to a situation with one pre-defined proposer and two pre-defined responders.

5.2 Group identity effects

Group identity affects subjects' decisions in the coalition formation game, as is shown by the significant difference in outcomes for minority and majority players. There are three leading explanations for this difference: first of all, in-group/out-group considerations change players' preferences over outcomes (Chen and Li); secondly, group identity causes players to co-ordinate on particular outcomes; thirdly, minority status creates the impression of weaker bargaining power, resulting in minority players receiving or making less advantageous offers (eg Ball et al).

The results of the dictator games are clear evidence that many subjects' preferences do change, in the direction one would anticipate: placing greater weight on the payoffs of ingroup members than outgroup members. This is unsurprising, and in line with the minimal group paradigm literature. The question is to what extent the changes in preferences are necessary or sufficient to explain outcomes in the coalition formation game, and to what extent are they masked by the strategic environment. Unfortunately it does not seem possible at this stage to disentangle changing preference from co-ordination effects, as shall now be explained.

For whatever reason, most of the action was among four focal points: the three-way even split, and the three two-way even splits. Most of the difference in payoffs between majority and minority players was a result of a high number of two-ways splits between majority players, which, if one reduces the game to selecting one of the four focal outcomes, can be easily explained by preferences weighted in favour of ingroup members.

On the other hand, it can be argued that which focal point is most salient is also altered in the heterogenous games. All these divisions can be considered fair, depending on the relevant reference group. In the homogenous games, the possible reference groups are the group as a whole, which would favour the three-way even split, or the deciding coalition, which would favour a two-way even split. In the heterogenous games, a third reference group is introduced, which is defined by group membership and would favour the two-way even split between the majority players. The outcomes of the experiments then accord with the results of Roth et al. [1981] in finding that people tend to select among different conceptions of fairness the one most favourable to themselves.

It can also be argued that it is a reluctance to treat identical players differently, as observed in Charness and Rabin, that leads to minority players choosing more three-way even splits (22% of offers, rather than 14% for majority players and 18% for players in homogenous games). The fact that the others share a group which is *different* from one's own makes them *more alike to one another* than if they shared a group which was the same as one's own. Also, having the possibility of making offers to players from different groups makes the three-way even split less salient for majority players.

There is little evidence of minority players being disadvantaged in the coalition formation game by a perceived lack of bargaining power. Majority players are more likely to send suggested divisions to minority players for all divisions apart from (6,6,0) offers, suggesting that it is believed that minority players are more likely to find asymmetric outcomes and three-way even splits acceptable. However this is also true of (5,7,0) offers. The differences in outcomes in the two-person bargaining games are too small to say much given the small sample size. Overall, the dominance of the four focal outcomes leaves little room for any role of bargaining power.

At the end of the session, subjects were asked how closely they identified with their group, on a scale from 1 to 10, with 10 being the strongest identification. Regressing this on minority status and total money earnt finds both coefficients to be significant at the 5% level (Table 11). Ceteris paribus, minority members respond on average 0.83 lower on the scale, while each extra Euro earnt increases the average answer by 0.19. This is consistent with the idea that people identify more strongly with more successful groups, e.g. Shayo [2009].

5.3 Moral Wiggle Room?

Altruistic behaviour is much less prevalent in the bargaining game than the dictator game. There are two pieces of clear evidence for this. First of all players tend to receive more in two-player bargaining game than in dictator game, despite having less control over the outcome. Looking only at individuals who were in homogenous triads in both games, 28 received more in the bargaining game than the dictator game, 19 the same, and 19 received less.

It is possible that when a selfish player is bargaining with an altruist, for some reason the outcome is always selfish. However, in seven cases both bargaining players had chosen a (4,4,4) split in the dictator game. Out of these, only in two cases was the outcome a (4,4,4) split, in one case a (5,5,2) division, and in four cases a (6,6,0) split. So most of the time when two subjects who behave as fairly as possible in a dictator game arrive together in the bargaining game, they become as selfish as possible.

Two explanations come to mind. One possibility is that this is moral wiggle-room, as identified in Dana et al. [2007]. In the dictator game, each subject is clearly responsible for behaving unfairly, whereas in the bargaining game the blame can be laid at the feet of the other bargainer. The situation is similar to the third experiment in the aforementioned paper, where in order to implement a selfish outcome both active players must choose that option, otherwise a fair outcome occurs. But here the behaviour is even more cynical. Whereas in Dana et al. a player can select the selfish option and pretend they are leaving it up to the other player, here the player accepting a (6,6,0) split knows it will be implemented.

An alternative explanation is that the asymmetric situation, or the interaction of bargaining leads the bargainers to identify as an ingroup and see the third player as an outsider.

6 Conclusion

Group identity has a significant impact on the payoffs of players in a three player coalition formation game, with minority players earning less. Outcomes both in games where all players are from one group, and games where two players are from one group and one from the other, are concentrated on four focal outcomes: the three possible even two-way splits, and the even three-way split. The lower average payoff to minority players is largely due to a lower frequency of minority-majority even two-way splits and higher frequency of majority-majority even two-way splits. The root of the difference is discrimination in offering behaviour, whereas there seems to be no discrimination in acceptance choices. Discrimination could be driven either by an underlying preference for sharing with in-group members rather than out-group members, or an increased salience of the in-group two-way even split focal point.

References

K. J. Arrow. *Discrimination in Labour Markets*, chapter The Theory of Discrimination, pages 3–33. Princeton University Press, 1973.

Robert J. Aumann and Michael Maschler. The bargaining set for cooperative games. Research Memorandum No. 34, Princeton University, November 1961.

Sheryl Ball, Catherine Eckel, Philip J. Grossman, and William Zame. Status in markets. *Quarterly Journal of Economics*, 116(1):161–188, February 2001.

Gary Becker. *The Economics of Discrimination.* University of Chicago Press, 1957.

Gary Charness and Mathew Rabin. Understanding social preferences with simple tests. *The Quarterly Journal of Economics*, 117(3):817–869, August 2002.

Yan Chen and Xin Li. Group identity and social preferences. *American Economic Revies*, 2009.

J. Dana, R.A. Weber, and X. Kuang. Exploiting moral wiggle room: Experiments demonstrating and illusory preference for fairness. *Economic Theory*, 33:67–80, 2007.

Daniel Diermeier and Rebecca Morton. *Social Choice and Strategic Decisions*, chapter Experiments in Majoritarian Bargaining. Springer: Berlin, 2005.

E. Fehr and K. Schmidt. A theory of fairness, compietition, and cooperation. *Quarterly Journal of Economics*, 114, 1999.

Chaim Fershtman and Uri Gneezy. Discrimination in a segmented society: an experimental approach. *Quarterly Journal of Economics*, 116(1):351–377, 2001.

Urs Fischbacher. z-tree: Zurich toolbox for ready-made economic experiments. *Experimental Economics*, 10(2):171–178, June 2007.

Guillaume R. FrÃ©chette, John H. Kagel, and Massimo Morelli. Gamson's law versus non-cooperative bargaining theory. *Games and Economic Behavior*, 51:365–390, 2005.

W. GÃŒth and E. van Damme. Information, strategic behavior and fairness in ultimatum bargaining - an experimental study. *Journal of Mathematical Psychology*, pages 227–247, 1998.

Hakan J. Holm. What's in a name? - an ethnical discrimination experiment. Lund University Working Paper, 2000.

John Kagel and Katherine Wolfe. Tests of difference aversion to explain anomalies in simple bargaining games. mimeo, 2000.

G. Kalisch, J. W. Milnor, J. Nash, and E. D. Nerring. Some experimental n-person games. Project RAND Research Memorandum, August 1952.

R. Duncan Luce and Howard Raiffa. *Games and Decisions*. John Wiley & Sons, 1957.

Richard D. McKelvey and Peter C. Ordshook. Vote trading: An experimental study. *Public Choice*, 35:151–184, 1980.

A. Okada and A. Riedl. Inefficiency and social exclusion in a coalition formation fame: Experimental evidence. Working Paper, CREED, University of Amsterdam, 2002.

Edmund Phelps. The statistical theory of racism and sexism. *American Economic Review*, 62:659–661, 1972.

Arno Riedl and Jana Vyrastekova. Responder behavior in three-person ultimatum game experiments. CentER for Economic Research discussion paper, Tilburg University, 2003.

Thomas Romer and Howard Rosenthal. Political resource allocation, controlled agendas, and the status quo. *Public Choice*, 33:27–45, 1978.

Alvin E. Roth, Michael W. K. Malouf, and J. Keith Murnighan. Sociological versus strategic factors in bargaining. *Journal of Economic Behavior and Organization*, 2:153–177, 1981.

Moses Shayo. A model of social identity with an application to political economy: Nation, class, and redistribution. *American Political Science Review*, 103(2): 147–174, May 2009.

Dale O. Stahl and Paul W. Wilson. On players' models of other players: Theory and experimental evidence. *Games and Economic Behavior*, 10:218–254, 1995.

Henri Tajfel, M. G. Billig, and R. P. Bundy. Social categorization and intergroup behaviour. *European Journal of Social Psychology*, 1971.

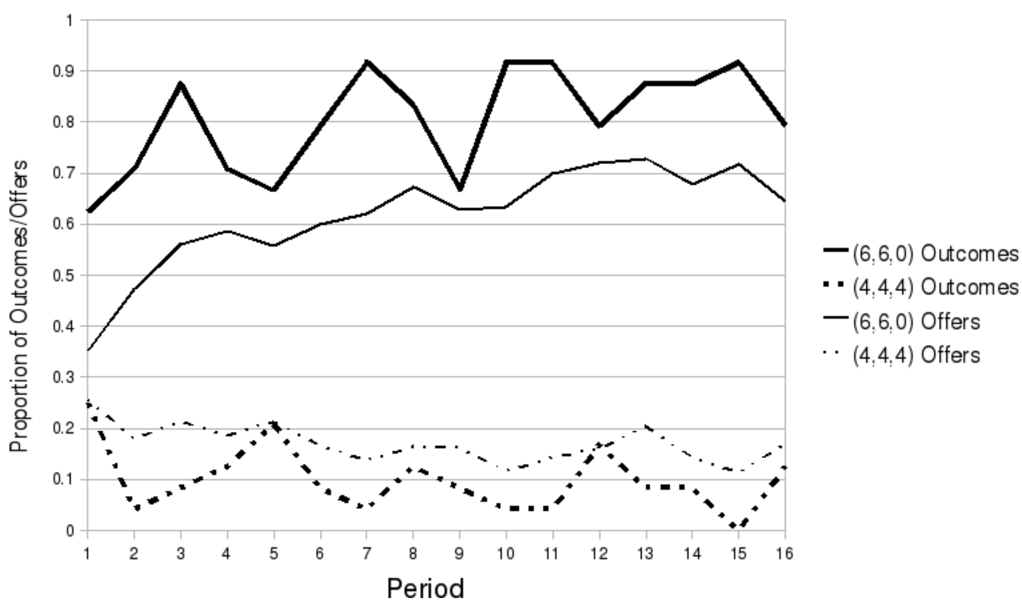
John von Neumann and Oskar Morgenstern. *Theory of Games and Economic Behavior*. Princeton University Press, 1944.

Appendix A

Table 1: Outcomes - Homogenous Triads[13]

To Self	To Other	To Third	Offered	Proportion Accepted	Expected Return
8	4	0	26	0.12	0.92
8	2	2	12	0	0
7	5	0	68	0.22	1.54
6	6	0	628	0.49	2.96
5	7	0	14	0.64	3.21
5	5	2	17	0.24	1.18
4	4	4	184	0.21	0.83

Figure 1: Types of Offers and Outcomes



[13]Excludes offers which occured less than 10 times, and offers which were clearly errors, i.e. where the player to whom the offer was send would receive zero.

Figure 2: Focal Outcomes

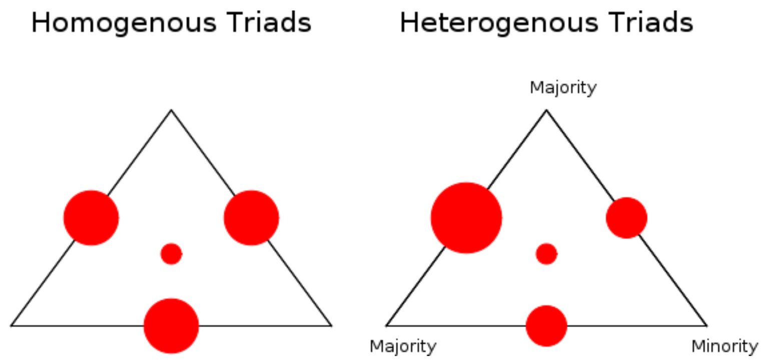


Figure 3: Asymmetric Outcomes

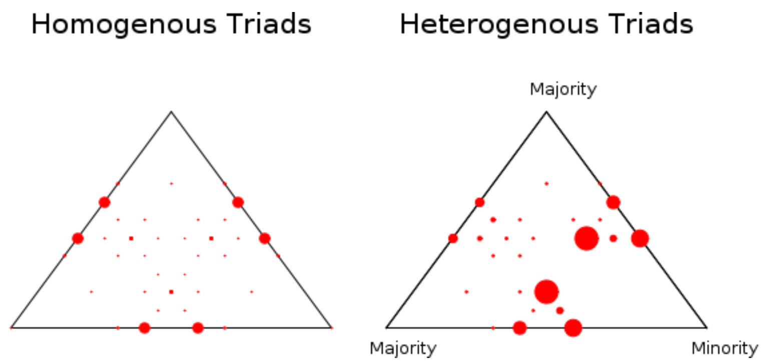


Table 2: Payoffs

	All observations		Errors excluded	
COEFFICIENT	All rounds	Last 10 rounds	All rounds	Last 10 rounds
minority	-0.788**	-0.941***	-0.963***	-1.138***
	(0.391)	(0.289)	(0.316)	(0.162)
Constant	4.263***	4.314***	4.315***	4.386***
	(0.130)	(0.0964)	(0.114)	(0.0491)
Observations	1056	660	903	570
Number of subjects	66	66	65	65

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 3: Probability of receiving zero

	All observations		Errors excluded	
COEFFICIENT	All rounds	Last 10 rounds	All rounds	Last 10 rounds
minority	0.135*	0.152***	0.171***	0.195***
	(0.0698)	(0.0585)	(0.0529)	(0.0277)
Observations	1056	660	903	570

Probit regressions: Change in probability with respect to a discrete change in "minority" from 0 to 1 is reported. Robust standard errors clustered by session in parentheses.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 4: Probability an offer is accepted

	(1)	(2)	(3)	(4)
COEFFICIENT	Homogenous	Offer to Majority	(6,6,0) to Majority	Offer to Minority
Tokens offered	0.192***	0.105***		0.132***
	(0.0136)	(0.0325)		(0.00883)
Tokens to third	0.0272***	-0.0246		0.0354
	(0.00778)	(0.0215)		(0.0327)
Timemade	0.0150***	0.00311	0.00515	0.0235***
	(0.00409)	(0.00705)	(0.00784)	(0.00432)
Offer by minority		-0.0601	-0.0640	
		(0.0911)	(0.115)	
Observations	1049	714	427	297

Marginal effects at variable means reported. Robust standard errors clustered by session in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 5: Types of offers - Majority Players

To Self	To Other	To Third	Offered (To Majority)	Offered (To Minority)	Expected Payoff (To Majority)	Expected Payoff (To Minority)
7	5	0	16	21	1.31	2
6	6	0	238	145	3.13	2.36
5	7	0	9	13	2.22	3.08
5	5	2	8	23	0.56	1.96
4	4	4	37	49	0.86	1.31

Table 6: Types of offers - Minority Players

To Self	To Other	To Third	Offered	Proportion Accepted	Expected Payoff
7	5	0	16	0.19	1.31
6	6	0	189	0.46	2.73
5	7	0	1	1	5
5	5	2	17	0.12	0.59
4	4	4	72	0.15	0.61

Table 7: Means of first offers in last 10 periods

	Tokens kept	Tokens for receiver	Tokens for excluded	Even 3-way splits
Homogenous	5.85	5.52	0.63	0.14
Majority to Majority	5.92	5.66	0.42	0.07
Majority to Minority	5.71	5.53	0.76	0.14
Minority to Majority	5.69	5.45	0.86	0.15

Table 8: Types of first offers

COEFFICIENT	(1) Tokens Kept	(2) Tokens Offered	(3) Tokens to third	(4) (4,4,4) (Probit)	(5) (6,6,0) (Probit)
Majority to Majority	-0.0208	0.171**	-0.151	-0.0823***	0.0346
	(0.135)	(0.0676)	(0.178)	(0.0266)	(0.110)
Majority to Minority	-0.135	0.148	-0.0186	-0.00728	-0.151***
	(0.128)	(0.145)	(0.266)	(0.0725)	(0.0480)
Minority to Majority	-0.396***	-0.0683	0.465**	0.0227	-0.0367
	(0.146)	(0.0726)	(0.205)	(0.0671)	(0.0329)
period	0.0640***	0.0819***	-0.145***	-0.0163***	0.0501***
	(0.0173)	(0.0189)	(0.0323)	(0.00615)	(0.00948)
period2	-0.00235**	-0.00331***	0.00560***	0.000645	-0.00206***
	(0.00108)	(0.00115)	(0.00194)	(0.000409)	(0.000667)
Constant	5.512***	4.921***	1.567***		
	(0.0421)	(0.0531)	(0.0656)		
Observations	1616	1616	1616	1705	1705
Number of psubject	134	134	134		
R^2	.	.	.	.	.

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9: Means of implemented offers

	Tokens kept	Tokens for receiver	Tokens for excluded	Even 3-way splits
Homogenous	5.79	5.76	0.45	0.10
Majority to Majority	5.88	5.75	0.36	0.05
Majority to Minority	5.52	5.59	0.88	0.16
Minority to Majority	5.71	5.77	0.51	0.10

Table 10: Three-way even splits

	Make at least one offer		Accept at least one offer	
	All rounds	Last 10 rounds	All rounds	Last 10 rounds
Homogenous	0.36	0.22	0.33	0.19
Majority	0.39	0.25	0.34	0.14
Minority to Majority	0.73	0.32	0.27	0.23

Table 11: Strength of group identity

	(1)	(2)
COEFFICIENT	groupidentity	groupidentity
minority	-0.833**	-0.833**
	(0.170)	(0.170)
moneyearned	0.191**	0.191**
	(0.0224)	(0.0224)
Constant	1.589	1.589
	(0.712)	(0.712)
Observations	66	66
R^2	0.073	0.073

Robust standard errors clustered by session in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Variable definitions

payoff: Number of tokens received in the round

excluded: Dummy variable = 1 if zero tokens received in the round

minority: Dummy variable = 1 if in minority group

age: Age in years

gender: Dummy variable = 1 if male

riskav: Number of lottery when first switching columns in Holt/Laury test (high means more risk averse)

participatedbefore: Dummy variable = 1 if subject has participated in other experiments

economics: Dummy variable = 1 if studying economics or related subject

favourite: =1 if subject preferred Kandinsky's paintings; =2 if subject preferred Klee's paintings

Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
age	138	21.39	2.94	18	41
gender	138	0.49	0.50	0	1
riskav	92	6.15	2.03	1	11
participatedbefore	138	0.32	0.47	0	1
economics	135	0.63	0.48	0	1
favourite	138	1.33	0.47	1	2

Correlations

	age	gender	riskav	participatedbefore	economics	favourite
age	1					
gender	0.002	1				
	(0.982)					
riskav	0.053	0.071	1			
	(0.616)	(0.503)				
participatedbefore	0.100	0.103	0.056	1		
	(0.244)	(0.228)	(0.599)			
economics	-0.034	0.209**	0.072	0.317***	1	
	(0.694)	(0.015)	(0.500)	(0.000)		
favourite	0.053	-0.082	0.092	0.011	0.022	1
	(0.541)	(0.339)	(0.383)	(0.898)	(0.803)	

p-values in parentheses

*** p<0.01, ** p<0.05, * p<0.1